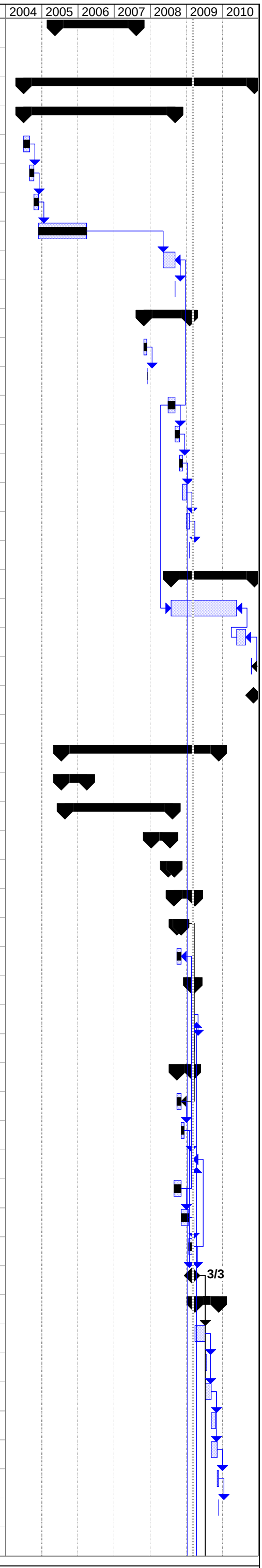
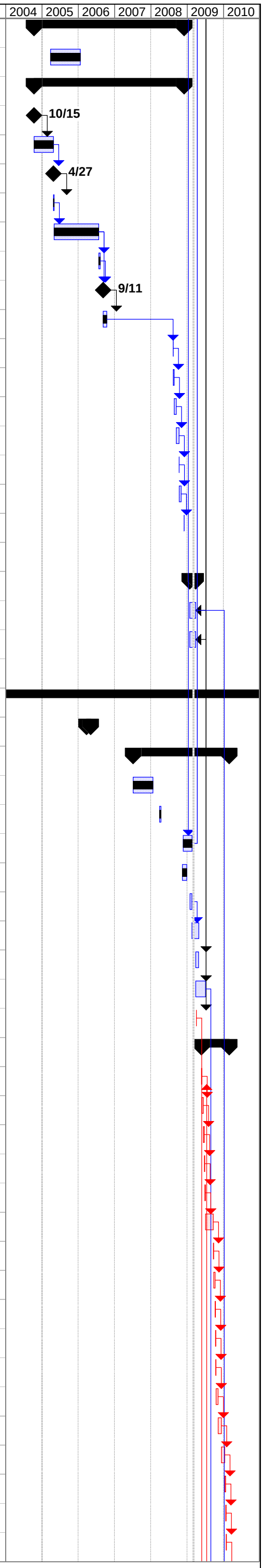
APPENDIX M
MHTS Project Schedule

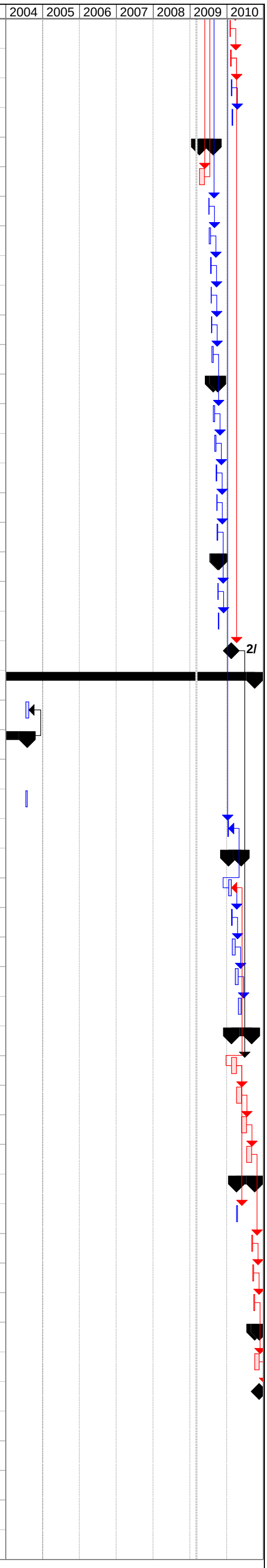
ID	Task Name	Duration	Start	Finish
1	**CERCLA Documentation**	**823 days**	**Mon 5/16/05**	**Thu 8/16/07**
23				
24	**DPH Permitting**	**2334 days**	**Sat 7/3/04**	**Mon 11/22/10**
25	**Policy Memo 97-005**	**1532 days**	**Sat 7/3/04**	**Thu 9/11/08**
26	Prepare Draft 97-005 Document	60 days	Sat 7/3/04	Tue 8/31/04
27	PWP Review	44 days	Wed 9/1/04	Thu 10/14/04
28	Prepare Revised Draft 97-005 Document	47 days	Fri 10/15/04	Tue 11/30/04
29	DPH Review	486 days	Wed 12/1/04	Fri 3/31/06
30	Prepare Final 97-005 Document	120 days	Wed 5/14/08	Wed 9/10/08
31	Submit Final 97-005 Document	1 day	Thu 9/11/08	Thu 9/11/08
32	**Technical Report/RD-RA Work Plan/PSP**	**463 days**	**Thu 11/1/07**	**Thu 2/5/09**
33	Prepare Conceptual Design Report	30 days	Thu 11/1/07	Fri 11/30/07
34	Regulatory Review Meeting	1 day	Tue 12/4/07	Tue 12/4/07
35	Prepare Draft TR/RD-RA WP/PSP (50% Design)	70 days	Thu 7/3/08	Wed 9/10/08
36	Regulatory (including DPH) Review	45 days	Thu 9/11/08	Sat 10/25/08
37	Prepare Draft Final TR/RD-RA WP/PSP (90% Design)	30 days	Sun 10/26/08	Mon 11/24/08
38	Regulatory Review	42 days	Tue 11/25/08	Mon 1/5/09
39	Prepare Final TR/RD-RA WP/PSP (100% Design)	30 days	Tue 1/6/09	Wed 2/4/09
40	Submit Final Report to DPH	1 day	Thu 2/5/09	Thu 2/5/09
41	**DPH Permit Amendment: Pasadena Water Permit**	**843 days**	**Sat 8/2/08**	**Mon 11/22/10**
42	Preparation of DPH Application Information	663 days	Sat 8/2/08	Thu 5/27/10
43	DPH Engineering Report	90 days	Thu 5/27/10	Tue 8/24/10
44	Public Hearing	1 day	Sat 10/23/10	Sat 10/23/10
45	DPH Evaluation and Permit Issuance	10 days	Sat 11/13/10	Mon 11/22/10
46				
47	**City of Pasadena Permitting**	**1592 days**	**Tue 7/19/05**	**Thu 11/26/09**
48	**Predevelopment Plan Review**	**258 days**	**Tue 7/19/05**	**Sun 4/2/06**
60	**CEQA**	**1087 days**	**Wed 8/24/05**	**Fri 8/15/08**
70	**Conditional Use Permit (CUP) Processing**	**191 days**	**Mon 1/14/08**	**Tue 7/22/08**
91	**Design Commission Review**	**62 days**	**Fri 7/4/08**	**Wed 9/3/08**
98	**Building Department Permitting**	**212 days**	**Sun 8/31/08**	**Mon 3/30/09**
99	**Storm Water Pollution Prevention (SUSMP)**	**43 days**	**Tue 9/30/08**	**Tue 11/11/08**
100	SUSMP Preparation and Submittal	43 days	Tue 9/30/08	Tue 11/11/08
101	**Construction and Demolition Waste Management Plan**	**30 days**	**Mon 2/23/09**	**Tue 3/24/09**
102	Plan Preparation and Submittal	15 days	Mon 2/23/09	Mon 3/9/09
103	Plan Review and Approval	15 days	Tue 3/10/09	Tue 3/24/09
104	**Construction/Traffic Plans**	**161 days**	**Tue 9/30/08**	**Mon 3/9/09**
105	Draft Plan Preparation and Submittal	43 days	Tue 9/30/08	Tue 11/11/08
106	Plan Review	30 days	Wed 11/12/08	Thu 12/11/08
107	Plan Finalized by Construction Conractor	15 days	Mon 2/23/09	Mon 3/9/09
108	Submit Bldg Permit Application (90% Design)	73 days	Sun 8/31/08	Tue 11/11/08
109	Building Dept Review of Revised Draft Design	76 days	Wed 11/12/08	Mon 1/26/09
110	Incorporate Comments and Re-submit (100% Design)	35 days	Tue 1/27/09	Mon 3/2/09
111	Obtain Building Department Approval	28 days	Tue 3/3/09	Mon 3/30/09
112	**California Accidental Release Plan**	**241 days**	**Tue 3/31/09**	**Thu 11/26/09**
113	CalARP, RMP, and Process Safety Manag. Plan Prep/Sub.	105 days	Tue 3/31/09	Mon 7/13/09
114	Public Notification	15 days	Tue 7/14/09	Tue 7/28/09
115	Completeness Review	60 days	Tue 7/14/09	Fri 9/11/09
116	Public Comment Period	45 days	Sat 9/12/09	Mon 10/26/09
117	Technical Review by Fire Department	60 days	Sat 9/12/09	Tue 11/10/09
118	Address All Comments and Revise Plan	15 days	Wed 11/11/09	Wed 11/25/09
119	CalARP Approval by Pasadena Fire Department	1 day	Thu 11/26/09	Thu 11/26/09
120				



ID	Task Name	Duration	Start	Finish
121	**PWP System Procurement**	**1512 days**	**Fri 10/15/04**	**Thu 12/4/08**
122	Monk Hill Treatment System Agreement	300 days	Wed 3/30/05	Mon 1/23/06
123	**System Procurement**	**1512 days**	**Fri 10/15/04**	**Thu 12/4/08**
124	Battelle Submit Input on RFP	0 days	Fri 10/15/04	Fri 10/15/04
125	PWP Updates	195 days	Fri 10/15/04	Wed 4/27/05
126	PWP Submit Standard RfP for NASA Review	0 days	Wed 4/27/05	Wed 4/27/05
127	Caltech and NASA Review	7 days	Thu 4/28/05	Wed 5/4/05
128	City Review of the RfP	450 days	Thu 5/5/05	Fri 7/28/06
129	NASA Finalization of the RfP	14 days	Sat 7/29/06	Fri 8/11/06
130	Distribute RFP to Potential Bidders	0 days	Mon 9/11/06	Mon 9/11/06
131	Receive Vendor Quotations	37 days	Mon 9/11/06	Tue 10/17/06
132	Recommendation by Staff	1 day	Sat 8/16/08	Sat 8/16/08
133	Contract Drafting	10 days	Sun 8/17/08	Tue 8/26/08
134	Negotiate Contract with Selected Vendor	21 days	Wed 8/27/08	Tue 9/16/08
135	Agenda Report Routing and Approval	28 days	Wed 9/17/08	Tue 10/14/08
136	City Council Approval	1 day	Wed 10/15/08	Wed 10/15/08
137	Contract Review, City Signatures, and City Approval	20 days	Thu 10/16/08	Tue 11/4/08
138	Notice to Proceed to the Vendor	1 day	Thu 12/4/08	Thu 12/4/08
139				
140	**Coordination with Other Agencies**	**60 days**	**Fri 1/30/09**	**Mon 3/30/09**
141	Coordinating with Raymond Basin	60 days	Fri 1/30/09	Mon 3/30/09
142	Coordinating with LA RWQCB Permitting	60 days	Fri 1/30/09	Mon 3/30/09
143				
144	**Treatment System Installation/Startup**	**2836 days**	**Tue 9/2/03**	**Tue 6/7/11**
145	**Contracting-Installation**	**42 days**	**Tue 3/28/06**	**Mon 5/8/06**
149	**System Installation (NASA)**	**968 days**	**Tue 7/10/07**	**Wed 3/3/10**
150	Pipeline Survey	200 days	Tue 7/10/07	Fri 1/25/08
151	Pipeline Pressure Tests	15 days	Tue 4/1/08	Tue 4/15/08
152	Establish Subcontracts	90 days	Tue 11/25/08	Sun 2/22/09
153	Landscaping - Phase I	45 days	Mon 11/17/08	Wed 12/31/08
154	Review of Calgon Construction/Shop Drawings	19 days	Mon 2/2/09	Fri 2/20/09
155	Equipment Procurement (Calgon)	70 days	Sat 2/21/09	Fri 5/1/09
156	Mfg. Pipe and Concrete Materials	30 days	Tue 3/31/09	Wed 4/29/09
157	Mfg. Pumps	100 days	Tue 3/31/09	Wed 7/8/09
158	Mobilize Construction Equipment	1 day	Tue 4/7/09	Tue 4/7/09
159	**Windsor Site/MHTS Construction**	**280 days**	**Thu 5/28/09**	**Wed 3/3/10**
160	Civil/Structural - Soil Erosion	5 days	Thu 5/28/09	Mon 6/1/09
161	Civil/Structural - Site Grading	14 days	Tue 6/2/09	Mon 6/15/09
162	Civil/Structural - Ex/BF Treament Pad	10 days	Tue 6/16/09	Thu 6/25/09
163	Civil/Structural - Ex/BF Disinfc Bldgs	5 days	Fri 6/26/09	Tue 6/30/09
164	Civil/Structural - Construct Asphalt Paved Drives	7 days	Wed 7/1/09	Tue 7/7/09
165	Civil/Structural - Construct Concrete Pad	79 days	Wed 7/8/09	Thu 9/24/09
166	Civil/Structural - Final Site Survey	4 days	Fri 9/25/09	Mon 9/28/09
167	Civil/Structural - Modify Existing Sandbox	14 days	Tue 9/29/09	Mon 10/12/09
168	Civil/Structural - Install 30" RCP SD	3 days	Tue 10/13/09	Thu 10/15/09
169	Mechanical - 12" DIP Extenstion from Windsor	4 days	Fri 10/16/09	Mon 10/19/09
170	Mechanical - Connect 12" DIP w/ 16" Stl	2 days	Tue 10/20/09	Wed 10/21/09
171	Mechanical - 24" DIP MHTS Influent	21 days	Thu 10/22/09	Wed 11/11/09
172	Mechanical - 24" DIP MHTS Effluent	34 days	Thu 11/12/09	Tue 12/15/09
173	Mechanical - 10" DIP Backwash	33 days	Wed 12/16/09	Sun 1/17/10
174	Mechanical - 24" and 10" Connection at Sandbox	9 days	Mon 1/18/10	Tue 1/26/10
175	Electircal - SCADA Conduit and Wire	5 days	Wed 1/27/10	Sun 1/31/10
176	Electircal - Conduit, Wire, Lighting	4 days	Mon 2/1/10	Thu 2/4/10



ID	Task Name	Duration	Start	Finish
177	Electircal - Remove Existing MCC	5 days	Fri 2/5/10	Tue 2/9/10
178	Electircal - New Services	8 days	Wed 2/10/10	Wed 2/17/10
179	Streeet Improvement - Curb and Gutter	7 days	Thu 2/18/10	Wed 2/24/10
180	Street Improvements - Sidwalk	7 days	Thu 2/25/10	Wed 3/3/10
181	**Construction of Ventura Well**	**137 days**	**Wed 4/8/09**	**Sat 8/22/09**
182	Civil/Structural - Construct Enclosure	50 days	Wed 4/8/09	Wed 5/27/09
183	Mechanical - Install Pump and Motors	4 days	Thu 7/9/09	Sun 7/12/09
184	Mechanical - Pump Discharge Pipe	14 days	Mon 7/13/09	Sun 7/26/09
185	Mechanical - Pump Station	7 days	Mon 7/27/09	Sun 8/2/09
186	Electrical - Remove Existing MCC	2 days	Mon 8/3/09	Tue 8/4/09
187	Electrical - New Servcies	4 days	Wed 8/5/09	Sat 8/8/09
188	Electrical - Conduit, Wire, Lighting	14 days	Sun 8/9/09	Sat 8/22/09
189	**Construction of Arroyo Well**	**45 days**	**Sun 8/23/09**	**Tue 10/6/09**
190	Civil/Structural - Install 30" RCP Discharge	14 days	Sun 8/23/09	Sat 9/5/09
191	Civil/Structural - Construct Transfer Pad	14 days	Sun 9/6/09	Sat 9/19/09
192	Electrical - Temporary Power for Booster Pumps	7 days	Sun 9/20/09	Sat 9/26/09
193	Electrical - Remove Existing MCC	2 days	Sun 9/27/09	Mon 9/28/09
194	Electrical - New Services	8 days	Tue 9/29/09	Tue 10/6/09
195	**Construction of Well 52**	**11 days**	**Wed 10/7/09**	**Sat 10/17/09**
196	Electrical - Remove Existing MCC	4 days	Wed 10/7/09	Sat 10/10/09
197	Electrical - New Services	7 days	Sun 10/11/09	Sat 10/17/09
198	System Operational	1 day	Thu 2/18/10	Thu 2/18/10
199	**Well Rehabilitation (NASA)**	**2593 days**	**Tue 9/2/03**	**Thu 10/7/10**
200	Establish Subcontracts	30 days	Tue 7/20/04	Wed 8/18/04
201	**Initial Well/Pump Inspection**	**337 days**	**Tue 9/2/03**	**Tue 8/3/04**
202	Arroyo and Well 52 Inspections	15 days	Tue 9/2/03	Tue 9/16/03
203	Windsor and Ventura Inspections	15 days	Tue 7/20/04	Tue 8/3/04
204	Install Temporary Treatment System	7 days	Thu 1/14/10	Thu 1/21/10
205	**Well Repair/Rehab**	**127 days**	**Thu 1/21/10**	**Thu 5/27/10**
206	Windsor Well	30 days	Thu 1/21/10	Sat 2/20/10
207	Move Temporary Treatment System	7 days	Sat 2/20/10	Fri 2/26/10
208	Arroyo Well	30 days	Sat 2/27/10	Sun 3/28/10
209	Ventura Well	30 days	Mon 3/29/10	Tue 4/27/10
210	Well 52	30 days	Wed 4/28/10	Thu 5/27/10
211	**Test Pumping/Spinner and Video Logging**	**200 days**	**Sat 2/20/10**	**Tue 9/7/10**
212	Windsor Well	50 days	Sat 2/20/10	Sat 4/10/10
213	Arroyo Well	50 days	Sun 4/11/10	Sun 5/30/10
214	Ventura Well	50 days	Mon 5/31/10	Mon 7/19/10
215	Well 52	50 days	Tue 7/20/10	Tue 9/7/10
216	**Pump Installation and Well Performance Testing**	**180 days**	**Sun 4/11/10**	**Thu 10/7/10**
217	Windsor Well	10 days	Sun 4/11/10	Tue 4/20/10
218	Arroyo Well	10 days	Wed 9/8/10	Fri 9/17/10
219	Ventura Well	10 days	Sat 9/18/10	Mon 9/27/10
220	Well 52	10 days	Tue 9/28/10	Thu 10/7/10
221	**System Operation**	**46 days**	**Fri 10/8/10**	**Mon 11/22/10**
222	Startup Testing	45 days	Fri 10/8/10	Sun 11/21/10
223	Water Delivery	1 day	Mon 11/22/10	Mon 11/22/10
224	**Installation Report**	**77 days**	**Wed 3/23/11**	**Tue 6/7/11**
225	Submit Draft Report	1 day	Wed 3/23/11	Wed 3/23/11
226	StakeHolders Review	45 days	Thu 3/24/11	Sat 5/7/11
227	Prepare Final Report	30 days	Sun 5/8/11	Mon 6/6/11
228	Submit Final Report	1 day	Tue 6/7/11	Tue 6/7/11



APPENDIX N
MHTS Operations and Maintenance Manual

CALGON CARBON CORPORATION

PRELIMINARY OPERATION AND MAINTENANCE MANUAL

MODEL 12
GAC & ION EXCHANGE SYSTEMS

FOR

MONK HILL WELLS
PASADENA, CA

PREPARED BY
CALGON CARBON CORPORATION
PITTSBURGH, PA

CALGON CARBON PROJECT NUMBER: **IX-08089.MHLL**
SERVICES CONTRACT NUMBER: **19,780**

DATE OF PRINT: MARCH, 2009

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TABLE OF CONTENTS

SECTION 1 -- SYSTEM DESCRIPTION

1.1 General System Description 1.1
1.2 Perchlorate (ClO_4) Removal System 1.1
1.3 Volatile Organic Contaminates (VOC) Removal System 1.2
1.4 Design Basis ..... Later

SECTION 2 -- INSTALLATION

2.1 Foundations 2.1
2.2 Equipment Installation 2.1
2.3 General Handling and Lifting Instructions 2.3
2.4 Recommended Unloading and Placement Procedures 2.3

SECTION 3 – ION EXCHANGE OPERATION

3.1 Pre-Operation Check-Out 3.1
3.2 IX Vessel Disinfection 3.1
3.3 Filling an Exchanger With Resin 3.1
3.4 Backwashing and Backflushing 3.2
3.4.1 Backwash/Backflush -- General 3.2
3.4.2 Backwashing an Exchanger 3.3
3.4.3 Starting System after Backwashing 3.3
3.5 Start-Up in Series Flow 3.4
3.6 Steady State Operation 3.5
3.6.1 Monitoring 3.5
3.6.2 Valve Operation 3.5
3.6.3 Exchanger Sequencing -- PV1 Lead, PV2 Lag 3.6
3.6.4 Exchanger Sequencing -- Taking Adsorber PV1 Off-Line 3.7
3.6.5 Exchanger Sequencing -- PV1 Back On-Line As the Lag Vessel 3.7
3.6.6 Exchanger Sequencing -- Taking Adsorber PV2 Off-Line 3.7
3.6.7 Exchanger Sequencing -- PV2 Back On-Line As the Lag Vessel 3.8
3.7 Shutdown 3.8
3.7.1 Short Term Shutdown 3.8
3.7.2 Extended Shutdowns 3.8
3.8 Operational Scenarios 3.9
3.9 Troubleshooting Guide 3.9

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SECTION 4 -- RESIN TRANSFER PROCEDURE

4.0 Resin Transfer Procedure - Standard Trailer....4.1
4.1 Site Requirements....4.1
4.2 Spent Resin Transfer to DOT Supersacks....4.1
4.2.1 Spent Resin Transfer....4.1
4.3 Fresh Resin Transfer From Trailer....4.3
4.3.1 Transfer Resin to Exchanger....4.3

SECTION 5 -- GAC OPERATION

5.1 Pre-Operation Check-Out....5.1
5.2 Filling An Adsorber With Carbon....5.1
5.3 Wetting (Deaerating The Carbon)....5.2
5.4 Backwashing and Backflushing....5.3
5.4.1 Backwash/Backflush -- General....5.3
5.4.2 Backwashing An Adsorber....5.4
5.4.3 Re-Starting System After Backwashing....5.5
5.5 Start-Up....5.5
5.5.1 Series Flow....5.5
5.5.2 Parallel Flow....5.6
5.6 Steady State Operation....5.8
5.6.1 Monitoring....5.8
5.6.2 Valve Operation....5.8
5.6.3 Adsorber Sequencing -- PV1 Lead, PV2 Lag....5.9
5.6.4 Adsorber Sequencing -- Taking Adsorber PV1 Off-Line....5.9
5.6.5 Adsorber Sequencing -- PV1 Back On-Line As The Lag Vessel....5.10
5.6.6 Adsorber Sequencing -- Taking Adsorber PV2 Off-Line....5.10
5.6.7 Adsorber Sequencing -- PV2 Back On-Line As The Lag Vessel....5.10
5.6.8 Adsorber Sequencing -- Parallel Operation....5.11
5.7 Shutdown....5.11
5.7.1 Short Term Shutdown....5.11
5.7.2 Extended Shutdowns....5.11
5.8 Troubleshooting Guide....5.12

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SECTION 6 -- GAC TRANSFER PROCEDURE

6.0 Standard Trailer 6.1
6.1 Site Requirements 6.1
6.2 Spent Carbon Transfer to Trailer 6.2
6.2.1 Spent Carbon Transfer 6.2
6.2.2 Drain Water From Trailer 6.3
6.3 Fresh Carbon Transfer From Trailer 6.4
6.3.1 Fill The Trailer With Water 6.4
6.3.2 Transfer Carbon To Adsorber 6.5

SECTION 7 -- CARBON GENERAL INFORMATION

7.1 Maintenance 7.1
7.2 Safety Considerations 7.2
7.2.1 Oxygen Demand Due To Activated Carbon 7.2
7.2.2 Emergency Procedures 7.3
7.2.3 Pressure Relief Warning 7.3
7.3 Record Keeping 7.3

SECTION 8 -- ACTIVATED CARBON / ADSORPTION INFORMATION

8.1 Adsorption 8.1
8.2 Activated Carbon And How It Works 8.1
8.3 Factors Affecting Adsorption 8.3
8.4 Additional Adsorption Theory 8.5
8.5 Glossary 8.6

SECTION 9 -- OPERATING INFORMATION

Figure 1 – Vessel PV-1 to PV-2 Series Flow 9.1
Figure 2 – Vessel PV-2 On-Line Vessel PV-1 Carbon Transfer 9.2
Figure 3 – Series Flow Vessel PV-2 to PV-1 ..... 9.3
Figure 4 – Vessel PV-1 On-Line Vessel PV-2 Carbon Transfer 9.4
Figure 5 – Parallel Flow Vessel PV-1 and PV-2 ..... 9.5
Figure 6 – Vessel PV-2 On-Line Vessel PV-1 Backwashing 9.6
Figure 7 – Vessel PV-1 On-Line Vessel PV-2 Backwashing 9.7
Figure 8 – Calgon Carbon Standard Trailer 9.8
Figure 9 – Calgon Carbon Triple Compartment Trailer 9.9
Carbon Acceptance Canister Instructions 9.10
Spare Parts Program 9.12
Video Agreement 9.13

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SECTION 10 – MEDIA/PRESSURE DROP INFORMATION

- Resin Sales Specification Sheet – CalRes 2109
- Material Safety Data Sheet – CalRes 2109
- Activated Carbon Product Bulletin/Specifications – Filtrasorb 300
- Material Safety Data Sheet – Filtrasorb 300
- Curve: Rate Of Wetting Versus Time For Granular Activated Carbon
- Curve: GAC Percent Bed Expansion
- Curve: IX Per Cent Bed Expansion (Later)
- Application Bulletin: Disinfection Of Granular Activated Carbon
- System Pressure Drop
- Model 12 GAC Pressure Drop Curve – Series Operation
- Model 12 GAC Pressure Drop Curve – Backwash (Later)
- Model 12 IX Pressure Drop Curve – Series Operation
- Model 12 IX Pressure Drop Curve – Backwash (Later)

SECTION 11 – ASME SECTION VIII U1A FORMS

SECTION 12 -- SPECIFICATIONS AND CATALOG CUT SHEETS

SECTION 13 -- SHIPPING SPECIFICATION

SECTION 14– DRAWINGS

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CALGON CARBON CORPORATION

SECTION 1

SYSTEM DESCRIPTION

SECTION 1

SYSTEM DESCRIPTION

1.1 Overview

The system is designed to treat 7,000 gpm of well water for Perchlorate (ClO4), Trichloroethene (TCE), Tetrachloroethylene (PCE), 1,2-Dichloroethane (1,2-DCA), Carbon Tetrachloride (CCl4) and 1,2,3 – Trichloropropane (1,2,3-TCP).

Design Feed Water Quality to Treatment System
(Per Table 1 of RFP)

Perchlorate	Nitrate	Sulfate	Chloride	Bicarbonate	TCE	PCE	1,2-DCA	CCl_4	1,2,3 - TCP
(ppb)	(ppm)	(ppm)	(ppm)	(ppm)	(ppb)	(ppb)	(ppb)	(ppb)	(ppb)
45	24	55	53	230	3.2	0.59	0.46	2.7	0.02

Design Treated Water Quality from Treatment System
(Per Table 1 of RFP)

Perchlorate	Nitrate	Sulfate	Chloride	Bicarbonate	TCE	PCE	1,2-DCA	CCl_4	1,2,3 -TCP
(ppb)	(ppm)	(ppm)	(ppm)	(ppm)	(ppb)	(ppb)	(ppb)	(ppb)	(ppb)
<4	36	60	60	NA	<0.5	<0.5	<0.5	<0.5	<0.005

The volatile organic contaminates will require a separate treatment sub-system (carbon) than the anions (ion exchange resin) to efficiently remove them from the well water to achieve the required treatment goals.

1.2 Perchlorate (ClO_4) Removal System

The water is treated for perchlorate prior to the VOC removal system. 6,300 - 7,000 gpm of the well water flow is passed through (3) 10 micron cartridge filters in parallel to remove sediment and particulates which may be discharged from the well pumps to prevent fouling and excessive pressure drop across the treatment systems. The well water is then directed and distributed between (4) fixed bed ion exchange systems. The ion exchange systems will be CCC Model 12 units, which consist of (2) 12’ diameter vessels and the necessary piping, valves and other components required to operate them in a lead/lag configuration (series flow through first one resin bed and then the other) . Each vessel will contain single-use, ion exchange resin for perchlorate removal. The resin will become saturated with perchlorate over time. Once the lead resin bed has become saturated with perchlorate, the resin is

replaced with fresh resin and the bed is placed in the lag position (with the former lag resin bed placed in the lead position). The saturated resin is disposed of.

Virgin resin beds will be backwashed with treated water (free of perchlorates) prior to being brought on-line for the first time. The backwash water will be passed through a carbon trailer prior to being discharge to the sewer. Resin vessels that are not in service for periods greater than a week will have 5 bed volumes of city water passed through per vessel per week to ensure the water in the vessel has been completely turned over.

1.3 Volatile Organic Contaminates (VOC) Removal System

The effluent water from the perchlorate removal sub-system will be distributed between (5) fixed bed absorbers units. These adsorbers systems will be CCC Model 12 systems, which consist of (2) 12' diameter vessels and the necessary piping, valves and other components required to operate them in a lead/lag configuration (series flow through first one GAC bed and then the other). Each vessel will contain Filtrasorb 300 granulated, activated carbon (GAC). This GAC will become saturated with VOCs over time. Once the lead GAC bed has become saturated with the VOCs, the GAC is replaced with fresh GAC and the bed is placed in the lag position (with the former lag GAC bed placed in the lead position). The saturated GAC is disposed of or sent offsite for thermal reactivation.

Prior to being brought online, the carbon beds should be backwashed with clean water to stratify the bed and remove carbon fines. To prevent fouling and excessive pressure drop across the GAC adsorbers overtime, provisions need to be made for the periodic backwashing of the GAC beds.

GAC beds which have sat idle for an extended period of time may need to be exposed to a caustic solution to sterilize the bed followed by an in situ neutralization.

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CALGON CARBON CORPORATION

SECTION 2

INSTALLATION

SECTION 2

2.0 INSTALLATION

In addition to the instructions below, refer to the Shipping Specification included with this manual for instruction on shipping and handling of large adsorber systems.

2.1 FOUNDATIONS

The equipment can be set on a permanent or temporary foundation. A temporary foundation could be a steel skid or plate, paved area or concrete foundation to which the adsorber vessels can be secured. Any foundation, either temporary or permanent, must be adequate to support the operating weight of the unit. See the Calgon Carbon Corporation general arrangement drawing for the dimensions and weights of the system.

Before installation of a permanent system, the adsorber tanks should be oriented on the foundation to ensure that the inlet and outlet opening and anchor lugs are positioned properly. Anchoring can be installed either in the foundation or at time of vessel installation, provided local codes or regulations are satisfied. The outline of the adsorbers should be marked on the foundation.

2.2 EQUIPMENT INSTALLATION

A crane is required to off-load the vessels and piping skid. Lifting lugs are provided on all the vessels. A properly trained and experienced rigging crew should be employed to set the equipment. The vessels should be set on the foundation in a level position and be anchored as required by local codes and seismic regulations. Each vessel must be individually set.

1. The following instructions are typical for large modular adsorber systems. Refer to the project drawings for specific details; i.e. dimensions, weights and pipe sizes.
2. Before the equipment is shipped, a site visit is recommended to review specific site conditions that may affect delivery or installation. Special note should be made for:
   - Overhead clearances – power lines, trees, plant piping
   - Access to site – fences, trees, locations within neighborhood or plant
   - Soil conditions – Can the delivery truck get close to the installation site?
   - Foundations – Properly cured? Correct size to accept new system?

3. Receive adsorption equipment in accordance with plant site requirements. Typically, one truck is used to ship the equipment. Shipment is normally comprised of the following items:

   - (2) Adsorber Vessels; Refer to project specific drawings for exact vessel dimensions and weight.
   - (12) Prefabricated pipe spools.
   - (1) Crate of hardware; Containing bolts, gaskets, pipe supports and u-bolts, gages etc.

- (1) Valve Rack; Refer to the following table for the weight of a pipe rack.

Pipe Size	Weight
6”	2,800 lbs.
8”	3,900 lbs.
10”	6,300 lbs.

Refer to the project drawings and material list enclosed in the crate for a comprehensive account of components provided for the particular job being installed.

4. Off load the equipment from truck to the pre-prepared mounting location. Set equipment on properly formulated foundation ensuring weight loading, anchor bolt depth, smooth level surface and adequate dimension for equipment footprint. For recommended lifting procedures refer to the section titled Lifting & Handling Guidelines.

5. The following installation steps can be accomplished in utilizing a crane for one day. Refer to the installation drawing, Figure 1, for generalized details and the project drawings for more specific details.
   - Set one vessel in proper location on the foundation
   - Position valve rack at the estimated point of hook-up. Make sure that vessel and valve rack are set true and level to plan.
   - Align the effluent nozzle on the bottom head, the effluent pipe, and rubber expansion joint with the appropriate valve rack connection.
   - Bolt-up snug when alignment is satisfactory.
   - Align the influent piping to the designated valve rack connection and connect expansion joint piping with tank nozzle on the top of the vessel, and bolt-up snuggly.
   - Attach all pipe bracket supports and u-bolts as provided.
   - When it is determined that complete line up is acceptable finish bolting both effluent and influent lines.
   - Set the second vessel into position and line up second vessel with valve rack and effluent/influent piping as previously described.
   - When accomplished finish the bolt-up.
   - When completely satisfied with installation bolt vessels to foundation using predetermined anchor bolt hardware.
   - Connect (1) carbon fill, and (1) carbon discharge line to each vessel.
   - Install the vessel sample ports and connecting hardware as detailed on the project drawings.
   - Mount pressure gauges and instruments as shown on project drawings.
   - Install the Carbon Acceptance Canister.
   - If equipment is supplied with an electrical panel, run power feed to the panel and make connections per the interconnection drawing.

6. The customer should connect from the connections on the pipe rack; influent, effluent, backwash supply and backwash outlet, to the plant supply piping. Gaskets and bolts supplied by the customer.
   Client supplied effluent piping for the adsorption system should include an anti-siphon loop or adequate backpressure to ensure that the water level in the vessels covers the media during operation.

   The pressure relief discharges to the backwash outlet/vent line. The backwash outlet/vent line should have unrestricted flow to atmosphere.

7. Each vessel has underdrain nozzles pre-installed by CCC. For internal underdrains; ring type and internal cones, the septa should be checked for tightness before the manway covers are closed and secured.

8. The system is now ready for hydro testing and disinfection as required.

2.3 GENERAL HANDLING AND LIFTING INSTRUCTIONS

The recommended lift points are shown on the installation drawing; lifting lugs on vessel top head, vessel leg anchor base plates and location shown on the valve rack.

1. Always make lift attachments to the designated lift points when using chains or cables. Never lift using a vessel nozzle.
2. Operators of hoisting and moving equipment must follow proper rigging procedures at all times.
3. Always lift - **NEVER** roll or slide equipment.
4. When moving equipment, do not drop or allow hard impact. Do not allow cables, hooks, or spanner bars to swing against or slide over the vessel.
5. Never allow tools to strike or drop on equipment (especially inside or outside of vessels).
6. Never allow bare metal chains or cable to slide against the metal surface of equipment causing marring, deformation or serious defects in the metal.
7. Avoid temporarily bracing vessels or equipment with metal structures, wood is acceptable for this application. Avoid striking vessel with tools or instruments of any kind.
8. All ladders used inside vessels shall have ends protected. Ladders shall have rubber protectors to prevent damaging the lining.
9. Workmen entering a lined vessel must wear soft-soled shoes, free of grit. Workmen must follow plant and OSHA requirements for confined space entry.

2.4 RECOMMENDED UNLOADING AND PLACEMENT PROCEDURES
(Refer to Shipping Specification VS13)

1. Vessel and miscellaneous equipment unloading shall be accomplished in such a manner as to avoid damage to finished surfaces. Adequate padding may be necessary around the lifting point. Wooden chalks and crating should be carefully removed where necessary.
2. Utilize chains, nylon slings, or a spreader bar for hoisting vessels. The angle between the lifting point and the top of the equipment must always be 60° or greater. Workmen shall keep control over the vessel with guidelines. No metal rigging may come in contact with the vessel except for specifically designed lift points or lifting lugs.
3. A crane is required to off-load, move and hoist into position the vessels and piping assemblies. Lift points are provided on all pieces. A properly trained and experienced rigging crew shall be employed to set the equipment. The equipment shall be set on a solid foundation, made level as possible and anchored as required by local codes and seismic regulations. Each vessel must be individually set.
4. Piping connection points to vessels and valve rack shall be free of mechanical stress. Do not force pipe connections to these points for damage can result.
5. Follow safe anchor bolt installation practices.
6. Dirt marks shall be cleaned from the surface of all Equipment upon completion of the installation. Marred paint resulting on Vessels and all equipment pieces shall be touched up with a paint of comparable color and quality. More severe damage requires appropriate surface cleaning and preparation before primer and finishing paint are applied.

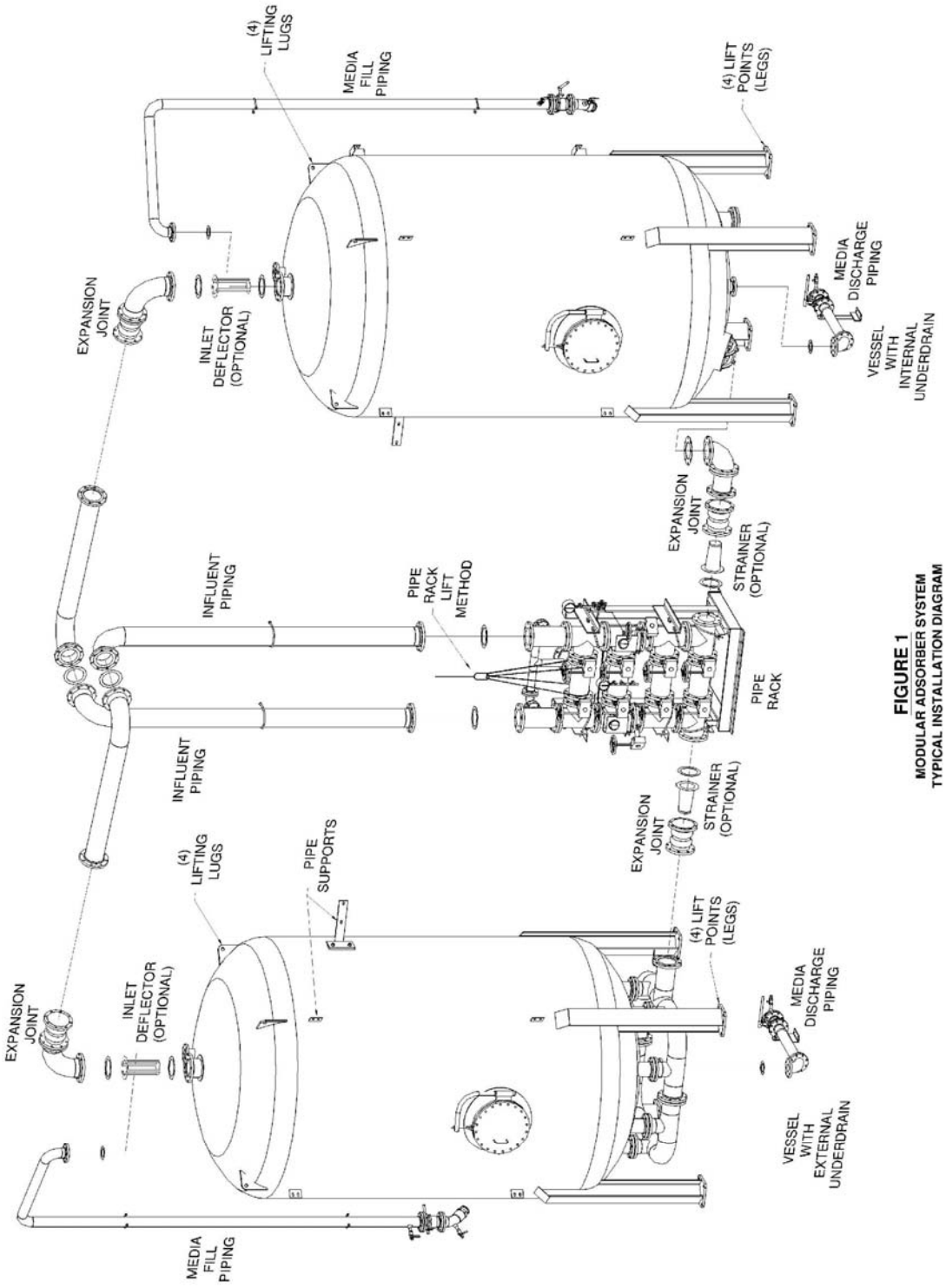


FIGURE 1
MODULAR ADSORBER SYSTEM
TYPICAL INSTALLATION DIAGRAM

CALGON CARBON CORPORATION

SECTION 3

ION EXCHANGE OPERATION

SECTION 3

3.0 ION EXCHANGE OPERATION

3.1 PRE-OPERATION CHECK-OUT

All equipment and systems affiliated with the ion exchange system such as pumps, filters, etc. should be checked out according to the manufacturer's instructions. Specific activities to complete before operating the ion exchange equipment should include the following:

1. Check all piping connections for proper installation and tightness.
2. Ensure that all gauges and instruments are functional and installed correctly. Re-zero or re-calibrate if necessary.
3. Close all valves in the ion exchange piping system.

For potable water treatment installations, the customer will be responsible for cleaning and disinfecting the vessels and piping prior to filling the system with resin. The procedures to complete this step in the installation process are the responsibility of the customer.

3.2 IX Vessel Disinfection

Prior to a virgin resin fill on new equipment, an IX vessel should be disinfected. The disinfection should be conducted as per CCC's standard procedure. This is recommended to prevent any pollutants that may have contaminated the interior of the IX vessel. The responsibility for conducting the disinfection can be either CCC's or the customers, depending on the agreed upon terms.

3.3 FILLING AN EXCHANGER WITH RESIN

After the system has been checked, the ion exchangers are ready to be filled with resin. The resin is transferred to the exchanger via vacuum or slurry. The detailed procedures for making the transfer are given in Section 4. Unlike activated carbon, ion exchange resin is supplied in the hydrated form and therefore does not require a wetting step. However, it is recommended that prior to transfer of the resin into the exchanger, the ion exchanger is filled ~ 1/3 full of water. This allows proper settling of the resin as it is transferred into the exchanger.

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3.4 BACKWASHING AND BACKFLUSHING

3.4.1 BACKWASH/BACKFLUSH – GENERAL

Backwashing and backflushing are procedures involving running clean, contaminant-free water upflow through the exchanger. Backwashing or backflushing of a resin bed can be done after fresh resin has been transferred into an exchanger and wetted, or during operation to remove sediment from the top of the bed.

If the exchangers are to be backwashed during operation, they should be backwashed prior to startup.

The reasons for backwashing before placing fresh resin on-line are to:

1. Size segregate the resin so subsequent backwashing will return the resin to the same relative position in the bed.
2. Remove any remaining air from the bed.
3. Remove resin fines which can, in some cases, lead to excessive pressure drop and flow restriction

Backwashing is done during operation to remove:

1. Sediment from the top of the bed.
2. Resin fines that may be plugging the underdrain nozzles and air that is binding the bed

The need to backwash is indicated by an increased bed pressure drop.

Backwashing an exchanger results in expanding the resin bed, removing air, suspended solids and resin fines and classifying the resin particles. The backwash flow rate depends upon the resin particle mesh size and the water temperature (refer to the bed expansion curve in Section 10). Generally, rates in the range of 1 to 1.5 gpm/ft² (113-170 gpm) are sufficient to remove solids, remove air, and expand the bed. However, backwashable Model 12 units are designed with significant straight side height to permit 30% bed expansion, and the selected backwash rate should limit the bed expansion to a maximum of 30%. For your system, refer to the flow diagram in the Drawing section of this O&M for the backwash flow rate.

Note
This rate assumes a 68°F backwash water source.
Use the bed expansion curve in the Section 10 to determine a backwash rate if the water source is at a different temperature.

3.4.2 BACKWASHING AN EXCHANGER

In this mode, a clean external source is used as the source for the backwash water. Note that the lead exchanger is taken out of service while the backwashing procedure takes place. This sequence applies to a series operated system, with the lag exchanger remaining on-line during the backwash.

1. Isolate the exchanger to be backwashed. If exchanger PV1 is to be backwashed, refer to Section 3.6.4 for valve sequencing. If exchanger PV2 is to be backwashed, refer to Section 3.6.6 for sequencing.
2. Open the vent valve (V5 for exchanger PV1, V6 for exchanger PV2).
3. Open the backwash water inlet valve (V8 for exchanger PV1, V7 for exchanger PV2) and start the backwash pump.
4. Open backwash effluent valve (V5 for exchanger PV1, V6 for exchanger PV2).

The backwash water enters the vessel through the effluent line and flows up through the underdrain and the resin bed. The backwash water discharge from the vent line should be observed for clarity to determine the duration of backwashing. Backwashing for high pressure drop should take approximately 10 minutes. If excessive sediment and turbidity exists in the untreated water, the backwashing times may have to be increased to 15 minutes. A fresh resin fill should be backwashed to classify the resin. The time required for this step is approximately 30 minutes or until the backwash discharge is free of fines.

3.4.3 STARTING SYSTEM AFTER BACKWASHING

The valve sequence given below describes the steps taken to bring a system on-line after backwashing. The valve numbers refer to bringing exchanger PV1 back on-line in the lead position. Valve numbers applying to placing exchanger PV2 back in the lead position are in parentheses.

1. Close the backwash water inlet valve V8. (V7)
2. Close vent valve V5. (V6)
3. Open crossover valve V10. (V9)
4. Open influent valve V1. (V2)
5. Close influent valve V2. (V1)

3.5 START-UP IN SERIES FLOW

The ion exchange system is normally operated in a series mode. Valves in the influent and effluent lines are opened or closed, as required, to set the operation of the ion exchange vessels in the desired configuration. The first bed in the system is called the lead bed. The second bed is referred to as the polish or lag bed.

The following sequence of steps should be followed to bring an Ion Exchange System on-line in the series mode:

1. Place the feed pump (s) in service to supply the ion exchange module at the required flow and pressure.

2. Check that all the valves in the ion exchange system are closed.

3. Open the valve in the effluent line from the polish exchanger (V4 for exchanger PV-1, V3 for exchanger PV-2).

4. Open the valve in the cross-over line between the exchangers (V10 for PV1 in the lead position, V9 for PV-2 in the lead position).

5. Start the feed pump and open the valve in the pump discharge line.

6. Slowly open the valve in the influent line to the lead exchanger (V1 for exchanger PV-1, V2 for exchanger PV-2) and allow the pressure to increase to the operating level. V1 and V2 should be opened slowly. The valve should be opened such that the flow to the exchanger is increased 100 gpm per minute until the desired flowrate is achieved.

7. Open the 3/4" valve located on the side wall of each vessel to bleed off any air that is trapped underneath the internal cone.

At this point, flow should be established downflow through both vessels and they will be on-line in series.

Set the flow rate to the system at the desired value after flow is established to the unit. The flow control meters and control instrumentation will be provided by the customer as required for the system.

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In order to obtain full utilization of the resin and prevent air entrapment and channeling in the bed, the water level must remain above the resin bed. To prevent the bed from draining due to gravity or loss of influent supply, a vacuum break (anti-siphon) loop or backpressure should be included by the customer in the effluent piping. This start-up sequence assumes that an anti-siphon loop is present in the effluent piping. If no anti-siphon loop or backpressure is present, start the system by starting the pump and opening the valves in the opposite order of the sequence given previously (i.e., open the influent valve first, followed by the cross-over valves and effluent valve).

3.6 STEADY STATE OPERATION

Once flow is established to both vessels and the flow rate is set, no further adjustments are made during normal operation. The operator should establish a routine to check the exchangers and to collect operating data. This data can be used to establish a maintenance schedule or to determine when fresh resin is needed. Inlet flow rates should not fall below 400 gpm per IX train. The differential pressure across the resin bed should not exceed 20 psi, nor should the delivery pressure exceed 125 psi. Lower than 400 gpm can result in flow channeling, which could lead to under utilization of the resin. Differential pressures greater than 20 psi could lead to physical damage to the resin beads, while delivery pressure greater than 125 psi will cause the vessels rupture disks to fail.

3.6.1 MONITORING

Sample connections are provided on the influent and effluent lines from each vessel to take periodic samples for analysis.

Pressure gauges are provided to determine the pressure drop across each resin bed. Taking periodic pressure readings will provide the operator with historic data for troubleshooting purposes. In the event that operating conditions change, the operator has the capability of taking corrective action.

3.6.2 VALVE OPERATION

All valves should be operated in a slow and even motion. Abrupt opening and closing of the valves can shock the system. Valves should be opened / closed such that the flow is increased / decreased 100 gpm per minute. Since complete shut-off of flow while a pump is operating could cause damage to the pump, the valves should be operated in the proper sequence in order to always maintain flow through the system. If the vessels are identified as PV1 and PV2 then the corresponding valve positions during ion exchange are given as follows:

PROCESS VALVE NUMBER	SERIES PV1 TO PV2 (FIGURE 1)	PV2 SINGLE OPERATION (FIGURE 2)	SERIES PV2 TO PV1 (FIGURE 3)	PV1 SINGLE OPERATION (FIGURE 4)	PARALLEL OPERATION (FIGURE 5)
V-1	Open	Closed	Closed	Open	Open
V-2	Closed	Open	Open	Closed	Open
V-3	Open	Open	Closed	Closed	Open
V-4	Closed	Closed	Open	Open	Open
V-5	Closed	Closed	Closed	Closed	Closed
V-6	Closed	Closed	Closed	Closed	Closed
V-7	Closed	Closed	Closed	Closed	Closed
V-8	Closed	Closed	Closed	Closed	Closed
V-9	Closed	Closed	Open	Closed	Closed
V-10	Open	Closed	Closed	Closed	Closed

Single stage operation occurs for short time periods, such as during resin transfer or during other routine maintenance on one of the exchanger vessels.

***Note:** Flow Sequence Changes (As Described In The Following Sections) Should Be Performed Only When Resin Change-outs Or Other Vessel Maintenance Is Required*.

3.6.3 EXCHANGER SEQUENCING: PV-1 LEAD, PV-2 LAG

This sequence should be used to start up the system in series mode from PV-1 to PV-2. Refer to Section 3.4 for additional details.

Starting valve position: All valves closed.

- Open valve V3
- Open valve V10
- Open valve V1

At this point, flow should be established from PV-1 to PV-2.

3.6.4 EXCHANGER SEQUENCING: TAKING EXCHANGER PV-1 OFF-LINE

When exchanger PV-1 is taken off-line for resin transfer, all of the process flow should be sent through exchanger PV-2.

Starting valve position: Series flow from PV-1 to PV-2.

- Open valve V2
- Close valve V10
- Close valve V1

Flow should now be established through exchanger PV2 with exchanger PV-1 off-line for resin transfer.

3.6.5 Exchanger Sequencing: PV-1 Back On-Line As Lag Vessel

After exchanger PV-1 is filled with fresh resin, it should be placed on-line in the polish position with exchanger PV-2 moved to the lead position.

Starting valve position: Single stage flow to PV-2.

- Open valve V9
- Open valve V4
- Close valve V3

Flow should now be established from exchanger PV-2 into exchanger PV-1.

3.6.6 EXCHANGER SEQUENCING: TAKING EXCHANGER PV-2 OFF-LINE

When exchanger PV-2 is taken off-line for resin transfer, all of the process flow should be sent through exchanger PV-1.

Starting valve position: Series flow from PV-2 to PV-1.

- Open valve V1
- Close valve V9
- Close valve V2

Flow should now be established through exchanger PV-1 with exchanger PV-2 off-line for resin transfer.

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3.6.7 EXCHANGER SEQUENCING: PV-2 BACK ON-LINE AS LAG VESSEL

After exchanger PV-2 is filled with fresh resin, it should be placed on-line in the polish position, with exchanger PV-1 moved to the lead position.

Starting valve position: Single stage flow to PV-1.

- Open valve V10
- Open valve V3
- Close valve V4

Flow should now be established from exchanger PV-1 into exchanger PV-2.

3.7 SHUTDOWN

3.7.1 SHORT-TERM SHUTDOWN

For short duration shutdowns lasting less than one week, little needs to be done. Close all valves in the exchanger piping system and open the vent line valves on each vessel. The feed pumps should be shut down and the valves closed in the lines to and from the pumps. Any drain valves in the pump casing should be opened for the duration of the shutdown. Freeze protection measures such as draining lines at the low points should be taken when there is a chance of freezing. Freeze protection measures are the responsibility of the client.

3.7.2 EXTENDED SHUTDOWNS

For extended shutdowns, in addition to the steps in Section 3.8.1, the exchangers should be drained of all water and filled with clean, non chlorinated, treated water. Water in vessel should be replaced every week. Run water through the vessel at a minimum flowrate of 400 gpm for 5 minutes. Bring the exchangers back on-line in the downflow mode, monitor the effluent for perchlorate concentration and monitor the pressure drop.

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3.8 OPERATIONAL SCENARIOS

Refer to NASA's technical memorandum "Proposed Utility Water Treatment Procedures for the City of Pasadena Monk Hill Treatment System" and Pasadena Water and Power's document "MHTS Well Purging and Vessel Backwash Sequencing for Utility Waters" for the correct procedures concerning well sequencing during the operating year.

3.9 TROUBLESHOOTING GUIDE

PROBLEM		PROBABLE CAUSE		REMEDY
High pressure drop across exchangers.	1.	Bed not flooded. Bed is air bound.	1.	Open vent valve or resin inlet valve to release pressure. Add water downflow to fill vessel. Establish constant forward flow, then close valve.
	2.	High feed pump pressure.	2.	Throttle feed pump.
	3.	High suspended solids loading.	3.	Test feed for suspended solids. Install influent filter.
	4.	Improper valve settings.	4.	Check valve sequence.
	5.	Resin in effluent retainer.	5.	Shut down system. Clean out retainer and effluent line. Remove resin from exchanger. Inspect vessel using side manway and repair damaged underdrain in exchanger.
Resin in the effluent.	1.	Internal mechanical (i.e. underdrain) failure.	1.	Determine which exchanger is causing the problem, then remove resin and make repairs. In addition, inspect resin retainer in effluent line and replace if necessary.
Leaking flange.	1.	Loose bolts.	1.	Tighten bolts.

3.8 TROUBLESHOOTING GUIDE (CONTINUED)

PROBLEM		PROBABLE CAUSE		REMEDY
Excessive flow out vent line.	1.	Broken rupture disk.	1.	Check the following conditions before replacing disk: 1) Check downstream valving to make sure that the system is not plugged off. 2) Check feed pump pressure to make sure it is not too high. 3) Check process valve sequence. 4) Check that excessive pressure build-up did not occur in closed vessels during extended shutdowns. Once the potential source of over-pressurization is removed, replace rupture disk.
Sudden high contaminant concentration in effluent.	1.	Resin heel from improper transfer.	1.	Wait until contaminant flushes out. Review transfer procedures.
	2.	Leaking valve.	2.	Repair/replace valve.
	3.	Mass transfer zone has extended into effluent.	3.	Replace resin.

3.8 TROUBLESHOOTING GUIDE (CONTINUED)

PROBLEM		PROBABLE CAUSE		REMEDY
Premature breakthrough of perchlorate in the effluent.	1.	Influent concentration change.	1.	Confirm by analyzing effluent sample(s) before changing resin.
	2.	Air in the influent stream.	2.	Open vent valve and fill bed upflow with water as required.
	3.	Leaking valves.	3.	Check operation of valves in influent and effluent lines.
	4.	Incorrect valve sequence.	4.	Sequence the flow through the system properly.
Resin heel in empty vessel.	1.	Insufficient rinse water.	1.	Provide additional rinse water flow.
	2.	Mechanical failure.	2.	Check vessel internal parts and make repairs.
	3.	Foreign material on the resin.	3.	Rinse vessel to remove resin.

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CALGON CARBON CORPORATION

SECTION 4

RESIN TRANSFER PROCEDURE

SECTION 4

4.0 RESIN TRANSFER PROCEDURE - STANDARD TRAILER

The procedures that are detailed in this section of the manual are for Calgon Carbon's standard resin trailer. Resin is delivered on a flat-bed trailer in 1 m3 supersacks. The maximum number of supersacks which can be delivered on a single trailer is 22 sacks for a total of 22 m3 / 800 ft3.

4.1 SITE REQUIREMENTS

A flat paved area is needed to support the Calgon Carbon service trailer which may weigh up to 100,000 pounds. The overhead clearance required for the ion exchanger system is 13 feet.
The utility requirements are required by each exchanger during resin changeout.

4.2 SPENT RESIN TRANSFER TO DOT SUPER SACKS

Spent resin transfer from the exchanger to the DOT Super sacks is accomplished using vacuum. The vacuum system is equipped with a hopper which will extend out at which point a DOT super sack will be place underneath it. The super sack will be supported via forklift and straps. When the super sack is full of spent resin it will be place in a pre-designated location on a pallet. Once all spent resin is out of the exchanger, placed into DOT super sacks, and on pallets, the spent resin transfer is complete.

4.2.1 SPENT RESIN TRANSFER

A. Prepare for Spent Resin Transfer:

1. Isolate the exchanger needing service via closing all appropriate valves.

2. Dewater the exchanger that needs to be serviced. Two ways to accomplish this follow:

   Gravity flow via existing effluent piping.

   Connect air fitting and pressurize the exchanger to push water through existing effluent piping.

3. Once the exchanger is fully dewatered, relieve the pressure from the exchanger via 4" vacuum fill line.

4. Once all pressure is relieved from the exchanger, connect the 4" flex hose from the spent resin discharge line to the vacuum system.

B. Transfer Spent Resin

1. Power up the vacuum system.

2. Place a DOT supersack under the vacuum hopper with forklift and straps supporting it in place.

3. Open the 4" resin discharge line at the bottom of the exchanger.

4. The resin will flow from the Model 10 to the hopper. The hopper will fill with resin until it is full. It then discards to the supersack. Two hoppers will fill a supersack. The spent resin transfer will take about 3-4 hours to complete.

5. Once all spent resin has been vaced out of the Model 10, shut down the vac system and open the side manway to visually inspection the exchanger internal.

6. Restart the vac system and using a 1" water line, rinse the exchanger of any residual resin left inside. Alternatively, the effluent water from the on-line exchanger can be used if a tap is available from any of the exchangers.

C. End Transfer

1. Secure the side manway.

2. Remove 4" transfer hose from the bottom discharge line.

3. Open the exchanger vent valve (V5 or V6) to further aid the venting.

4. Close the exchanger resin outlet valve (V12 for exchanger PV1, V11 for exchanger PV2).

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4.3 FRESH RESIN TRANSFER FROM SUPERSACKS

Fresh resin is transferred again using vacuum. Each supersack is first dumped into an open top holding tank. The transfer hose from the holding tank to the exchanger resin transfer line is connected. After putting a water cushion in the exchanger, the vacuum hose is attached to the piping manifold at a special 45o pipe which replaces the backwash connection

4.3.1 TRANSFER RESIN TO EXCHANGER

A. Prepare for Transfer

1. Open the exchanger vent valve (V-14 to vent PV-1 or V-13 to vent PV-2) and the exchanger cone vent valve.

2. Slowly open both backwash valves (V-8 for PV-1 and V-7 for PV-2) to allow treated water to flow from the exchanger currently on-line to the exchanger to be filled with resin. This water cushion allows the resin bed to settle during transfer and prevent channeling during startup. This also helps to protect the underdrain system and vessel lining during resin transfer. If the amount of water cannot be measured, fill the vessel until water flows from the air bleed nozzle located at the point where the internal cone meets the vessel sidewall. After water flows from this point, continue to fill the vessel for twice the period of time required for water to exit the cone vent valve.

3. Once the water cushion has been added, close all valves on the exchanger.

4. Connect the 4” flexible hose to the exchanger fill line.

5. Connect another section of 4” flexible hose from the 4” male adapter on the piping rack to the vac system.

B. Transfer Fresh Resin

1. Open the exchanger resin fill line valve (V14 for exchanger PV-1, V13 for exchanger PV-2).

2. Start the vac system.

3. Lift the supersack above the holding tank using the forklift.

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4. Carefully cut the bottom of the supersack, allowing the resin to flow from the supersack into the holding tank.

5. When the supersack has emptied, lower the emptied sack, remove it from the forks, and pick up the next supersack.

6. Repeat steps 3, 4, and 5 until the vessel has a sufficient amount of resin

C. End Transfer

1. Shut down vacuum system.

2. Close the vacuum vent line and remove the flex hose.

3. Exchanger is now ready for more water and resin backwash.

CALGON CARBON CORPORATION

SECTION 5

GAC OPERATION

SECTION 5

5.0 OPERATION

5.1 PRE-OPERATION CHECK-OUT

All equipment and systems affiliated with the granular carbon adsorption system such as pumps, filters, etc. should be checked out according to the manufacturer's instructions. Specific activities to complete before operating the adsorption equipment should include the following:

1. Check all piping connections for proper installation and tightness.
2. Ensure that all gauges and instruments are functional and installed correctly. Re-zero or re-calibrate if necessary.
5. Close all valves in the adsorber piping system.
4. Install the carbon acceptance canister (if provided) after checking to ensure it is filled with carbon.

For potable water treatment installations, the client will be responsible for cleaning and disinfecting the vessels and piping prior to filling the system with carbon. The procedures to complete this step in the installation process are the responsibility of the client.

5.2 FILLING AN ADSORBER WITH CARBON

After the system has been checked, the adsorbers are ready to be filled with granular activated carbon. The carbon is transferred to the adsorbers as a water slurry from Calgon Carbon trailers. The detailed procedures for making the transfer are given in Section 4.

The trailer driver connects the necessary hoses and operates all the valves on the trailer. A plant operator should be available to operate the valves on the adsorber system.

After all the carbon is transferred from the trailer, the driver disconnects the hoses and closes the valves on the trailer. The plant operator closes the valves in the vent and carbon fill lines on the adsorber. The adsorber is now ready to be backwashed or backflushed.

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5.3 WETTING (DEAERATING THE CARBON)

In a typical bed of virgin carbon, the pore volume is approximately 40% of the bed volume. Carbon which is shipped dry will contain air in these pores. Therefore, the carbon must be properly wetted prior to being placed on stream. If this is not done, the air within these pores will displace into the void spaces between the carbon particles during operation and cause high pressure drop and channeling in the adsorbers. These problems can cause premature breakthrough of contaminants. Air will not migrate out of the bed during normal downflow operation.

The time required for wetting is a function of liquid temperature and viscosity. Generally, a minimum wetting period of 24 hours is required using water at ambient temperatures, although a period of up to 72 hours is preferred for complete wetting. After wetting, backwashable adsorbers should be backwashed to remove air and segregate the carbon by size.

As an alternative, the Calgon Carbon Service trailer containing fresh carbon may be filled with water and allowed to stand for several hours. When the fresh carbon is transferred to the adsorber, the adsorber should be backwashed to eliminate any remaining air.

After the carbon has been wetted, the adsorber should be drained and then backfilled until water flows out the system vent line. The adsorber should be filled up-flow at 2 gpm/ft^2 maximum. For a Model 12 System this is 225 gpm, maximum.

If the unit must be placed on-stream before the carbon has been wetted, the adsorbers should be drained and backfilled when the pressure drop becomes prohibitive or after two days of operation, whichever occurs first.

For process applications, the same procedure is required. If the process liquid cannot be diluted with water and the carbon must be wetted with the process liquid there will be a significant heat of adsorption. In this case, Calgon Carbon should be contacted for specific instructions on the method to be used for wetting.

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5.4 BACKWASHING AND BACKFLUSHING

5.4.1 BACKWASH/BACKFLUSH -- GENERAL

Backwashing and backflushing are procedures involving running clean, contaminant-free water upflow through the adsorber. Backwashing or backflushing of a carbon bed can be done after fresh carbon has been transferred into an adsorber and wetted, or during operation to remove sediment from the top of the bed.

If the adsorbers are to be backwashed during operation, they should be backwashed prior to startup. The reasons for backwashing before placing fresh carbon on-line are to:

1. Size segregate the carbon so subsequent backwashing will return the carbon to the same relative position in the bed.
2. Remove any remaining air from the bed.
3. Remove carbon fines which can, in some cases, lead to excessive pressure drop and flow restriction.

Backwashing is done during operation to remove:

1. Sediment from the top of the bed.
2. Carbon fines that may be plugging the underdrain nozzles.
3. Air that is binding the bed. The need to backwash is indicated by an increased bed pressure drop.

Backwashing an adsorber results in expanding the carbon bed, removing air, suspended solids and carbon fines and classifying the carbon particles. The backwash flow rate depends upon the carbon particle mesh size and the water temperature (refer to the bed expansion curve in Section 8). Model 12 units are designed with significant straight side height to permit 30% bed expansion, and the selected backwash rate should limit the bed expansion to a maximum of 25%.

For your system, refer to Section 1.1 for the design backwash water flow rate. Note that this rate assumes a 55˚F backwash water source. Use the bed expansion curve in Section 8 to determine a backwash rate if the water source is at a different temperature.

In a system that is not designed for backwashing, an operation termed backflushing can be used to remove fines from the upper portion of the bed. This operation will not remove fines from the lower portion of the bed because it does not expand the bed. Expansion of the bed allows the fines at the bottom of the bed to move to the top. However, fines do not always cause high pressure drop, and their removal is not always necessary.

The backflushing rate is 2 to 3 gpm/ft^2 and this is not significant enough to expand the carbon bed. For the Model 10 adsorber this is a flow rate from 225 gpm to 340 gpm. Flow rates of less than 225 gpm will not expand the bed; therefore, size segregation of the bed will not occur. The time required for backflushing is 30 to 45 minutes.

Normally when backwashing or backflushing, a clean external water source is used. The stream should be compatible with the system and free of suspended solids and organic contaminants which might affect adsorption. If necessary, effluent from the adsorber system may be used as the water source. In this case a tank with storage capacity for 15 minutes of backwash water (20,000 gallons) will be necessary.

When normal downflow operation is started after backwashing, the initial 5 to 15 minutes of effluent flow will be dark due to a small quantity of fines. Under normal operating conditions, this condition will clear up.

5.4.2 BACKWASHING AN ADSORBER (FIGURES 6 AND 7 IN SECTION 8)

In this mode, a clean external source is used as the source for the backwash water. Note that the lead adsorber is taken out of service while the backwashing procedure takes place. It is recommended that the entire system be taken off-line to retain all process conditions. However, for continuous flow, the lag adsorber can remain on-line while the lead bed is being backwashed.

For a system operating in parallel, only the vessel needing backwashed should be taken off-line when backwashing is required.

1. Isolate the adsorber to be backwashed. If adsorber PV1 is to be backwashed, refer to Section 5.6.4 for valve sequencing. If adsorber PV2 is to be backwashed, refer to Section 5.6.6 for sequencing. If entire system is taken off-line, make sure source is turned off (i.e., pump) and all valves at system are closed.
2. Open the vent valve (V5 for adsorber PV1, V6 for adsorber PV2).

3. Open the backwash water inlet valve (V8 for adsorber PV1, V7 for adsorber PV2) and start the backwash pump. Backwash flow should be increased to design flow gradually, avoiding water hammer.

The backwash water enters the vessel through the effluent line and flows up through the underdrain and the carbon bed. The backwash water discharge from the vent line should be observed for clarity to determine the duration of backwashing. Backwashing for high pressure drop should take approximately 10 minutes. If excessive sediment and turbidity exists in the untreated water, the backwashing times may have to be increased to 15 minutes. A fresh carbon fill should be backwashed to classify the carbon. The time required for this step is approximately 15 minutes or until the backwash discharge is free of fines.

5.4.3 RE-STARTING SYSTEM AFTER BACKWASHING

The valve sequence given below describes the steps taken to bring a system on-line after backwashing. The valve numbers refer to bringing adsorber PV1 back on-line in the lead position. Valve numbers applying to placing adsorber PV2 back in the lead position are in parentheses.

1. Close the backwash water inlet valve V8. (V7)
2. Close vent valve V5. (V6)
5. Open cross-over valve V10. (V9)
4. Open influent valve V1. (V2)
5. Close influent valve V2. (V1)

5.5 START-UP

5.5.1 SERIES FLOW

The adsorber system is normally operated in a series mode. Valves in the influent and effluent lines are opened or closed, as required, to set the operation of the carbon vessels in the desired configuration. The first bed in the system is called the lead bed. The second bed is referred to as the polish or lag bed.

The following sequence of steps should be followed to bring an adsorption system on-line in the series mode:

1. Check that all the valves in the adsorption system are closed.

2. Open the valve in the effluent line from the polish adsorber (V4 for adsorber PV1, V3 for adsorber PV2).
5. Open the valve in the cross-over line between the adsorbers (V10 for PV1 in the lead position, V9 for PV2 in the lead position).
4. Start the feed pump and open the valve in the pump discharge line.
5. Slowly open the valve in the influent line to the lead adsorber (V1 for adsorber PV1, V2 for adsorber PV2) and allow the pressure to increase to the operating level.
6. Open the 3/4" valve located on the side wall of each vessel to bleed off any air that is trapped underneath the internal cone.

At this point, flow should be established downflow through both vessels and they will be on-line in series.

Set the flow rate to the system at the desired value after flow is established to the unit. The flow control meters and control instrumentation will be provided by the client as required for the system.

In order to obtain full utilization of the carbon and prevent air entrapment and channeling in the bed, the water level must remain above the carbon bed. To prevent the bed from draining due to gravity or loss of influent supply, a vacuum break (anti-siphon) loop or backpressure should be included by the client in the effluent piping. This start-up sequence assumes that an anti-siphon loop is present in the effluent piping. If no anti-siphon loop or backpressure is present, start the system by starting the pump and opening the valves in the opposite order of the sequence given previously (i.e., open the influent valve first, followed by the cross-over valves and effluent valve).

After the system is operating at steady state, water flow to the Carbon Acceptance Canister (CAC) can be started. The GAC in the canister must first be wetted, refer to section 5.3 for wetting instructions and section 8 for information on the carbon acceptance canister.

5.5.2 PARALLEL FLOW

The following sequence of steps should be followed to bring an adsorption system on-line in the parallel mode:

1. Check that all the valves in the adsorption system are closed.
2. Open the valves in the effluent lines from the adsorbers (V3 and V4).

5. Start the feed pump and open the valve in the pump discharge line.
4. Slowly open the valve in the influent line to one adsorber (either V1 or V2) and allow the pressure to increase to the operating level.
5. Slowly open the valve in the influent line to the other adsorber (either V1 or V2) and allow the pressure to increase to the operating level.
6. Open the 3/4" valve located on the side wall of each vessel to bleed off any air that is trapped underneath the internal cone.

At this point, flow should be established downflow through both vessels and they will be on-line in parallel.

Set the flow rate to the system at the desired value after flow is established to the unit. The flow control meters and control instrumentation will be provided by the client as required for the system.

In order to obtain full utilization of the carbon and prevent air entrapment and channeling in the bed, the water level must remain above the carbon bed. To prevent the bed from draining due to gravity or loss of influent supply, a vacuum break (anti-siphon) loop or backpressure should be included by the client in the effluent piping. This start-up sequence assumes that an anti-siphon loop is present in the effluent piping. If no anti-siphon loop or backpressure is present, start the system by starting the pump and opening the valves in the opposite order of the sequence given previously (i.e., open the influent valves first, followed by the effluent valves).

For parallel operation, flow is established to each vessel by opening the valves as indicated previously. Changing the flow to one vessel may result in a flow change to the other vessel on the skid. This occurs because the vessels share a common influent and effluent line. Flow meters can be installed in the individual influent lines to each vessel to balance the flow to each unit if required.

After the system is operating at steady state, water flow to the Carbon Acceptance Canister (CAC) can be started. The GAC in the canister must first be wetted, refer to section 5.3 for wetting instructions and section 8 for information on the carbon acceptance canister.

5.6 STEADY STATE OPERATION

Once flow is established to both vessels and the flow rate is set, no further adjustments are made during normal operation. The operator should establish a routine to check the adsorbers and to collect operating data. This data can be used to establish a maintenance schedule, to determine when backwashing/backflushing is necessary, or to determine when fresh carbon is needed.

5.6.1 MONITORING

Sample connections are provided on the influent and effluent lines from each vessel to take periodic samples for analysis.

Pressure gauges are provided to determine the pressure drop across each carbon bed. Taking periodic pressure readings will provide the operator with historic data for troubleshooting purposes. In the event that operating conditions change, the operator has the capability of taking corrective action.

5.6.2 VALVE OPERATION

All valves should be operated in a slow and even motion. Abrupt opening and closing of the valves can shock the system. Since complete shut-off of flow while a pump is operating could cause damage to the pump, the valves should be operated in the proper sequence in order to always maintain flow through the system. If the vessels are identified as PV1 and PV2 then the corresponding valve positions during adsorption are given as follows:

PROCESS VALVE NUMBER	SERIES PV1 TO PV2 (FIGURE 1)	PV2 SINGLE OPERATION (FIGURE 2)	SERIES PV2 TO PV1 (FIGURE 3)	PV1 SINGLE OPERATION (FIGURE 4)	PARALLEL OPERATION (FIGURE 5)
V-1	Open	Closed	Closed	Open	Open
V-2	Closed	Open	Open	Closed	Open
V-3	Open	Open	Closed	Closed	Open
V-4	Closed	Closed	Open	Open	Open
V-5	Closed	Closed	Closed	Closed	Closed
V-6	Closed	Closed	Closed	Closed	Closed
V-7	Closed	Closed	Closed	Closed	Closed
V-8	Closed	Closed	Closed	Closed	Closed
V-9	Closed	Closed	Open	Closed	Closed
V-10	Open	Closed	Closed	Closed	Closed

Refer to Section 8 for the figures referenced in this table.

Single stage operation occurs for short time periods, such as during carbon transfer or backwashing, or during other routine maintenance on one of the adsorber vessels.

NOTE: FLOW SEQUENCE CHANGES (AS DESCRIBED IN THE FOLLOWING SECTIONS) SHOULD BE PERFORMED ONLY WHEN CARBON CHANGEOUTS, BACKWASHING, OR OTHER VESSEL MAINTENANCE IS REQUIRED.

5.6.3 ADSORBER SEQUENCING: PV1 LEAD, PV2 LAG

This sequence should be used to start up the system in series mode from PV1 to PV2. Refer to Section 5.5.1 for additional details.

Starting valve position: All valves closed.

- Open valve V3
- Open valve V10
- Open valve V1

At this point, flow should be established from PV1 to PV2.

5.6.4 ADSORBER SEQUENCING: TAKING ADSORBER PV1 OFF-LINE

When adsorber PV1 is taken off-line for carbon transfer or backwashing, all of the process flow should be sent through adsorber PV2.

Starting valve position: Series flow from PV1 to PV2.

- Open valve V2
- Close valve V10
- Close valve V1

Flow should now be established through adsorber PV2 with adsorber PV1 off-line for carbon transfer or backwashing.

5.6.5 ADSORBER SEQUENCING: PV1 BACK ON-LINE AS LAG VESSEL

After adsorber PV1 is filled with fresh carbon, it should be placed on-line in the polish position, with adsorber PV2 moved to the lead position.

Starting valve position: Single stage flow to PV2.

- Open valve V9
- Open valve V4
- Close valve V3

Flow should now be established from adsorber PV2 into adsorber PV1.

5.6.6 ADSORBER SEQUENCING: TAKING ADSORBER PV2 OFF-LINE

When adsorber PV2 is taken off-line for carbon transfer or backwashing, all of the process flow should be sent through adsorber PV1.

Starting valve position: Series flow from PV2 to PV1.

- Open valve V1
- Close valve V9
- Close valve V2

Flow should now be established through adsorber PV1 with adsorber PV2 off-line for carbon transfer or backwashing.

5.6.7 ADSORBER SEQUENCING: PV2 BACK ON-LINE AS LAG VESSEL

After adsorber PV2 is filled with fresh carbon, it should be placed on-line in the polish position, with adsorber PV1 moved to the lead position.

Starting valve position: Single stage flow to PV1.

- Open valve V10
- Open valve V3
- Close valve V4

Flow should now be established from adsorber PV1 into adsorber PV2.

5.6.8 ADSORBER SEQUENCING: PARALLEL OPERATION

The following sequence should be used to start up the system in parallel mode. Refer to Section 5.5.2 for details.

Starting valve position: All valves closed.

- Open valves V3 and V4
- Open valves V1 and V2

Flow should now be established through the system in parallel. When carbon transfer or backwashing is required, the system should be shut down until the operation is complete.

5.7 SHUTDOWN

5.7.1 SHORT TERM SHUTDOWN

For short duration shutdowns lasting less than one or two weeks, little needs to be done. Close all valves in the adsorber piping system, and open the vent line valves on each vessel. The feed pumps should be shut down and the valves closed in the lines to and from the pumps. Any drain valves in the pump casing should be opened for the duration of the shutdown. Freeze protection measures such as draining lines at the low points should be taken when there is a chance of freezing. Freeze protection measures are usually the responsibility of the client.

5.7.2 EXTENDED SHUTDOWNS

For extended shutdowns, in addition to the steps in Section 5.7.1, the adsorbers should be drained of all water.

When the adsorbers are started up again, the carbon beds may require disinfection. If disinfection is required, the procedures to disinfect a carbon bed can be found in Section 8 of this manual. Once the disinfection is complete, backwashable adsorbers should be backwashed prior to start-up.

After disinfection, bring the adsorber back on-line in the downflow mode, monitor the effluent for coliform count and monitor the pressure drop.

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5.8 TROUBLESHOOTING GUIDE

PROBLEM		PROBABLE CAUSE		REMEDY
High pressure drop across adsorber.	1.	Bed not flooded. Bed is air bound.	1.	Open vent valve or carbon inlet valve to release pressure. Add water upflow to fill vessel. Establish constant forward flow, then close valve.
	2.	High feed pump pressure.	2.	Throttle feed pump.
	5.	High suspended solids loading or carbon fines around the nozzles.	5.	Test feed for suspended solids. Install influent filter. Backwash/backflush the adsorber.
	4.	Improper valve settings.	4.	Check valve sequence.
	5.	Carbon in effluent strainer.	5.	Shut down system. Clean out retainer and effluent line. Remove carbon from adsorber. Inspect vessel using side manway and repair damaged underdrain in adsorber.
Carbon in the effluent.	1.	Internal mechanical (i.e. underdrain) failure.	1.	Determine which adsorber is causing the problem, then remove carbon and make repairs. In addition, inspect carbon retainer in effluent line and replace if necessary.
Leaking flange.	1.	Loose bolts.	1.	Tighten bolts.

5.8 TROUBLESHOOTING GUIDE

PROBLEM		PROBABLE CAUSE		REMEDY
Excessive flow out vent line.	1.	Broken rupture disk.	1.	Check the following conditions before replacing disk: 1) Check downstream valving to make sure that the system is not plugged off. 2) Check feed pump pressure to make sure it is not too high. 3) Check process valve sequence. 4) Check that excessive pressure build-up did not occur in closed vessels during extended shutdowns. Once the potential source of overpressurization is removed, replace rupture disk.
Sudden high contaminant concentration in effluent.	1.	Carbon heel from improper transfer.	1.	Wait until contaminant flushes out. Review transfer procedures.
	2.	Leaking valve.	2.	Repair/replace valve.
	5.	Mass transfer zone has extended into effluent.	5.	Replace carbon.

5.8 TROUBLESHOOTING GUIDE

PROBLEM		PROBABLE CAUSE		REMEDY
Premature breakthrough of organics in the effluent.	1.	Influent concentration change.	1.	Confirm by analyzing effluent sample(s) before changing carbon.
	2.	Air in the influent stream.	2.	Open vent valve and fill bed upflow with water as required.
	5.	Background TOC or colloids present.	5.	Change carbon.
	4.	Leaking valves.	4.	Check operation of valves in influent and effluent lines.
	5.	Incorrect valve sequence.	5.	Sequence the flow through the system properly.
Carbon heel in empty vessel.	1.	Insufficient rinse water.	1.	Provide additional rinse water flow.
	2.	Mechanical failure.	2.	Check vessel internal parts and make repairs.
	5.	Foreign material on the carbon.	5.	Rinse vessel to remove carbon.

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SECTION 6

GAC TRANSFER PROCEDURE

SECTION 6

6.0 CARBON TRANSFER PROCEDURE -- STANDARD TRAILER

The procedures that are detailed in this section of the manual are for Calgon Carbon's standard carbon trailer. Carbon may be delivered in any of two types of trailers; the standard (single compartment) trailer, or the multi compartment trailer.

The multi compartment trailer (Figure 9) is built to hold 10,000 pounds of carbon in each end section and 20,000 pounds in its center section. The multi compartment trailer arrives at the site with fresh carbon in the end sections. First, spent carbon is transferred to the center section of the trailer and then the fresh carbon is transferred from the end compartments to the adsorber.

In cold weather conditions, steam may be used to thaw the trailer and transfer lines if necessary. Contact Calgon Carbon for trailer steaming procedures if required.

6.1 SITE REQUIREMENTS

A flat paved area is needed to support the Calgon Carbon service trailer which may weigh up to 100,000 pounds. The overhead clearance required for the adsorption system is 13 to 14 feet. Diagrams of the trailers with on-board piping are shown in Figures 8 and 9.

The utility and piping requirements to connect to the adsorber and trailer are as follows:

Adsorber

Plant Air Line	3/4" Universal air connection 100 scfm at 30 psig min. (Attaches to 3/4" flush connection on carbon fill line above carbon inlet valve)
Plant Water Line	100 gpm (max) at 30 psig min. (Attach at drain connection using a 2" female Kamlock, or through backwash inlet using an 8" 150 lb. flanged connection)

Trailer (See Figure 8)

Plant Air Line	3/4" Universal air connection (for both industrial and food grade trailer) 100 scfm regulated to 15 psig max.

Plant Water Line	4" Kamlock connection (female for industrial trailer, male for food grade trailer) 100 gpm regulated to 15 psig max. (Connect to Trailer Carbon Fill or Discharge Line)

6.2 SPENT CARBON TRANSFER TO TRAILER

Spent carbon transfer from the adsorber to the trailer is accomplished by pressurizing the adsorber with plant air. When the transfer is complete, the spent carbon in the trailer is drained of water. Prior to disconnecting any lines, the air supply must be shut off, and the adsorber and all transfer lines must be vented.

6.2.1 Spent Carbon Transfer

A. Prepare for Spent Carbon Transfer:

1. Close all adsorber valves.
2. Connect the adsorber carbon outlet line to the trailer carbon fill line using 4" flexible hose.
3. Open the center manway of the trailer or trailer vent valve T1 for venting.
6. Open valve T2 in the trailer carbon fill line.
5. Check that the adsorber is full of water.
6. To aid the initial phase of transferring spent carbon, fill the transfer line with water. To do this, use a 3/4" water hose to fill the transfer line with water at the adsorber carbon outlet valve's flush-out connection.

B. Transfer Spent Carbon

1. Open the 3/4" air line valve slowly and pressurize the adsorber to 25 to 30 psig.
2. Open the 4" adsorber carbon outlet valve (V12 for adsorber PV1, V11 for adsorber PV2) and transfer the spent carbon to the trailer.
3. As the trailer starts to fill with carbon slurry, open the trailer septa valves T8, T9, and T10 to drain off excess motive water.

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The transfer should take 20 to 30 minutes per 20,000 lbs of carbon. The transfer will end with a loss of pressure in the adsorber and the sound of air in the transfer line.

A small heel of carbon may remain in the adsorber. This material will have to be removed. Close the carbon outlet valve on the adsorber and add plant water to the adsorber for 2-3 minutes (through the drain connection or backwash inlet). Leave the 3/4" air line open. When the adsorber pressure reaches 25 psig, open the adsorber carbon outlet valve (V12 for adsorber PV1, V11 for adsorber PV2) and transfer the remaining amount of carbon into the trailer.

C. End Transfer

1. Close the plant air line valve.
2. Vent the tank and lines through the trailer vent valve T1.
3. Open the adsorber vent valve (V5 or V6) to further aid the venting.
6. Close the adsorber carbon outlet valve (V12 for adsorber PV1, V11 for adsorber PV2).
5. Using a 3/4" water hose at the adsorber carbon discharge line flush-out connection, flush out the transfer line for a few minutes to remove all traces of carbon. Bleed the water hose and remove it.

6.2.2 Drain Water From Trailer

A. Prepare for Draining Water

1. Close all valves on the trailer. Close the trailer manway.
2. Connect the plant air line to the 3/4" connection on trailer carbon fill line using the air line hose.
3. Connect the trailer carbon discharge/drain line to the drain line in the trench by means of a 4" flexible hose.

B. Draining Trailer

1. Pressurize the trailer to 15 psig by slowly opening plant air line valve T4 on the trailer.
2. Open 2" trailer septa valves T8, T9, and T10.

By pressurizing the trailer, water will be drained in less time than if drained by gravity.

C. End Draining

1. When the carbon is completely drained, close the air line valve T4 on the trailer.
2. Vent trailer slowly through trailer vent valve T1.
3. When venting is complete, close all valves on the trailer and disconnect all hoses.

The trailer is now full of drained spent carbon and is ready for return to Calgon Carbon for reactivation.

6.3 FRESH CARBON TRANSFER FROM TRAILER

Fresh carbon is transferred in a slurry using plant air pressure. The trailer is first filled with water to create the slurry. The carbon slurry hose on the trailer is connected to the adsorber fill line and the trailer carbon discharge line. After putting a water cushion in the adsorber, the trailer is pressurized and the carbon slurry is transferred to the empty adsorber. Prior to disconnecting any lines, the air supply must be shut off, and the trailer and all transfer lines must be vented.

Under no circumstances should the standard and triple compartment trailers be connected to a pressure source exceeding 15 psig.

6.3.1 Fill The Trailer With Water

If the carbon is wetted prior to delivery, about 4000 gallons of water will be required. If the carbon is dry, about 5000 gallons of water will be required. The trailer may be filled either upflow or downflow.

A. Filling Operation

1. Connect water line to the trailer (carbon fill line if filling downflow, carbon discharge line if filling upflow) using a 4" flexible hose.
2. Open one top manway to vent trailer during filling.
3. Open trailer vent line valve T1.
6. Open trailer water line valve (valve T2 if filling downflow, valves T8, T9, and/or T10 if filling upflow).
5. Open plant water line valve slowly and fill the trailer.

The trailer will be filled with approximately 4000 to 5000 gallons of water. The trailer filling shall be visually determined by observing the water level through the manway or by metering the desired amount.

B. End Filling Operation

1. Close plant water line valve.
2. Close trailer water line valve (T2 for downflow, T8, T9, and T10 for upflow), manways, and trailer vent valve T1.
3. Disconnect hose.

6.3.2 Transfer Carbon To Adsorber

A. Prepare for Transfer

Place about 3000 gallons of water in the adsorber. This water cushion helps to protect the underdrain system and vessel lining. If the amount of water cannot be measured, fill the vessel until water flows from the air bleed nozzle located at the point where the internal cone meets the vessel sidewall. After water flows from this point, continue to fill the vessel for several minutes to allow the water cushion to rise several inches above the internal cone.

1. Connect the adsorber fill line to the trailer carbon discharge/drain line using 4" flexible hose.
2. Connect the 3/4" plant air line to the trailer carbon fill line using the air line hose.
3. Close all valves on the adsorber.
6. Open the adsorber vent valve (V5 or V6).
5. To aid the initial phase of transferring fresh carbon, fill the transfer line with water. To do this, use a 3/4" water hose to fill the transfer line with water, at the carbon inlet valve's flush-out connection.

B. Transfer Fresh Carbon

1. Pressurize the trailer to 15 psig by slowly opening the plant air line valve and then slowly opening valve T4 in the trailer carbon fill line.
2. Open the adsorber fill line valve (V14 for adsorber PV1, V13 for adsorber PV2).

3. The Calgon Carbon trailer driver will open the trailer carbon outlet valves T5, T6, and T7 to empty the respective hoppers.
6. If a water cushion is utilized, open an adsorber drain valve shortly after starting the transfer. This is done to reduce the amount of water that overflows at the end of the transfer. The disposal of the excess motive water is provided by the customer.

C. End Transfer

1. Close the plant air valve and vent the trailer through the adsorber vent valve.
2. Close the adsorber drain valve if it was utilized during the transfer.
3. Slowly open trailer vent valve T1 for additional venting.
6. When completely vented, close the adsorber fill line valve (V14 for adsorber PV1, V13 for adsorber PV2), disconnect the hoses, and close the trailer valves.
5. Refer to Sections 3.3 and 3.6.2 for instructions on wetting and backwashing/backflushing the adsorber.
6. After the adsorber has been backwashed/backflushed, shut off the plant water and close the vent valve on the adsorber.

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CALGON CARBON CORPORATION

Section 7

CARBON GENERAL INFORMATION

SECTION 7

7.0 GENERAL INFORMATION

7.1 MAINTENANCE

As preventative maintenance, periodic inspection of the vessel internal parts should be made to ensure that the underdrain, vessel lining, and nozzles are in good condition. As a minimum, each adsorber should be inspected once per year or during carbon transfers if the on-line period exceeds one year. Any nozzles showing signs of fatigue or surface area restriction due to plugging of the nozzle slots should be replaced. Nozzles should be physically checked to ensure that they are tightly secured.

Systems with high backwash frequencies and rigorous backwash requirements should be inspected more frequently. The vessels must be fully emptied to allow inspection of the interior of the vessel. Follow the safety guidelines listed in the following sections when entering enclosed vessels. It is recommended that Calgon Carbon Field Service personnel be present during internal vessel inspections.

Pressure gauges have been installed to determine the pressure drop across each carbon bed. Taking periodic pressure readings will give the operator the capability of monitoring the pressure drop across the carbon vessels over time. If a pressure increase is observed, then corrective action can be taken before the pressure drop becomes a problem.

Differential pressure switches with indicating gauges are installed on each vessel to monitor the pressure drop across the vessel. The system should be operated to not exceed a differential pressure of 20 psi. If the differential pressure exceeds this value, the vessel should be backflushed. The backflush water flow rate should also be controlled to maintain the differential pressure at less than 20 psi.

To protect the vessel from high pressure, a safety device is provided to relieve pressure at the design rating of the vessels

In order to prevent carbon from entering the effluent stream, a carbon retainer screen is installed in the expansion joint located in the effluent line from each adsorber. In the event of an underdrain nozzle failure, the strainer will fill with carbon and the pressure drop will increase to a point where the system flow is reduced. If this should occur, the system should be operated in single vessel mode (see Figure 2 or Figure 4 in the Section 8) until the damaged underdrain in the other vessel is repaired.

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7.2 SAFETY CONSIDERATIONS

7.2.1 Oxygen Demand Due To Activated Carbon

Studies have shown that low oxygen content exists in vessels containing wet drained granular activated carbon. The laboratory experiments conducted since that time also have revealed that commercial activated carbons in a wet or moist condition will lower the oxygen content of an isolated space.

Preliminary indications of this research are:

1) The phenomenon occurs with all types of wet activated carbon.
2) The rate of oxygen uptake naturally varies with the degree of exposure of the wet carbon to the air. Thus, it is relatively rapid in a drained bed.
3) There is some indication of a limit to the carbon's capacity for oxygen, but until more is known, it would be prudent to assume that all carbons (fresh, used, reactivated) will also exhibit this characteristic. Similarly, although these tests were run with water, it should be assumed that the phenomenon will occur in other liquid and vapor systems.

Based on the properties of wet activated carbon, a confined space entry procedure should be established for any facility using carbon in confined vessels.

All confined spaces, including those containing activated carbon, should be presumed to be hazardous. Appropriate safety measures should always be taken before entering, as well as when workers are in a confined space. OSHA regulations applicable to respiratory protection in oxygen deficient atmospheres should be strictly adhered to.

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7.2.2 Emergency Procedures

In the event a malfunction which causes a shutdown of an adsorber should occur, the flow can either be switched to the second adsorber in the system or the flow can be stopped.

If a major leak or similar problem develops, flow to the adsorber should be stopped immediately and steps taken to correct the problem. Proper safety procedures should be observed at all times to prevent damage to the equipment or injury to personnel.

7.2.3 Pressure Relief Warning



TO AVOID VESSEL DAMAGE AND ENDANGERMENT OF OPERATING PERSONNEL, DO NOT BLOCK THE PRESSURE RELIEF DEVICE FROM VENTING TO ATMOSPHERE.

7.3 RECORD KEEPING

Normally, operating data is taken for: 1) flow rates, 2) which beds are in service, 3) pressure drop across each unit, and 4) necessary analytical work for Influent and effluent to each adsorber. This may include: pH, TOC level, BOD, COD, toxicity, organic contaminant levels, and inorganic levels.

CALGON CARBON CORPORATION

Section 8

ACTIVATED CARBON / ADSORPTION INFORMATION

SECTION 8

8.0 ACTIVATED CARBON / ADSORPTION INFORMATION

8.1 ADSORPTION

There are two types of adsorption: chemical and physical.

Chemical adsorption is a chemical reaction between a molecule in a solution or vapor with the surface of an adsorbent such as activated carbon. The chemical reaction is usually irreversible. An example of chemical adsorption is chlorine removal from water. The chemical reaction of chlorine with carbon and water forms Cl- and CO3= ions.

Physical adsorption is usually explained in terms of surface structure (or energy per unit volume) of the solid. While molecules in the interior of any solid material are subject to equal forces in all directions, the molecules on the material's surface are subjected to unbalanced forces. This results in an imbalance with inward forces toward the solids. Molecules that are either gaseous or liquid then become attracted (adsorbed) to the solid's surface.

The attractive forces, known as London Dispersion Forces, are the same forces responsible for surface tension and condensation of vapors to liquid. These forces are a type of Van der Waals force and range from very weak to moderately strong. Physical adsorption is reversible and changing the process variables in a system can cause molecules to be desorbed.

An important aspect to any adsorbent is the amount of pore volume it contains per unit volume or per net weight. Examples of adsorbents are activated carbon, silica gel, activated gel, alumina, and zeolite.

8.2 ACTIVATED CARBON AND HOW IT WORKS

Any organic material with high carbon content (coal, wood, peat, coconut shells, etc.) can be used as the raw material for making activated carbons of various activities and properties. When making high quality granular activated carbon from coal, the raw material is ground and a binder is added to give the end product suitable hardness. The mixture is then re-compacted and crushed to give it the desired particle size. The carbon is then activated by thermally decomposing and removing carbon from the

structure in a reducing atmosphere at about 1800°F. Furnace temperature and the furnace atmosphere are controlled to produce the desired adsorption properties in the product.

The resultant product has an incredibly large internal pore volume per unit particle volume and a network of submicroscopic pores where the adsorption takes place. About 40% of the particle volume is used to contain adsorbates. One pound of activated carbon contains an effective total area of over 100 acres.

Activated carbon normally removes adsorbates (contaminants or desired products) from a solution (solute) through physical adsorption. The adsorbate would have to differ from the solute. For example, in aqueous solutions the solute should be more neutral or non-polar and have a higher molecular weight.

Many factors affect carbon adsorption in liquids, such as pH, flow rate, temperature, solubility, concentration of adsorbate, type and number of different adsorbates, viscosity, and the level of adsorbate removal required.

In any stream, there are four steps that occur in order for adsorption to take place. First, the adsorbate molecule must migrate through the bulk of solution toward the carbon particle. This is known as bulk diffusion. Second, the adsorbate penetrates the surface film to reach the exterior surface of the carbon. This is known as film diffusion. Third, the adsorbate diffuses through the transport or large pores. This is known as pore diffusion. Fourth, the adsorbate is adsorbed deep into the micropore structure of the activated carbon. In most water applications, the rate limiting step is the pore diffusion step.

In a typical fixed bed carbon system, the liquid flows down through an adsorber. Initially, the adsorbate is adsorbed onto the top most portion of the carbon. The rate of adsorption will determine the depth of carbon (mass transfer zone) that is utilized to remove the adsorbates. The varying concentration in the mass transfer zone is known as the wavefront.

Eventually, the wavefront moves through the bed and contamination breaks through into the effluent from the bed. This is known as the breakpoint. In a single or parallel adsorber system, the contaminants are usually monitored until the effluent approaches the allowable limit. The adsorber is then taken off-line and the spent carbon is removed. The adsorber is then refilled with fresh carbon and brought back on-line. In a series mode, the mass transfer zone in the first or lead bed is allowed to pass through the adsorber into the second bed. Usually, when adsorbing multiple components, the first two or three compounds that are being monitored in the effluent from the lead bed are allowed to approach their influent levels, at which point the adsorber is taken off-line.

8.3 FACTORS AFFECTING ADSORPTION

Concentration: With each adsorbate, a high concentration will result in a higher adsorption capacity for that adsorbate on the carbon. For example, if an adsorbate has a one percent loading at 1 mg/l, it might have a three percent loading at 10 mg/l. However, the volume of carbon required to treat a fixed volume of solution will go up if the concentration goes up.

When the concentration of the feedstream changes dramatically, such as when a spill occurs upstream of a potable water plant intake, undesirable effects may occur. Concentrations at the intake of the plant may go up 100 to 1000 times the normal influent concentration. The activated carbon would adsorb the contamination with a higher capacity, if adsorptive capacity was available.

However, upon passage of the spill past the intake, the activated carbon may desorb some of the high level contamination to fresh carbon downstream of the mass transfer zone or into the effluent. When upsets occur, a conservative approximation is to assume that additional carbon is exhausted by the excess contaminant at the original loading rate for the normal influent level.

Another example is when the contaminant concentration in the influent decreases for a period of time. In this instance the adsorbate will start to desorb. The rate of desorption is slower than the rate of adsorption. Therefore, a conservative estimate of the overall effect is that a fixed volume at the reduced influent level will exhaust as much carbon as if the influent concentration was consistently high.

A steady feed concentration will help minimize the amount of carbon that is used in an application. A steady feed would usually be considered to be +/-25% of the average concentration. However, the carbon bed will act to average out upsets and variations, except when the bed is nearly exhausted.

Flow Rate: In many applications, the flow rate to the adsorber is varied because the flow demand changes. As the flow changes, so does the mass transfer zone (MTZ). These changes are approximated by a directly proportional relationship between MTZ length and flow rate. For example, if the MTZ is 1 foot at 250 gpm, it would be 2 feet at 500 gpm. If the flow rate is increased dramatically, the MTZ is further lengthened because some desorption may take place, resulting in less efficient operation. For the optimum carbon usage, the flow rate should be steady (if possible).

In a series configuration, increasing the flow rate usually has a minimal impact. In a parallel mode, this impact is more substantial since the carbon is usually taken off line on the basis of the effluent quality. since the MTZ is lengthened the on-stream time will be shortened.

Viscosity: As viscosity increases in a system, the time to adsorb lengthens, and thus the MTZ lengthens. In a process application the temperature of the feedstream may be raised to offset increases in viscosity, but if the temperature is raised too high degradation of product may occur or the adsorption capacity of the carbon may be reduced. In water applications, viscosity has minimal impact because it is relatively low.

Temperature: In liquid phase systems, the adsorptive capacity is usually lowered at higher temperatures because the solubility is increased.

Feedstream pH: The pH of the feedstream can impact adsorption efficiency. This impact may be substantial since the pH affects the ionization of the adsorbate. Usually, the more ionic adsorbates have less adsorption capacity. Therefore, organic acids adsorb better at lower pH levels, while organic bases adsorb better at higher pH levels.

Water Characteristics: On each start-up of fresh carbon, the pH of the effluent stream may rise. This occurs because species like sulfates, nitrates and chlorine adsorb and displace alkaline species. The pH will return to normal, depending on water characteristics, after 250 to 350 bed volumes have been treated. If this is a problem, then either acid should be added to the effluent, or the carbon should be allowed to stand in a sodium sulfate solution for 10 to 12 hours.

The carbon has a capacity for sodium sulfate of 1% by weight. Therefore, the water in contact with the carbon should contain a quantity of sodium sulfate at least equal to 2% by weight of the carbon. In a 20,000 pound adsorber this would be 400 pounds of Na2SO4 in 5,000 gallons of water.

Solubility: The water solubility of a particular compound is a very good indicator of its adsorptivity. Generally, the more soluble a compound is, the more difficult it is to be adsorbed. Also, a more water soluble compound has a longer MTZ.

Suspended Solids: Suspended solids should usually be taken out of the feedstream before the carbon adsorbers. Suspended solids (>10 microns) will usually be filtered out within the first 6" of carbon and the pressure drop across the carbon will increase. If the pressure drop increases too much, the unit should be backwashed or backflushed. Normally, feed streams containing suspended solids of more than 50 ppm are pre-filtered.

If the suspended solids are finer than 10 microns, the solids will usually not be filtered out by the carbon. The solids would then pass through the carbon into the effluent. This condition is very undesirable because the solids often contain dissolved or attached adsorbate and premature breakthrough can appear to occur. For materials to adsorb they must be in solution, so they can diffuse into the pore structure.

Immiscible Oils and Greases: Immiscible oils and greases have to be separated from the feedstream before the carbon adsorbers. If they are not removed, they may coat the carbon particles with a fine film. The adsorbates will not be able to pass through this film, and the carbon will not be effectively utilized. Oils and grease can also behave as a suspended, immiscible solid.

Heat of Adsorption: Heat is often given off when molecules are adsorbed. The amount of heat is conservatively estimated at two (2) times the heat of vaporization. In a process stream where the solvent is an organic liquid, a heat-up potential exists if the carbon has not been previously wetted and deaerated properly. Refer to Section 3.3 of this manual for wetting procedures.

Water has too low a heat of adsorption to cause a problem for aqueous solutions.

Competitive Adsorption: In most carbon applications (process, wastewater, groundwater, and potable water), more than one adsorbing compound is in the feedstream. Some of these compounds must be adsorbed while others may be permitted to pass through the carbon bed.

Unfortunately, the activated carbon cannot tell which of the molecules must be adsorbed. All of the components in the feedstream will compete for adsorption space, making the removal of target components less efficient. Therefore, competitive adsorption can cause premature breakthrough of the target component.

8.4 ADDITIONAL ADSORPTION THEORY

Desorption/Displacement: Desorption is the opposite of adsorption and may occur for many reasons. Changes in the feedstream components, temperature, pH, and feedstream concentration may promote desorption. In order to minimize desorption and optimize carbon usage, the feedstream should be stable (if possible). The rate at which desorption takes place is usually much slower than the adsorption rate.

If a more strongly adsorbed organic enters the feed it will desorb the target adsorbate. This forces the target adsorbate to re-adsorb deeper in the carbon bed, and eventually breakthrough will occur.

Roll-Over in Competitive Adsorption: When an adsorber system runs beyond breakthrough, the more weakly adsorbed components originally in the feedstream can be desorbed into the effluent. The resulting concentrations may exceed the inlet concentrations. This phenomenon is known as roll-over. In a properly operated column system, roll-over of key components will not be observed in the effluent.

Effect of Bacteria: Higher pressure drops can be a result of bacteria growth in some wastewater applications. This is due to bacteria slime and exhaust gasses from the bacteria. If backwashing does not get rid of the pressure drop problem, then either NaOH washing or higher temperatures will control bacteria growth. Usually, sodium hydroxide washing is used in lined vessels. Do not use biocides, chlorine, or other additives, since they will adsorb and reduce carbon life without affecting the bacteria.

Refer to Section 8 for sodium hydroxide washing procedures.

8.5 GLOSSARY

The following terms are commonly used to describe adsorption theory, activated carbon, and adsorption systems.

ABRASION NUMBER -- A test performed on a particulate material to define the resistance of the particles to degrade on handling. It is calculated by contacting a sample with steel balls in a Ro-Tap machine and determining the ratio of the final to the original mean particle diameter.

ACTIVATED CARBON -- A carbonaceous material that is a crude form of graphite with a random and amorphous structure. The structure is highly porous, over a broad range of pore sizes, from visible to molecular cracks and crevices.

ACID WASHED ACTIVATED CARBON -- Activated carbon which has been washed with an acid solution for the purpose of dissolving the iron from the carbon. Acid washed carbons are usually used in systems/processes operating at low pH.

ADSORBATE -- Any substance that is or can be adsorbed on the adsorbent.

ADSORBENT -- Any solid having the ability to concentrate significant quantities of other substances on its surface. Activated carbon is an adsorbent.

ADSORBER -- A vessel designed to hold granular activated carbon.

ADSORPTION -- A phenomenon where an adsorbate is physically attracted to the surface of the adsorbent.

ADSORPTION ISOTHERM -- A graphic depiction of the capacity of an adsorbent to adsorb a specific adsorbate. The measurements of capacity are performed at constant temperature using either varying amounts of the adsorbate or adsorbent.

ADSORPTION PORES -- The finest pores in the carbon structure. Pores which have adsorption capacity.

AGGLOMERATED -- Material that has formed into a solid mass.

AIR SCOURING -- A process that uses pressurized air to break-up any agglomerations in a carbon bed. Air is blown into the bottom of the bed before the bed is backwashed. Air scouring capability must be incorporated into the system design during the design phase.

APPARENT DENSITY -- A physical property that is defined as the mass per unit volume of a granular material under specified conditions. The apparent density includes the carbon skeleton volume plus the pore and void volumes.

ASH -- The noncombustible mineral matter that is contained in activated carbon and is the residue that remains after the combustion of a carbonaceous material. The measurement of ash is performed under specified conditions and is normally defined on a weight percent basis.

BACKWASH -- An operating method used to remove suspended solids from a carbon bed. Water is pumped into the bottom of the adsorber, flows upward through the carbon bed, and exits through the backwash outlet. The upward flow expands the bed and removes carbon fines, entrained air and suspended solids. The percent bed expansion (up to 50%) and time required for backwashing are a function of the backwash rate and water temperature.

BACKFLUSH -- A process similar to backwashing, but the flow rate is not high enough to expand the bed more than five percent.

CARBON HEEL -- Any quantity of spent carbon not removed from an adsorber before recharging the vessel with fresh carbon.

CARBON TETRACHLORIDE ACTIVITY -- A measurement of the increase in weight of a sample of activated carbon after air saturated with carbon tetrachloride is passed through the sample. The test is performed at a given temperature and the results are reported as weight percent.

CARBON TRAILER -- A bulk trailer used to transport 20,000 pound (or less) loads of granular carbon to/from the customer's plant site.

CHEMISORPTION -- A chemical process that binds an adsorbate to the surface of an adsorbent by forces whose energy levels approximate those of a chemical bond.

COLOR BODIES -- Complex molecules which impart color (usually undesirable) to a solution. Carbon adsorption is often used for color removal applications.

COUNTER-CURRENT OPERATION -- A mode of operation where the flow of liquid is opposite the movement of the adsorbent. This method of operation produces the lowest carbon usage rate or highest efficiency.

CRITICAL BED DEPTH -- The distance between the fresh carbon and the spent carbon for a bed of activated carbon. In other words, it is the portion of the bed which is partially spent and the zone where adsorption takes place. The critical bed depth is measured in feet. For a single column system, this is the amount of carbon that is not completely utilized when the effluent objective is reached and the carbon is taken off-stream.

DEAERATION (WETTING) -- The process of removing air (gases) from a carbon bed and the carbon pores. The volume of air in activated carbon is in the void space and pore volume, which typically accounts for 80% of the total volume in a carbon bed (the carbon skeleton accounts for the other 20%).

DESORPTION -- The opposite of adsorption. A phenomenon where an adsorbed substance leaves the surface of the adsorbent.

EDUCTOR -- A device to motivate a slurry of activated carbon and water slurry through hoses and pipes. An eductor has no moving parts and utilizes pressurized water as the motive force.

FRESH CARBON--New carbon that is placed into an adsorber. Fresh carbon can be either virgin carbon or newly reactivated carbon.

HARDNESS NUMBER -- A measurement of the resistance of a granular carbon to the degradation action of steel balls in a Ro-Tap machine. This number is calculated by using the weight of granular carbon retained on a particular sieve after the carbon has been in vigorous contact with the steel balls.

HEAT OF ADSORPTION -- The heat given off when molecules are adsorbed.

IODINE NUMBER -- The measurement of the amount of iodine adsorbed by one gram of carbon. The concentration of iodine is 0.02N. The iodine number is reported as milligrams of iodine.

LAG ADSORBER -- The second bed of carbon through which the liquid passes in a series operated adsorption system. The lag vessel contains carbon that is partially spent when the carbon in the lead adsorber is completely spent.

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LEAD ADSORBER -- The first bed of carbon through which the liquid passes in a series operated adsorption system. The lead vessel contains carbon that is the first to become spent.

MASS TRANSFER ZONE -- The adsorption gradient that exists in the carbon bed. It corresponds to the gradual transition of the carbon from spent to fresh.

MESH SIZE -- The measurement of the particle size of granular activated carbons determined by the U.S. Sieve Series. Particle size distribution within a mesh series is typically given in the specification of the particular Calgon Carbon carbon.

MOLASSES NUMBER -- A ratio of the optical densities of a molasses solution treated with a standard activated carbon compared to a molasses solution treated with the activated carbon in question.

MOISTURE -- The measurement of the amount of water adsorbed on activated carbon. Moisture is reported as percent. For Calgon Carbon's coal based products the moisture specification is less than 2% as packed.

PARALLEL FLOW -- The mode of operation when two or more adsorbers are operated so that the influent flow is distributed equally to each adsorber.

PARTICLE DENSITY -- A measurement of the weight per unit volume of granular activated carbon as determined by the displacement of mercury. Particle density is typically reported as g/cc. The particle density includes the carbon skeleton volume plus the pore volume.

POLISH ADSORBER -- See Lag Adsorber.

PORE VOLUME -- A measurement of the volume of pores in a unit weight of carbon. The pore volume is determined by obtaining the difference in the volumetric displacement of carbon in mercury and helium at standard conditions.

PRESSURE RELIEF DEVICE -- A device such as a rupture disk or a pressure relief valve which prevents a vessel from exceeding its design pressure.

REAL DENSITY -- A measurement of the weight per unit volume of the skeleton only of a carbon granule. This measurement excludes the pore volume and the inter-particle void space. This property is determined by helium displacement and is approximately 2.1 g/cc for coal-based carbons.

REACTIVATED CARBON (REACT CARBON) -- Granular carbon that has been thermally reactivated for re-use as fresh carbon in adsorption systems.

REACTIVATION -- A process to remove adsorbates from spent granular activated carbons using vaporization and oxidation at temperatures greater than 1000NF. Reactivated carbon can be reused. Depending on the application the performance of the reactivated

carbon can be less than, equal to, or better than virgin carbon. This is a type of carbon regeneration.

SERIES FLOW (LEAD-LAG OPERATION) -- A mode of operation where two or more adsorbers are operated so that each adsorber treats the entire influent flow, one after the other. When the carbon in the lead bed is spent, the carbon is replaced with fresh carbon and this adsorber is placed in the lag (polish) position.

SPECIFIC HEAT -- A physical property that is defined as the ratio of the quantity of heat required to raise the temperature of a compound through a particular temperature interval compared to the corresponding heat quantity for water. For Calgon Carbon carbons this value is approximately 0.20 cal/g/°C at temperatures less than 200°C.

SPENT CARBON -- Carbon that has adsorbed organic contaminants and must be removed from the system so that the effluent quality specifications are not exceeded.

SURFACE AREA -- A measurement of the total surface area available for adsorption inside the pores of activated carbon. Surface area is determined by the Brunauer, Emmett, and Teller method (BET Method), which uses the adsorption of nitrogen at liquid nitrogen temperature. Surface area is usually expressed in square meters per gram of carbon. The surface area of Calgon Carbon carbons ranges from 700 to 1200 square meters per gram.

TRANSFER TANK -- A storage tank designed to hold a charge of spent carbon. The purpose of the tank is to save on freight as only one truck is needed to deliver fresh carbon and return the spent carbon for reactivation.

TRANSPORT PORES -- Pores larger than the largest adsorption pores. These pores function as a diffusion path to transport adsorbates. Adsorption does not occur in these pores even at saturated conditions.

UNDERDRAIN -- A device located inside the adsorber to collect the fluid being treated. The underdrain permits the fluid to flow into the piping network while retaining the granular carbon in the vessel**.**

VENT -- A pipe line from an adsorber or transfer tank to an unrestricted sewer or the atmosphere.

VIRGIN CARBON -- Fresh granular activated carbon that has not been used.

VOIDS -- The space (volume) between the carbon granules. For Calgon Carbon carbons the typical range is 37% to 43% by volume.

WATER CUSHION -- The water added to an adsorber or transfer tank before charging the vessel with carbon. This is done to protect the underdrain, nozzles and lining.

WAVE FRONT -- See Mass Transfer Zone

CALGON CARBON CORPORATION

Section 9

OPERATING INFORMATION

SECTION 9

OPERATING INFORMATION

FIGURE 1 VESSEL PV-1 TO PV-2 SERIES FLOW

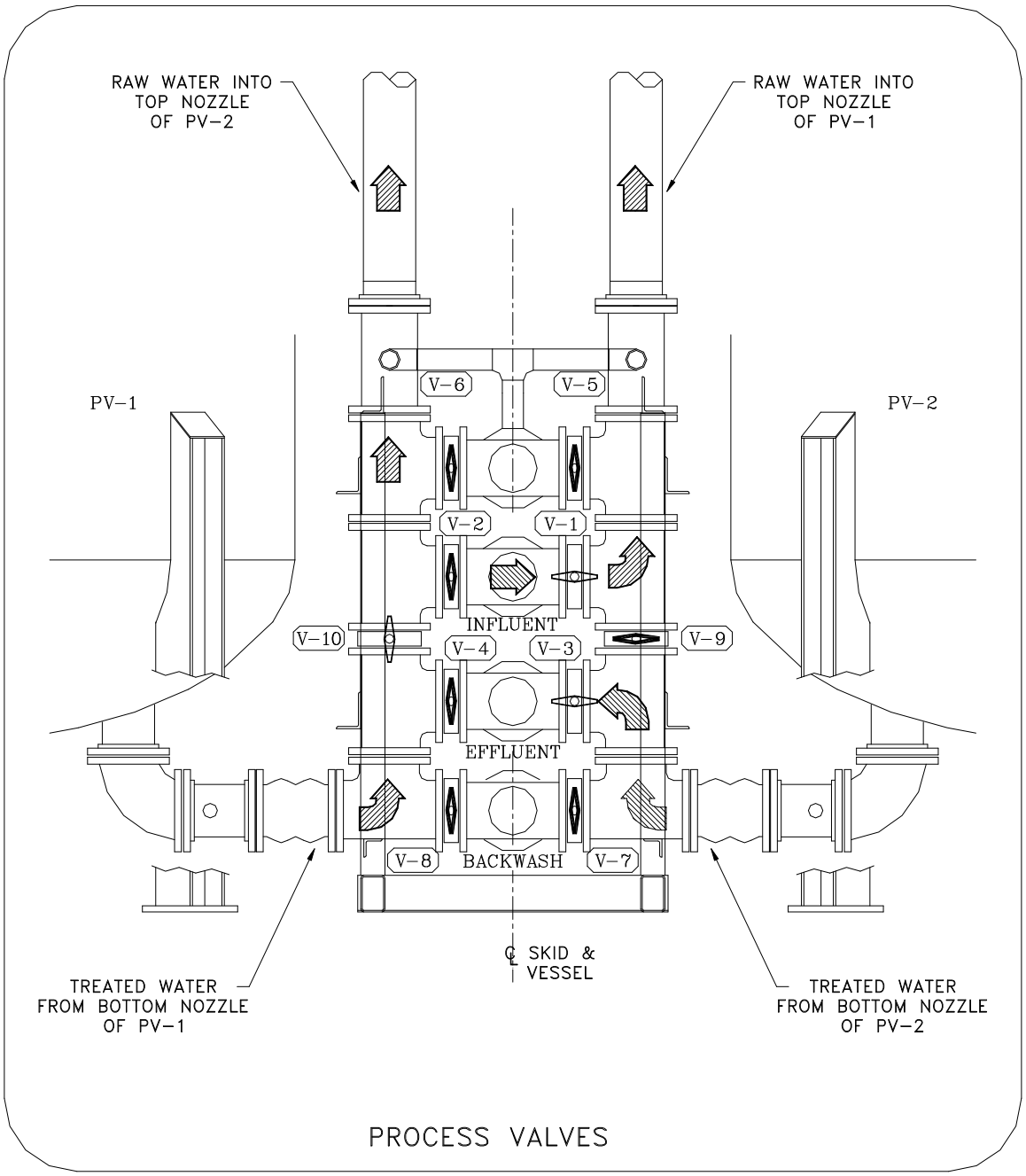


FIGURE 2 VESSEL PV-2 ON-LINE VESSEL PV-1 CARBON TRANSFER

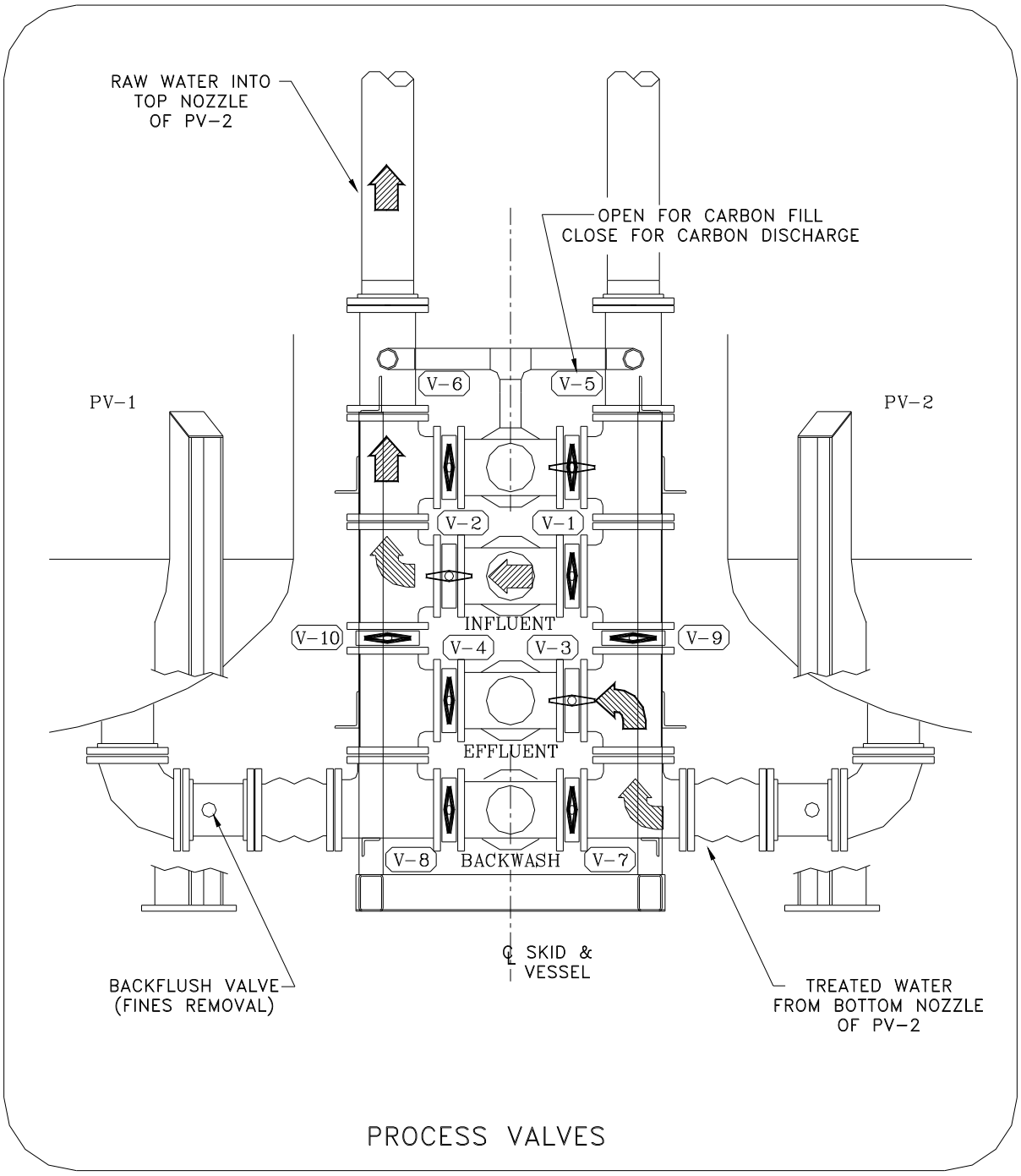


FIGURE 3 SERIES FLOW VESSEL PV-2 TO PV-1

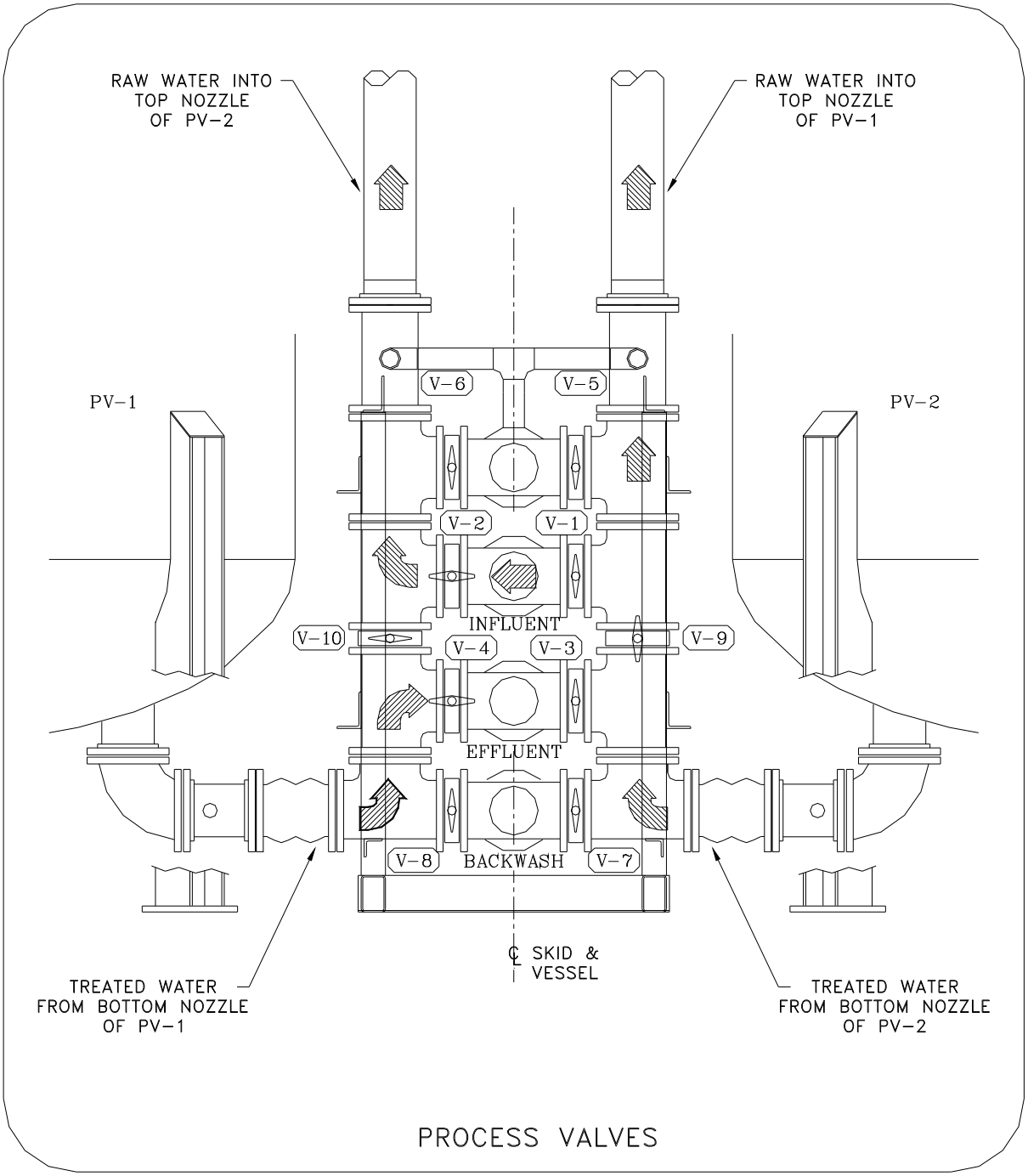


FIGURE 4 VESSEL PV-1 ON-LINE VESSEL PV-2 CARBON TRANSFER

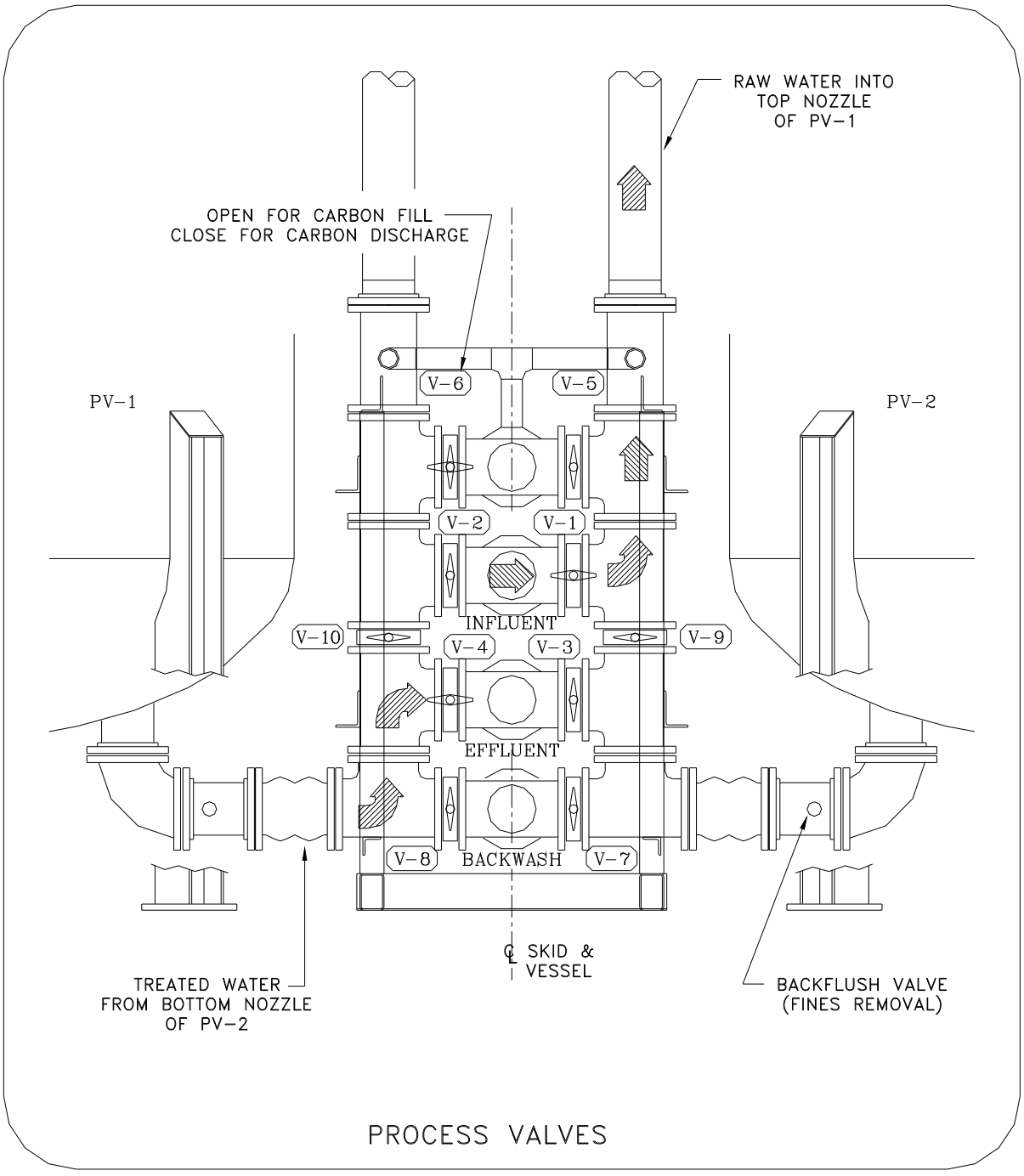


FIGURE 5 PARALLEL FLOW VESSEL PV-1 AND PV-2

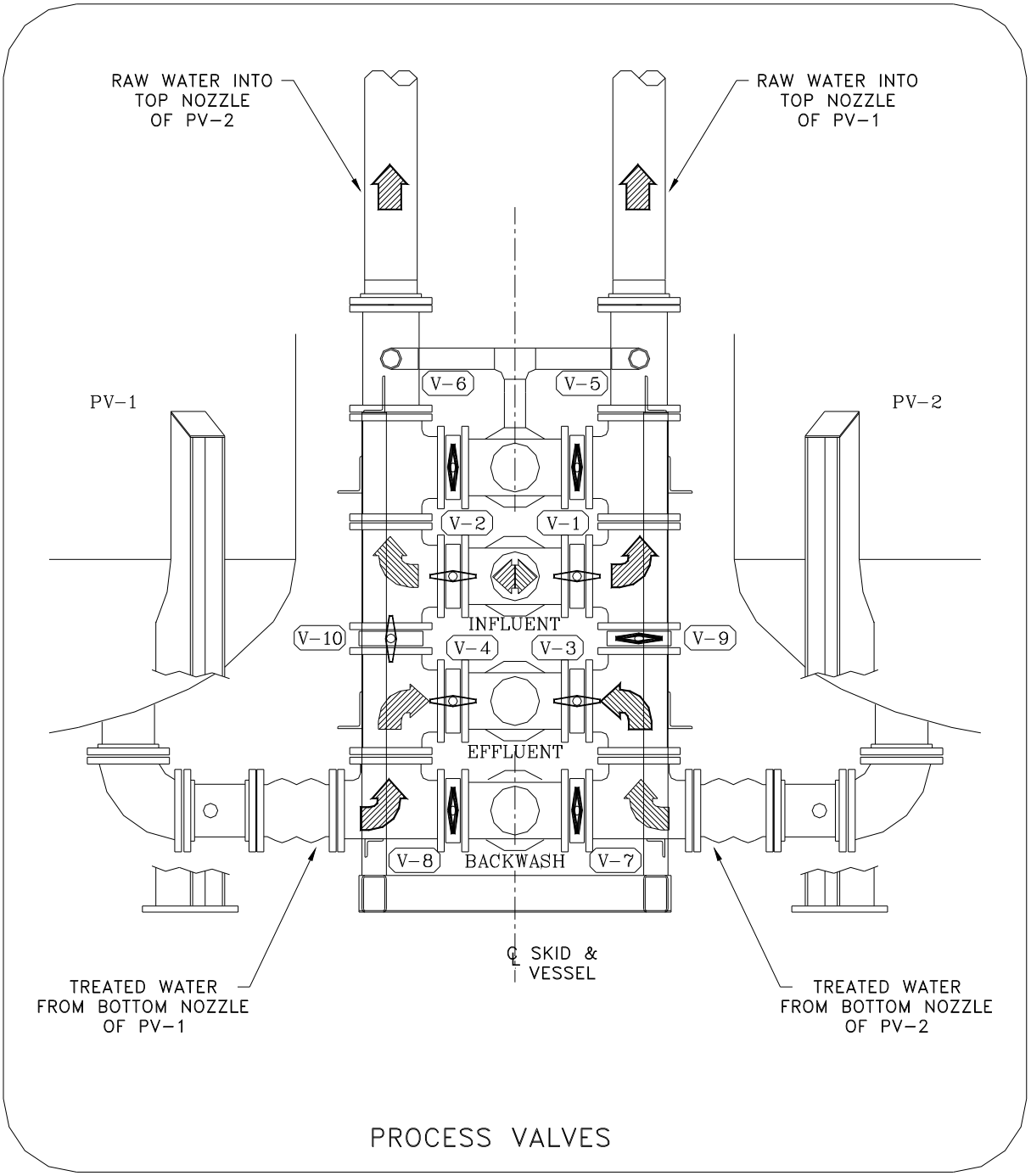


FIGURE 6 VESSEL PV-2 ON-LINE VESSEL PV-1 BACKWASHING

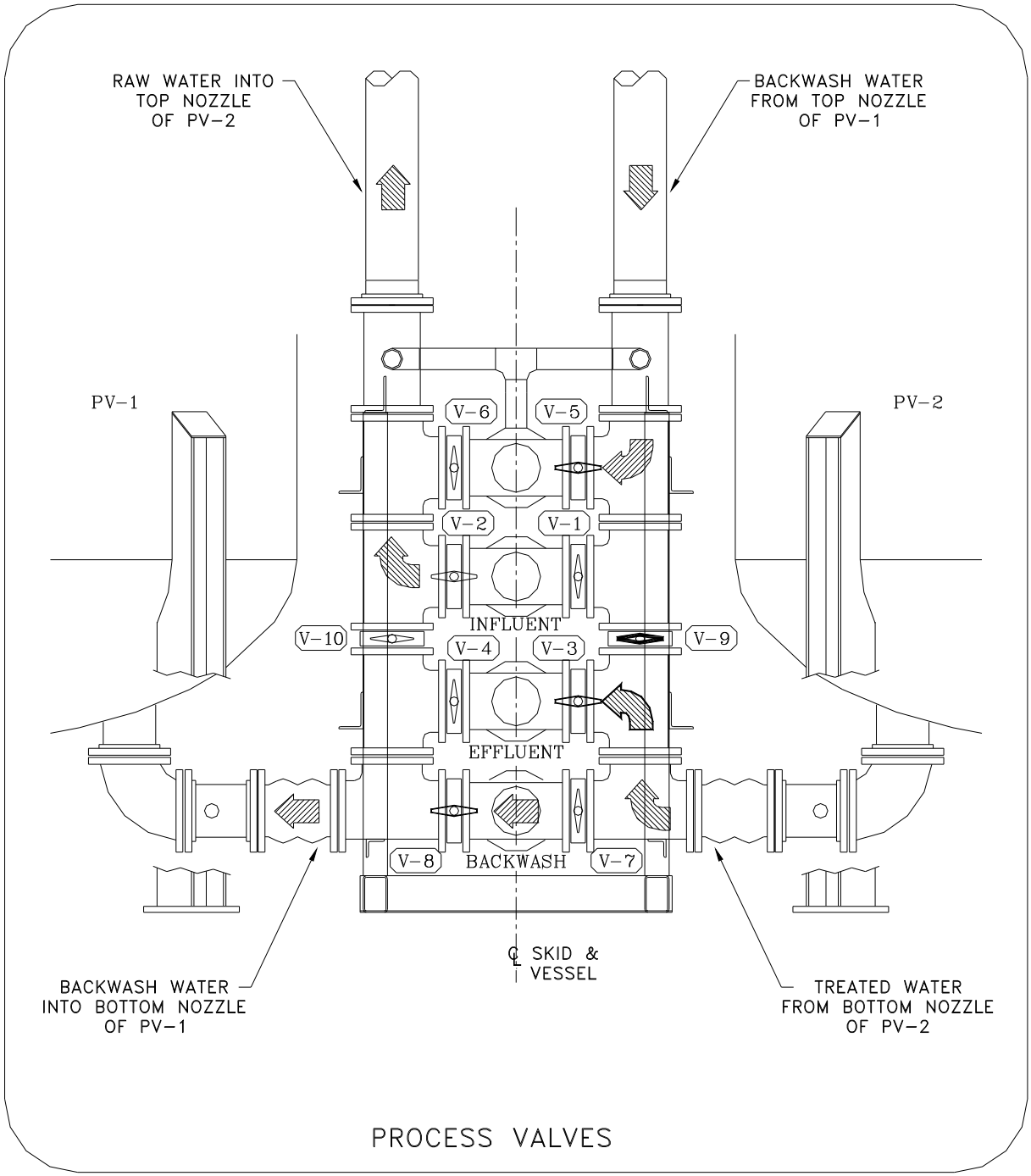


FIGURE 7 VESSEL PV-1 ON-LINE VESSEL PV-2 BACKWASHING

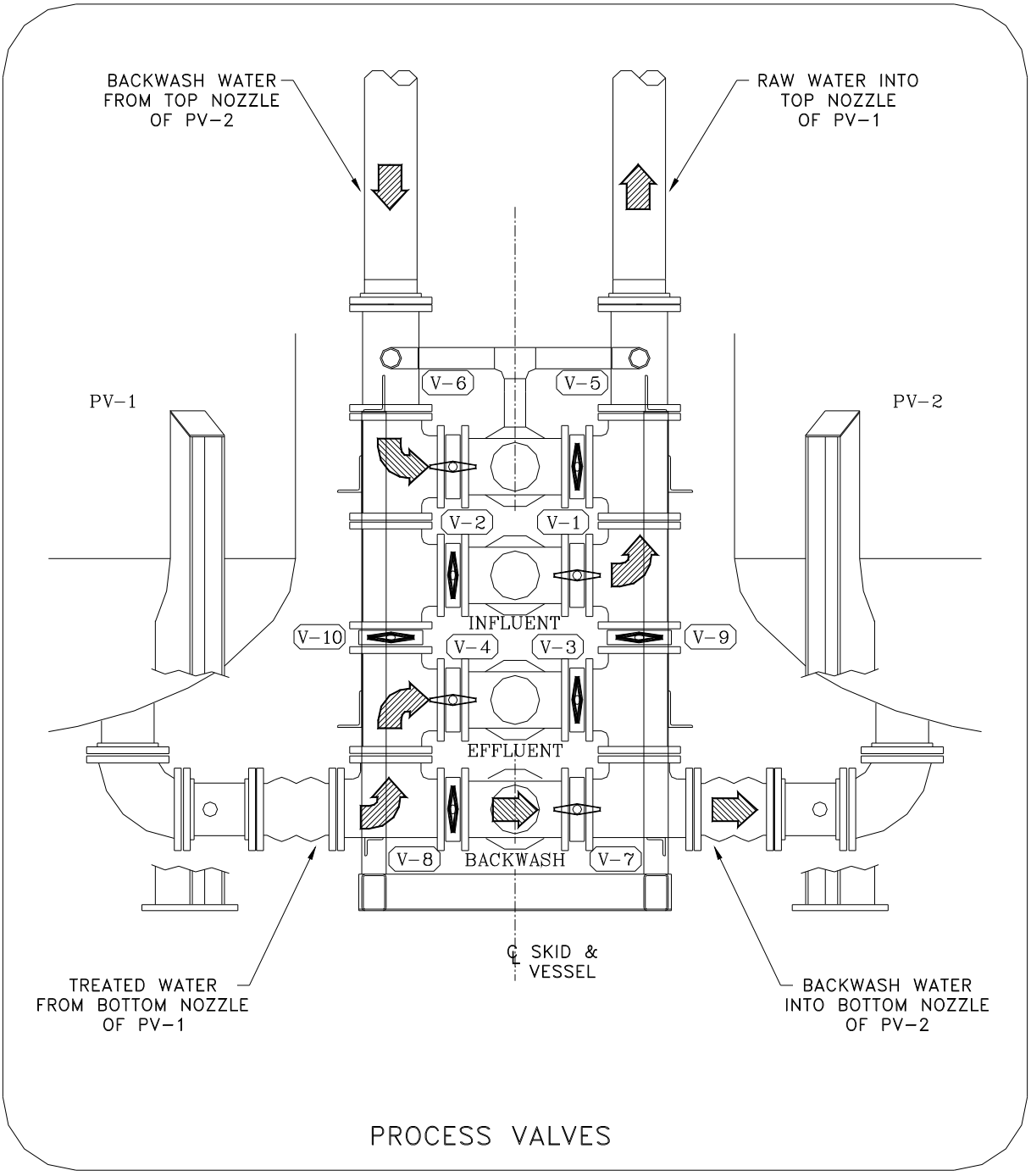


FIGURE 8 STANDARD TRAILER

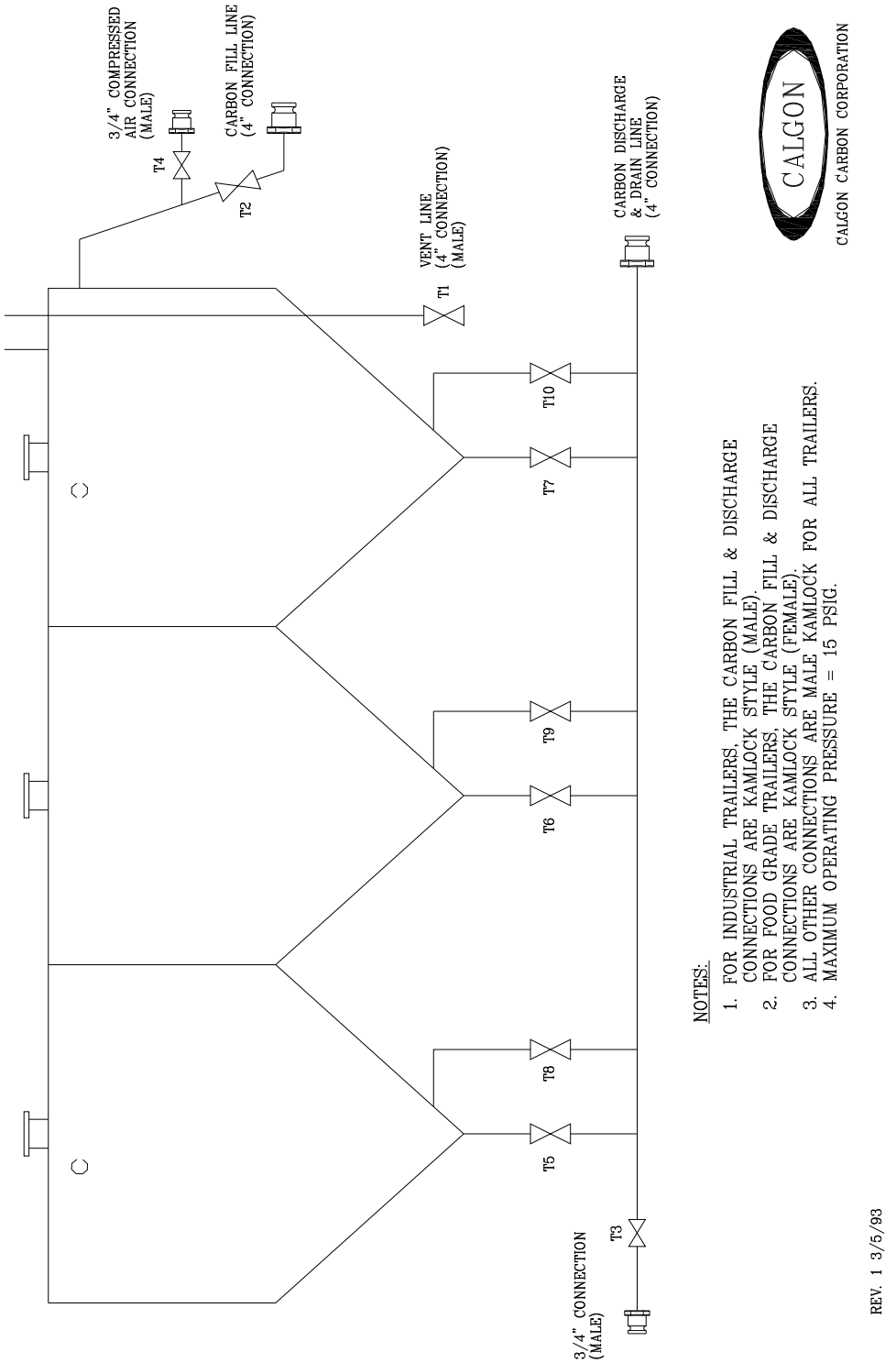
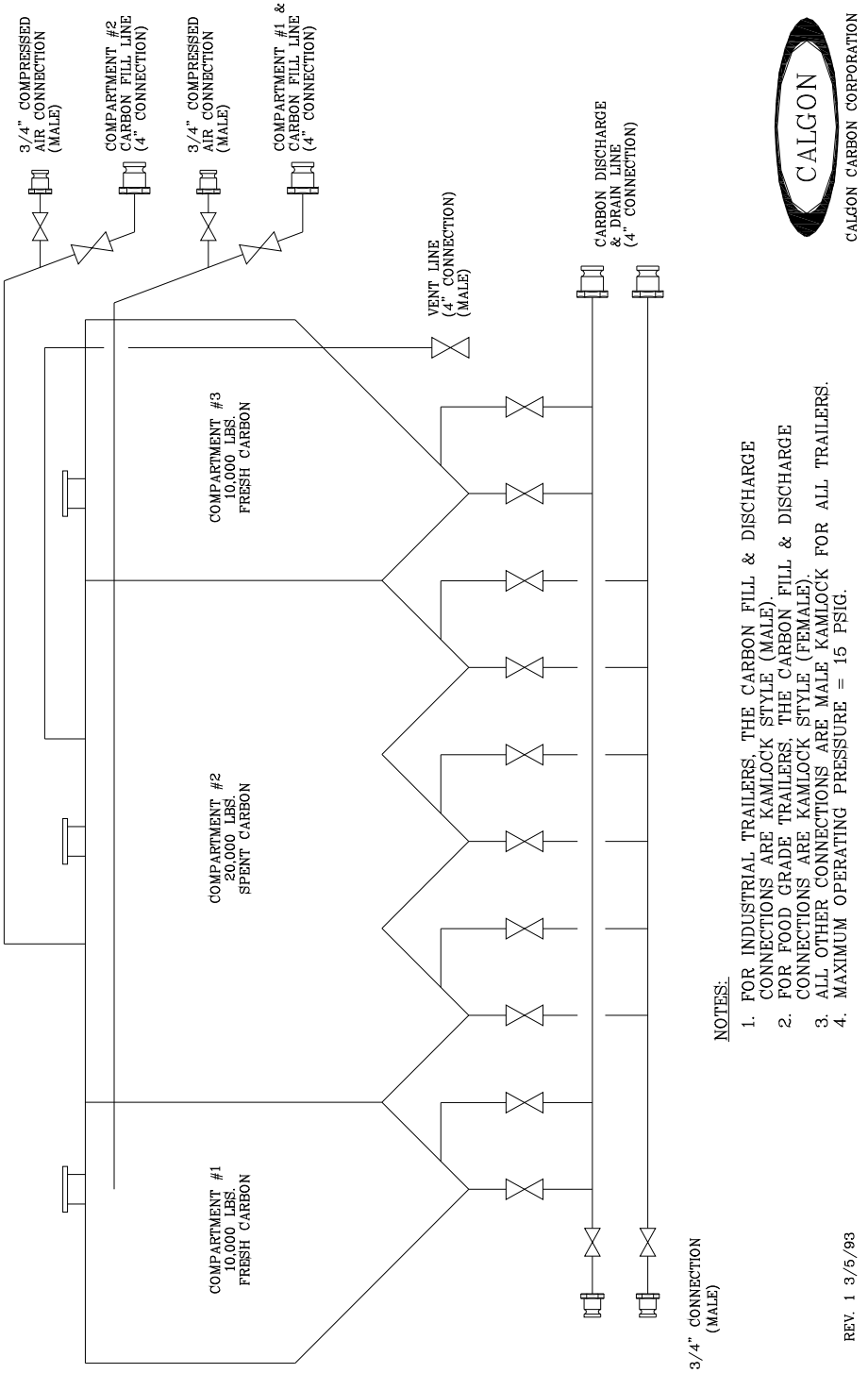


FIGURE 9 TRIPLE COMPARTMENT TRAILER



CARBON ACCEPTANCE CANISTER (CAC) INSTRUCTIONS

1. Connect the carbon acceptance canister (CAC) as shown on the drawing below. Start the adsorption system according to the operating manual. All valves in the influent and effluent lines to the CAC should be closed.

2. Open the top 2" plug on the CAC. Slowly fill the CAC with clean, hot water. If hot water is not available, ambient temperature water will be acceptable. Capacity of the CAC is approximately one (1) gallon.

3. For optimum performance, the water needs to be adsorbed into the carbon. To achieve this, allow the CAC to stand full with water for approximately 24 hours. After the water has been adsorbed, replace the plug in the top of the CAC.

4. Open both valves in the CAC effluent line. One valve, C-3, is located near the adsorption system's main effluent header and the other valve, C-4, is located near the CAC.

5. Disconnect the tubing on the CAC influent line at the isolation valve C-1 located on the system's main influent header.

6. Slowly open the CAC influent valve, C-2, to allow clean effluent water to back flow through the CAC to purge the lines and backflush the CAC. Allow about 5 gallons of clean water to flow through the CAC.

7. Close the valve, C-2, in the CAC influent line to stop the flow. Reconnect the tubing to the CAC influent isolation valve, C-1.

8. Slowly open both of the valves in the CAC influent line to allow untreated water to flow through the CAC.

9. If the carbon adsorption system is to be backwashed or shutdown, close the influent valve, C-2, and the effluent valve, C-3, on the CAC, and open the top plug in the canister to vent the CAC. Once the adsorption system is placed back into service, tighten the plug and open the CAC influent and effluent valves.

10. The CAC should be left in service according to the following guidelines:

    a. If the adsorption system is operating in parallel mode, the CAC should be left on-line for about 1/10 th of the anticipated bed life.
    b. If the adsorption system is operating is series mode, the CAC should be left on-line for about 1/5 th of the anticipated bed life.

11. After the CAC has been on-line for the recommended time period, it needs to be returned for carbon acceptance testing. The CAC is taken out of service by closing all of the valves in both the CAC influent and effluent lines. After the valves are closed, disconnect the effluent tubing connector at the CAC. Open the top plug to vent the CAC. Slowly open the CAC effluent valve, C-3, and drain the water from the CAC to a suitable container. Ensure that all necessary safety precautions are taken depending on the hazardous nature of the process liquid. Open the CAC influent valve C-2 and carefully disconnect the tubing from the influent isolation valve, C-1, on the system header. Allow the liquid in the influent tubing to drain through the CAC and into the container.

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12. Close the CAC influent valve C-2 and effluent valve C-3. Replace the top plug and remove the CAC from the adsorption system. Ship the CAC with the influent and effluent valves attached and closed. This is required to ensure that no water leaks from the CAC during shipment.

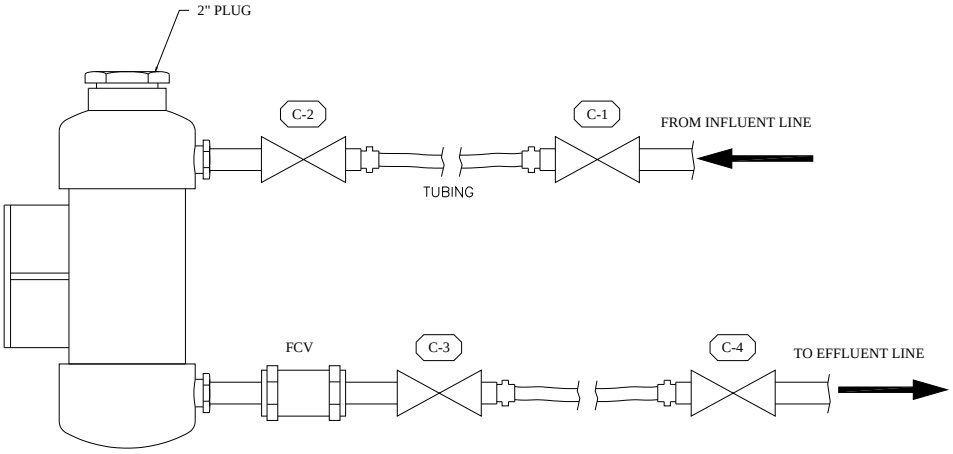
Ship the CAC to: Calgon Carbon Corporation
500 Calgon Carbon Drive
Pittsburgh, PA 15205
Attention: Carbon Acceptance

Contact the Calgon Carbon Sales Office in your area for additional information.

UNIT SPECIFICATIONS

Max. Operating Pressure:	125 psig
Body and Septa:	PVC
Valves	PPL
Tubing	PPL
Flow Control Valve	Nickel Plated Brass

CARBON ACCEPTANCE CANISTER



C-1 - CAC INFLUENT BLOCK VALVE
C-2 - CAC INFLUENT VALVE
C-3 - CAC EFFLUENT VALVE
C-4 - CAC EFFLUENT BLOCK VALVE
FCV - FLOW CONTROL VALVE (1 GPM)

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SPARE PARTS PROGRAM

INTRODUCTION: Calgon Carbon Corporation has developed a standard product line of engineered treatment systems for air and water applications. Much of the fabrication and assembly of these systems is done at Calgon Carbon's own facility; therefore most of the system parts and components are maintained in inventory. As a service to clients to provide a source of specified parts in a timely manner, these parts and components are available for purchase. Prices a valid for one year from the date on the list, after this time, the prices may be subject to revision.

ORDER ENTRY: The purchase order for spare parts should be entered using the spare parts order form provided. This form should be sent to:

Calgon Carbon Corporation
Order Service Department
P.O. Box 717
Pittsburgh, PA 15230-0717

Orders can also be placed via fax to 1-412-787-6323
Verbal orders can be placed by calling the Order Services Department at 1-800-4CARBON (1-800-422-7266).

SHIPPING: Order shipping options are either Rush (next day delivery by UPS) or Normal (one week delivery by UPS). Other shipping directions should be requested at the time of ordering. Shipping charges will be added to the total price of the order.

SALES TAX: Sales tax will be added to the invoice unless a sales tax exemption certificate is provided with the order.

PAYMENT: An invoice will be sent to the billing address upon shipment of the order. Payment terms are net 30 days after shipment.

WARRANTY: Calgon Carbon Corporation warrants that the equipment sold hereunder shall be free of defects in material and workmanship for a period of one (1) year from the date of shipment. This warranty does not apply to problems associated with normal wear and tear, improper maintenance, negligence, misuse, abuse or failure to operate the equipment in strict accordance with the operating and maintenance plan provided. For those items provided by, but not directly manufactured by Calgon Carbon, the manufacturer's warranty shall apply, provided warranty coverage exceeds that which is provided by Calgon Carbon. All other warranties, either expressed or implied, are hereby disclaimed, including, but not limited to, the warranty of merchantability and fitness for the particular purpose.

LIMITATIONS OF LIABILITY: The purchaser's exclusive remedy for any cause of action arising out of this transaction, including but not limited to breach of warranty, negligence and /or indemnification, is expressly limited to the maximum of the purchase price of the equipment sold hereunder. All claims of whatsoever nature shall be deemed waived unless made in writing within forty-five (45) days of the occurrence giving rise to the claim. In no event shall Calgon Carbon for any reason or pursuant to any provision of the warranty be liable for the incidental or consequential damages, or damages in excess of the purchase price of the equipment supplied, loss of profit, or fines imposed by Government agencies.

NOTE: TO CUSTOMERS INTERESTED IN VIDEOTAPING CALGON CARBON CORPORATION REPRESENTATIVES DURING OPERATOR TRAINING SESSIONS, CARBON TRANSFERS, SYSTEM INSPECTIONS, OR OTHER SITE ACTIVITIES PRIOR WRITTEN PERMISSION FROM CALGON CARBON CORPORATION IS REQUIRED BEFORE VIDEOTAPING MAY COMMENCE.

VIDEO AGREEMENT

This agreement is made this ___ day of _____, 20___, by and between Calgon Carbon Corporation, hereinafter referred to as "CCC", a Delaware corporation and _____, (hereinafter referred to as "Owner-Operator").

In consideration for allowing Owner to videotape "CCC" personnel performing maintenance or service, or demonstrating the operation of _____ (the equipment) the Owner-Operator and "CCC" agree as follows:

1. **The video tape is used at Owner-Operator's own risk and is not intended nor is it to be used as a substitute for safe operating procedure in accord with industry standard, training, safety instruction or the operation and maintenance manuals. CCC ASSUMES NO LIABILITY FOR THE COMPLETENESS OR ACCURACY OF THE VIDEO TAPE. ANY CLAIM FOR INJURY OR PROPERTY DAMAGE WHICH ARISES OUT OF OR IN CONNECTION WITH THE USE OF THE VIDEO TAPE BY THE OWNER-OPERATOR, ITS EMPLOYEES, OR AGENTS IS THE SOLE RESPONSIBILITY OF THE OWNER-OPERATOR.**

2. **OWNER-OPERATOR AGREES TO HOLD CCC HARMLESS AND PAY ALL LEGAL EXPENSESAND JUDGEMENTS INCLUDING PUNITIVE DAMAGES, RESULTING FROM LITIGATION WHERE THE TAPE IS ENTERED INTO EVIDENCE.**

3. **This tape is for the Owner-Operators own use, and the Owner agrees to not sell or transfer the tape to any other party.**

4. **CCC must receive a copy of the tape and reserves the right to final edit the tape a Owner-Operator's expense.**

5. **Owner-Operator must affix the label CCC provides to ALL the tapes and read the following statement on the tape both at the beginning and end of the taped presentation.**

THIS IS NOT A CCC TRAINING OF SAFETY INSTRUCTION TAPE. FOR SAFETY OR TRAINING INSTRUCTIONS YOU MUST CONSULT THE OPERATION AND MAINTENANCE MANUAL AND/OR CCC PERSONNEL, AND FOLLOW SAFE OPERATING PROCEDURE IN ACCORD WITH INDUSTRY STANDARDS

Notwithstanding the reasonableness of the agreements herein, in the event that a court of competent jurisdiction determines that any part of the agreement set forth in paragraphs 1, 2, 3, 4, and 5 be held invalid or unenforceable, the provisions of this video agreement shall be deemed severable, and the remaining parts shall be valid and enforceable as though the invalid and unenforceable parts had not been included in the agreement.

When this agreement is accepted and signed by the Owner-Operator and accepted by CCC the video taping may start. It is understood that Owner-Operator's camera operator will not hinder or distract CCC personnel during their work.

Accepted by: _____ *Accepted by:* _____
(Owner-Operator)

_____ _____
(Signature) *(Signature)*

_____ _____
(Position) *(Position)*

By signing this, the signer is verifying they have authorization to make such agreements binding on the Owner-Operator.

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Section 10

MEDIA / PRESSURE DROP INFORMATION

CALGON CARBON CORPORATION

SALES SPECIFICATION SHEET

CalRes™ 2109

Anion Exchange Resin

Resin Type:	Strong Base Anion
Structure:	Macroporous
Functional Group:	N-Tributyl Amine
Ionic Form:	Chloride

Test	Specification Min	Max	Calgon Carbon Test Method
Wet Volume Capacity, Cl Form, meq/mL	0.60		ASTM D 2187 Method M Mod.
Water Retention Capacity, Cl Form, %	50	65	ASTM D 2187 Method B Mod.
Bulk Density, g/L	0.68	0.72	CCC Internal Method
Particle Density, g/mL	1.05	1.15	CCC Internal Method
Whole Bead, %	90		CCC Internal Method
US Sieve Series, %			ASTM D 2187 Method D Mod.
+ 16		3	
- 50		5	

Manufacturing Point of Origin:	Product must be manufactured in the United States of America or EU.
Min. Required Approvals:	ANSI/NSF-61 by NSF, WQA, UL or other accredited laboratory California Department of Health Services Approval / Acceptance

This product is Made to Order.

Calgon Carbon Corporation's ion exchange products are continuously being improved and changes may have taken place since this publication went to press.

CALGON CARBON CORPORATION

P. O. Box 717
Pittsburgh, PA 15230

MATERIAL SAFETY DATA SHEET

IDENTITY: CalRes™ 2109	DATE: 08/17/2006
PRODUCT ID #:	IDENTITY (As used in Label and list): CalRes™ 2109 Anion Exchange Resins

SECTION I – MANUFACTURER'S NAME AND CONTACT INFORMATION

MANUFACTURED BY: CALGON CARBON CORPORATION P.O. Box 717 Pittsburgh, PA 15230 – 0717	EMERGENCY PHONE NUMBER: (412) 787 – 6700
Date Prepared: 08/17/2006	Prepared by: Peter Ritchey

SECTION II - COMPOSITION/INFORMATION ON INGREDIENTS

INGREDIENTS	% (BY WEIGHT)	CAS#
Styrene, divinylbenze polymer, chloromethylated, tributylamine-functionalized	45 – 65	116565-72-1
Water	35 – 55	007732-18-5

This document is prepared pursuant to the OSHA Hazard Communication Standard (29 CFR 1910.1200). In addition, other substances not 'hazardous' per this OSHA standard may be listed. Where proprietary ingredient is shown, the identity may be made available as provided in this standard.

SECTION III – PHYSICAL / CHEMICAL PROPERTIES

Boiling Point	N/A	Density	43 lb/ft^3	Solubility in Water	Negligible
Vapor Pressure (mm Hg)	N/A	Evaporation Rate (Butyl Acetate = 1)	N/A	Melting Point	N/A
Vapor Density (Air = 1)	N/A	Appearance & Odor	White to tan spherical beads with low to no odor		

SECTION IV – FIRE AND EXPLOSION HAZARD DATA

Flash Point:	N/A	Method Used:	N/A			
Flammability Limits:	LFL	N/A	UFL	N/A		
Extinguishing Media:	Water, Dry Chemical, or carbon dioxide fire extinguishers.					
Special Fire Fighting Procedures:	Wear positive pressure, self-contained breathing apparatus (SCBA) and protective fire-fighting clothing (including fire fighting helmet, coat, trousers, boots, and gloves). If protective equipment is not available, fight fire from a protected location or safe distance.					
Combustion Products:	Combustion products may include and are not limited to: Alkylbenzenes, vinylbenzenes, naphthalene, benzaldehydes, phenol, carbon dioxide, water, organic amines, chlorine, nitrogen oxides, ammonia, methyl chloride.					

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SECTION V – REACTIVITY DATA

Stability:	Stable	Conditions to Avoid:	Avoid temperatures over 230 °C.
Incompatibility (Conditions to Avoid):		Oxidizing materials such as nitric acid will attack organic resin under certain conditions degrading the resin, potentially to the point of explosive reaction.	
Hazardous Decomposition or Byproducts:		See combustion products in Section IV.	
Hazardous Polymerization:		Will not occur.	

SECTION VI – HEALTH HAZARD DATA

Effects and Hazards	
Eye Contact:	Solid or dust may cause irritation or corneal damage due to mechanical action.
Skin Contact	The product is not a skin irritant.
Skin Absorption:	Skin absorption is unlikely due to physical properties.
Inhalation:	Vapors unlikely due to physical properties. Dust inhalation could be problematic during resin transfers.
Ingestion:	Single dose oral LD50 has not been determined. Single dose oral toxicity is believed to be low. No hazards anticipated from ingestion.
Emergency and First Aid Procedures:	Eye contact – flush with copious quantities of water. If irritation persists, consult a physician. Skin contact – wash with soap and water.

SECTION VII – HANDLING PRECAUTIONS

Material Release or Spillage:	Sweep up all material immediately in refuse container or repackage. Resin beads cause the floor to become a slip hazard.
Waste Disposal Method:	Dispose of in accordance with federal, state, and local regulations.
Storing Requirements:	Keep supersacks and drums / plastic bags sealed to prevent drying or moisture loss from resin. Store below 50 °C (122 °F) and above 0 °C (32 °F).

SECTION VIII – CONTROL MEASURES

Ventilation:	Local ventilation is recommended.
Respiratory Protection:	A NIOSH-approved particulate respirator is recommended if excessive dust is generated.
Skin Protection:	Protective gloves recommended for minimize dust exposure.
Eye Protection:	Safety glasses or goggles recommended (ANSI Z87.1).

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SECTION IV – REGULATORY INFORMATION

SARA Hazard Category:	Non-hazardous
OSHA:	Nonhazardous according to definitions of health hazard and physical hazard provided in the Hazard Communication Standard (29 CFR 1910.1200)
WHMIS Classification:	Does not meet any hazardous classification.

SECTION V – OTHER REGULATORY INFORMATION

While this information and recommendations set forth herein are believed to be accurate as of the date hereof, Calgon Carbon Corporation makes no warranty with respect and disclaims all liability from reliance thereon.

END OF MATERIAL SAFETY DATA SHEET

FILTRASORB® 300
Granular Activated Carbon for Municipal Specifications

CALGON CARBON CORPORATION

Description

FILTRASORB® 300 is a granular activated carbon developed by Calgon Carbon Corporation for the removal of taste and odor compounds, disinfection by-product precursors, and other dissolved organic compounds from potable water.

This activated carbon is made from selected grades of bituminous coal to produce a high activity, durable granular product capable of withstanding the abrasion associated with repeated backwashing, air scouring, and hydraulic transport. Activation is carefully controlled to produce an equal blend of both low energy pores as measured by iodine number and high energy pores as measured by trace capacity number for effective adsorption of a broad range of high and low molecular weight organic contaminants. The higher density of this activated carbon results in a greater adsorptive capacity per filter volume as measured by the volume iodine number. The product is also formulated to comply with all the applicable provisions of the AWWA Standard for Granular Activated Carbon, edition B604-05, the stringent extractable metals requirements of ANSI/NSF Standard 61, and the Food Chemicals Codex.

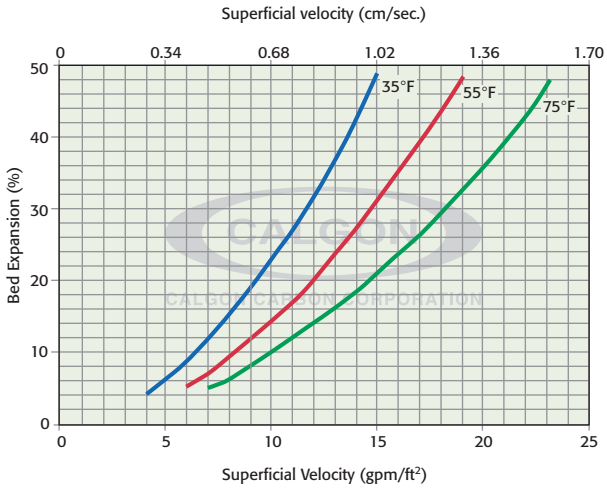
Specifications	Value
Iodine Number.	900 mg/g (min)
Moisture by weight	2% (max)
Effective size	0.8 - 1.0 mm
Uniformity Coefficient	2.1 (max)
Abrasion No.	78 (min)
Trace Capacity Number	10 mg/cc (min)
Screen Size by weight, US Sieve Series	
On 8 mesh	15% (max)
Through 30 mesh	4% (max)

Typical Property	Value
Apparent Density	0.56 g/cc
Ash by weight	7%

Features	Benefits
Bituminous-based raw material	Provides higher hardness relative to other raw materials reducing the generation of fines and product losses during backwashing.
Coal is pulverized and reagglomerated with suitable binder	Pore structure provides an equal blend of low and high energy pores for effective removal of a broad range of high and low molecular weight organic compounds. Has a high density, resulting in a greater adsorption capacity per filter volume, wets readily, and does not float, thus minimizing loss during backwash operations. Creates optimal transport paths for faster adsorption.

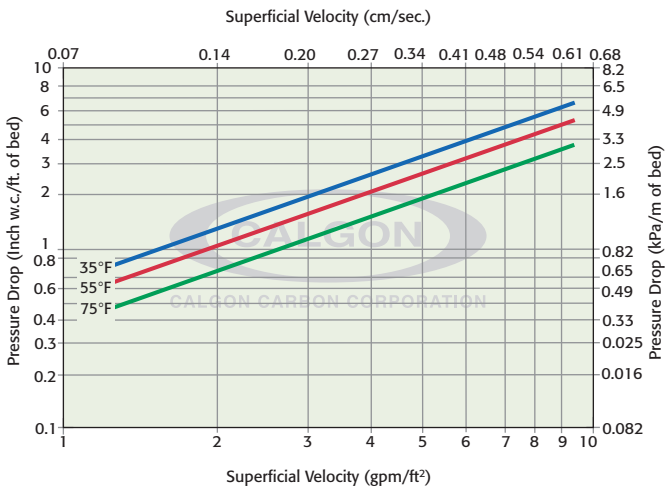
Bed Expansion

Based on backwashed and segregated bed



Pressure Drop

Based on backwashed and segregated bed



FILTRASORB® 300
Granular Activated Carbon for Municipal Specifications

CALGON CARBON CORPORATION

Applications

FILTRASORB® 300 activated carbon can be used to treat surface and groundwater sources for the production of drinking water. This product can be used as a complete replacement for sand and anthracite media. FILTRASORB® 300 activated carbon functions as a dual purpose media, providing both filtration and adsorption. FILTRASORB® has been used successfully in drinking water applications for over 40 years.

Design Considerations

As a replacement for existing filter media, conversion to FILTRASORB® 300 granular activated carbon imposes no major changes to a plant's normal filtration operations. Calgon Carbon Corporation can also provide complete modular adsorption systems as an add-on treatment stage if required.

Safety Message

Wet activated carbon preferentially removes oxygen from air. In closed or partially closed containers and vessels, oxygen depletion may reach hazardous levels. If workers are to enter a vessel containing carbon, appropriate sampling and work procedures for potentially low oxygen spaces should be followed, including all applicable Federal and State requirements.

CALGON CARBON CORPORATION

Making Water and Air Safer and Cleaner

Calgon Carbon Corporation
P.O. Box 717
Pittsburgh, PA USA 15230-0717
1-800-422-7266
Tel: 1-412-787-6700
Fx: 1-412-787-6713

Chemviron Carbon
European Operations of
Calgon Carbon Corporation
Zoning Industriel C de Feluy
B-7181 Feluy, Belgium
Tel: + 32 (0) 64 51 18 11
Fx: + 32 (0) 64 54 15 91

Calgon Carbon Asia PTE LTD
9 Temasek Boulevard
#08-01A Suntec Tower Two
Singapore 038989
Tel: + 65 6 221 3500
Fx: + 65 6 221 3554

Your local representative

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CPM-PB1042A-0108

Material Safety Data Sheet

U.S. Department of Labor
Occupational Safety and Health Administration
This form is consistent with ANSI standard for preparation of MSDS's in accordance with OSHA's Hazard Communication Standard, 29 CFR 1910.1200.

Product Type: **FILTRASORB 300**	
Product Code: 1975	**Profile No:** 1
Effective Date: **March 31, 2008**	**Supersedes: XXXXX**

SECTION I - PRODUCT AND COMPANY INFORMATION

Company Identification (USA)	**Calgon Carbon Corporation** P.O. Box 717 Pittsburgh, PA 15230-0717	
Telephone Number(s)	Information	412-787-6700
	Emergency	412-787-6700
Company Identification (Europe)	**Chemviron Carbon** Zoning Industriel de Feluy B-7181 Feluy, Belgium	
Telephone Number(s)	Information	32 64 51 18 11
	Emergency	32 64 51 18 11

Date Prepared January 26, 2009	Signature of Preparer (optional)	

SECTION II – COMPOSITION /INFORMATION ON INGREDIENTS

Nonhazardous components are listed at 3% or greater; acute hazards are listed when present at 1% or greater and chronic hazards are listed when present at 0.01% or greater. This is not intended to be a complete compositional disclosure.

Ingredient / Component	CAS No	% by Wt
Activated Carbon (Coal based)	7440-44-0	100

SECTION III – HAZARD(S) IDENTIFICATION

Emergency Overview: Black particulate solid, pellet or powder. Contact may cause eye irritation. Dust may be slightly irritating to eyes and respiratory tract. Avoid generation of dust during handling.

CAUTION: Wet activated carbon removes oxygen from air causing a severe hazard to workers in enclosed or confined space. Before entering such an area, sampling and work procedures for low oxygen levels should be taken to ensure ample oxygen availability, observing all local, state and federal regulations

OSHA Regulatory Status		Not regulated	
HMIS Ratings	Health	0	4 = Extreme/Severe 3 = High/Serious 2 = Moderate 1 = Slight 0 = Minimum W = Water Reactive OX = Oxidizer
(NFPA)	Flammability	1	
	Reactivity	0	
	Special		
Protective Equipment	Safety glasses with side shields or goggles, gloves, long sleeve shirt or lab coat, long pants recommended.		
Health Effects	See Section IV		
Environmental Effects	See Section XII		

Section IV – First-Aid Measures

Route of exposure	
Eyes	Dust may cause mild irritation, possibly reddening.
Skin	Dust may cause mild irritation, possibly reddening.
Inhalation	Dust may cause mild irritation to the upper respiratory tract.
Ingestion	Dust may cause mild irritation to digestive track resulting in nausea or diarrhea.
Signs/Symptoms of Exposure	Dust may cause irritation and redness of eyes, irritation of skin and respiratory system.
Emergency and First Aid Procedures	For eye contact, immediately flush with copious amounts of water for at least 15 minutes, lifting both the upper and lower lids occasionally; seek medical attention. For skin contact, wash with soap and water; seek medical attention. For inhalation, Remove to fresh air and rest as needed; seek medical attention for any breathing difficulty. For ingestion, drink plenty of water; seek medical attention.
Medical Conditions Generally Aggravated by Exposure	People with pre-existing skin conditions or eye problems or impaired respiratory function may be more susceptible to the potential effects of the dust.

SECTION V – FIRE FIGHTING MEASURES

Suitable Extinguishing Media	Use an extinguishing media suitable for the surrounding fire.
Unsuitable Extinguishing Media	None known
Specific Hazards	As with most organic solids, fire is possible at elevated temperatures or by contact with an ignition source. Activated carbon is difficult to ignite and tends to burn slowly (smolder) without producing smoke or flame. Carbon monoxide and carbon dioxide gas may be generated if combusted. Contact with strong oxidizers such as ozone or liquid oxygen may cause rapid combustion.
Protective Equipment and Procedures	Wear NIOSH approved self-contained breathing apparatus suitable for the surrounding fire.

SECTION VI – ACCIDENTAL RELEASE MEASURES

Personal Precautions	Wear protective equipment, keep unnecessary personnel away, ventilate area of spill.
Environmental Precautions	The material is not soluble but can cause a particulate emission if discharged to waterways; therefore, dike all entrances to sewers and drains to avoid introducing the material into the waterways.
Containment & Clean-up	Dike all entrances to sewers and drains. Vacuum or shovel spilled material and place in closed container for disposal. Remove product to appropriate storage area until it can be properly disposed of in accordance with local, state and federal regulations. Avoid dust formation. See section XIII
Other information	NA

SECTION VII – HANDLING AND STORAGE

Handling	Avoid prolonged contact with eyes and skin. Keep away from ignition sources. Use in well ventilated areas. Protect containers from physical damage. Wash hands after handling.
Storage	Store in cool, dry, ventilated area and in closed containers. Keep away from oxidizers, heat or flames. Store away from ignition sources.

SECTION VIII – EXPOSURE CONTROLS/PERSONAL PROTECTION

Component	OSHA PEL	ACGIH TLV	Other limits
Activated Carbon	5 mg/M^3 Resp	5 mg/M^3 Resp	

Exposure Guidelines	Wet activated carbon removes oxygen from air posing a hazard to workers in enclosed or confined space. Before entering such an area, sample the air to assure sufficient oxygen supply. Use work procedures for low oxygen levels, observing all local, state and federal regulations.
Engineering Controls	No special ventilation requirements. Good general ventilation should be adequate. Mechanical ventilation is recommended for enclosed or confined spaces
Personal Protective Equipment	Use of NIOSH approved particulate filter is recommended if dust is generated in handling. The usual precautionary measures for handling chemicals should be followed, i.e. gloves, safety glasses w/side shields or goggles, long sleeve shirt or lab coat, dust respirator if dusty. Other protective clothing/equipment as appropriate.
General Hygiene	The usual precautionary measures for handling chemicals should be followed: i.e. Keep away from food and beverage; remove contaminated clothing immediately; wash hands before breaks or eating; avoid contact with eyes and skin.

SECTION IX – PHYSICAL AND CHEMICAL PROPERTIES

Boiling Point	NA	**Melting Point**	NA
Vapor Pressure (mm Hg.)	0	**Evaporation Rate**	NA
Vapor Density (AIR = 1)	solid	**Flash Point**	NA
Specific Gravity	0.4 to 0.7	**UEL**	NA
		LEL	NA
Flammability Limits	Ignition Temperature > 220º C		
Odor	None		
Solubility in Water	Product is not soluble.		
Appearance	Black granular or powder material		

SECTION X – STABILITY AND REACTIVITY

STABILITY	**UNSTABLE**		**CONDITIONS TO AVOID:** None
	STABLE	**XX**	
HAZARDOUS REACTION	**MAY OCCUR**		**CONDITIONS TO AVOID:** None
	WILL NOT OCCUR	**XX**	
Caution: High concentrations of organics in air will cause temperature rise due to heat of adsorption. At very high concentration levels this may cause a bed fire. High concentrations of Ketones and Aldehydes may cause a bed temperature rise due to adsorption and oxidation.			
Incompatible Materials			Alkali Metals and Strong Oxidizers such as ozone, oxygen, permanganate, chlorine.
Hazardous Decomposition Products			Carbon monoxide and carbon dioxide gas may be generated during combustion of this material.

SECTION XI – Toxicological information

Acute Effects		
Toxicity Studies	Oral LD_{50}	Not Determined on the finished product.
	Dermal LD_{50}	Not Determined on the finished product.
Inhalation	See section IV	
Ingestion	See section IV	
Eye Irritation	See section IV	
Skin Irritation	See section IV	
Sensitization	Not Determined on the finished product.	
Target Organ (s) or System		Eyes, Skin and Upper Respiratory System
Signs and symptoms of Exposure		Irritation and redness of eyes, irritation of skin and respiratory system may result from exposure to carbon dust. See Sections III and IV
Chronic Effects		
Carcinogenicity	Not Determined on the finished product.	
Mutagenicity	Not Determined on the finished product.	
Reproductive Effects	Not Determined on the finished product.	
Developmental Factors	Not Determined on the finished product.	

SECTION XII – ECOLOGICAL INFORMATION

Ecotoxicity	Not Determined on the finished product.
Persistence/degradability	Not Determined on the finished product.
Bioaccumulation/Accumulation	Not Determined on the finished product.
Mobility in Environmental Media	Not Determined on the finished product.
Other Adverse Effects	Not Determined on the finished product.

SECTION XIII – DISPOSAL CONSIDERATIONS

Vacuum or shovel material into a closed container. Storage and disposal should be in accordance with applicable local, state and federal laws and regulations. Local regulations may be more stringent than state or federal requirements.

SECTION XIV – TRANSPORT INFORMATION

This information as presented below only applies to the material as shipped. The identification based on characteristic(s) or listing may not apply if the material has been used or otherwise contaminated. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste identification and disposal methods in compliance with applicable regulations.

Land	DOT Regulations	Proper Shipping Description	FILTRASORB 300 (Steam Activated Carbon)
	Canadian WHMIS	Hazard Class	NA See note below
		UN/NA	UN 1362
Water	IMO / IMDG	Proper Shipping Description:	FILTRASORB 300 (Steam Activated Carbon)
		Hazard Class	NA See note below
		UN/NA	UN 1362
Air	IACO / IATA	Proper Shipping Description	FILTRASORB 300 (Steam Activated Carbon)
		Hazard Class	NA See note below
		UN/NA	UN 1362
		Information reported for product/size: 0.5 Kg	

This product has been tested according to the *United Nations Transport of Dangerous Goods* test protocol for a "self-heating substance". It has been specifically determined that this product does not meet the definition of a self heating substance or any other hazard class, and therefore is not a hazardous material. Please note that this information is applicable only for the Activated Carbon Product identified in this document.

SECTION XV – REGULATORY INFORMATION

SARA Title III 302	Product is not subject to SARA Title III, section 302 regulation.	
SARA Title III 313	Product is not subject to SARA Title III, section 313 regulation.	
TSCA	Product is listed	
California Proposition 65	Product is not listed	
Canadian classification	**WHMIS**	Product is listed.
	DSL #	Product is listed.
EEC Council Directives relating to the classification, packaging, and labeling of dangerous substances and preparations.		
Risk and Safety Phrases	R36: Irritating to the eyes, R37: Irritating to the respiratory system, R38: Irritating to the skin,	

SECTION XVI – OTHER INFORMATION

Intended Use	The material is generally used for treatment of gases and liquids
The information contained in this document applies to this specific material as supplied. It may not be valid for this material if it is used in combination with any other materials. It is the user's responsibility to determine the suitability and completeness of this information for their particular use.	
While the information and recommendations set forth herein are believed to be accurate as of the date hereof, Calgon Carbon Corporation makes no warranty with respect to same and disclaims all liability for reliance there on.	

References:

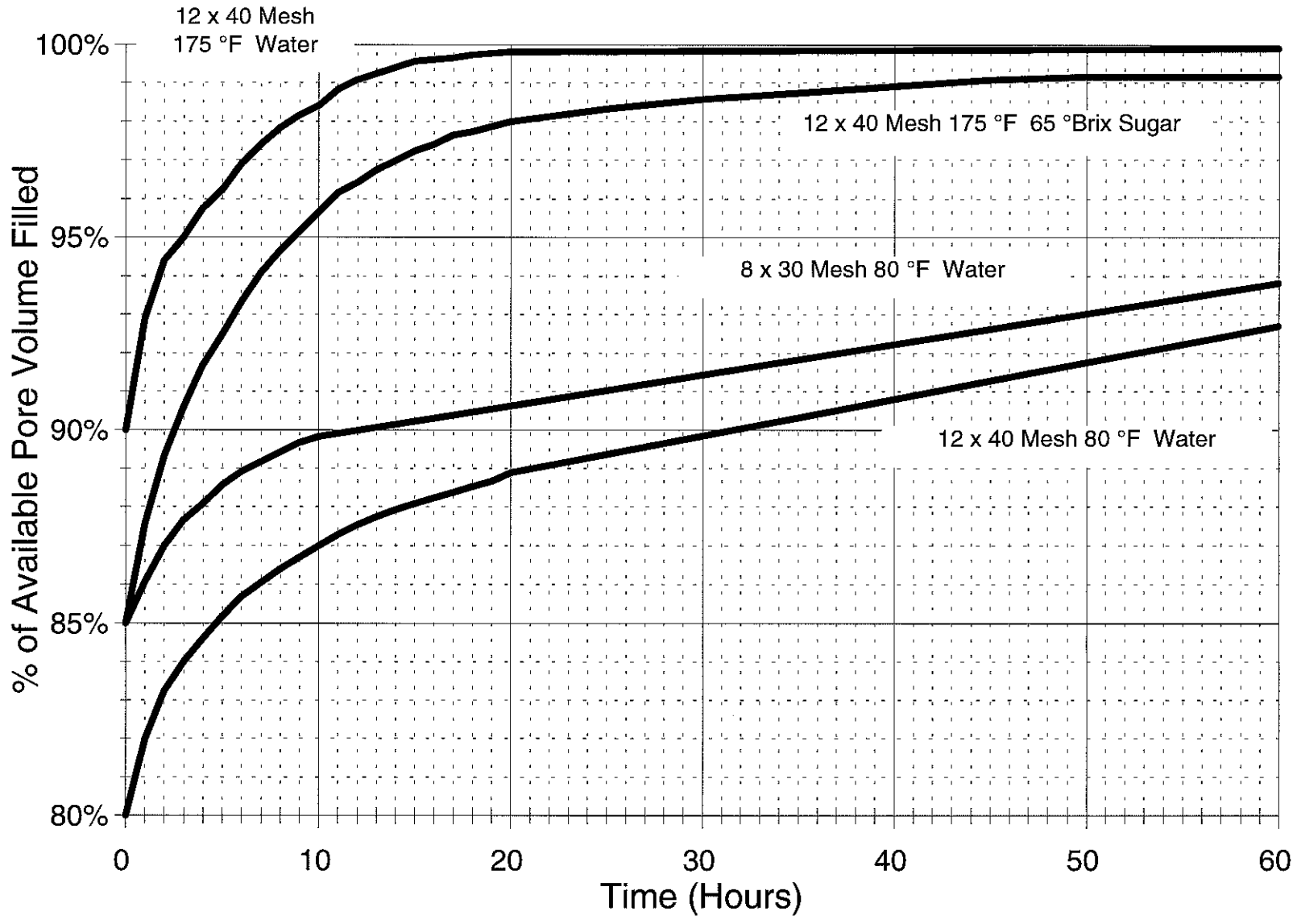
NA not applicable

Legend:

ACGIH	- American Conference of Governmental Industrial Hygienists
ANSI	- American National Standards Institute
ATSDR	- Agency for Toxic Substances and Disease Registry
C	- Ceiling (limit value)
CAS #	- Chemical Abstracts Service Registry Number
CERCLA	- Comprehensive Environmental Response, Compensation, and Liability Act
CEPA	- Canadian Environmental Protection Act
CFR	- Code of Federal Regulations
DOT	- Department of Transportation
DSL	- Domestic Substances List
EINECS	- European Inventory of Existing Commercial Chemical Substances
ERAP	- Emergency Response Assistance Plan
IATA	- International Air Transportation Association
IARC	- International Agency for Research on Cancer
ICAO	- International Civil Aviation Organization
IDLH	- Immediately Dangerous to Life and Health
IMO	- International Maritime Organization
IMDG	- International Maritime Dangerous Goods
LC_{50}	- The concentration of material in air expected to kill 50% of a group of test animals
LD_{50}	- Lethal Dose expected to kill 50% of a group of test animals
NFPA	- National Fire Protection Association
NIOSH	- National Institute for Occupational Safety and Health
NTP	- National Toxicology Program
OSHA	- Occupational Safety and Health Association
PEL	- Permissible Exposure Limit
RCRA	- Resource conservation and Recovery Act
RQ	- Reportable Quantity
SARA	- Superfund Amendments and Reauthorization Act
STEL	- Short Term Exposure Limit
TDG	- Transportation of Dangerous Goods Act/Regulation
TLV	- Threshold Limit Value
TSCA	- Toxic Substances Control Act
TWA	- Time Weighted Average
WHMIS	- Workplace Hazardous Material Information System

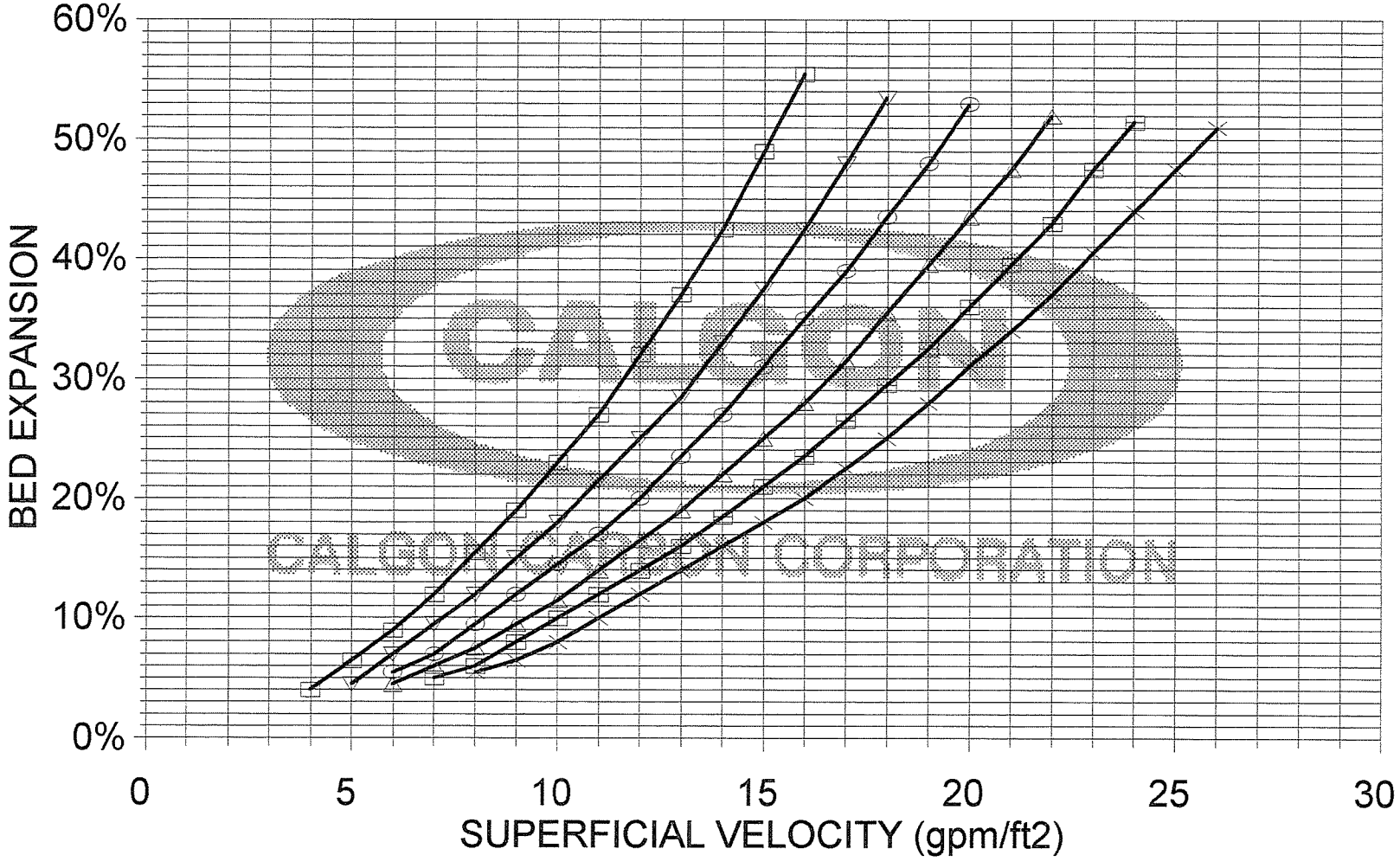
* * * END OF MATERIAL SAFETY DATA SHEET * * *

Wetting Times for GAC



FILTRASORB 300 - BED EXPANSION

BACKWASHED & SEGREGATED BED



JSR
7/27/94

Disinfection Of Granular Activated Carbon

CALGON CARBON CORPORATION

Introduction

There are situations where it becomes necessary to disinfect granular activated carbon (GAC) beds due to the presence of bacteria. The bacteria are usually present because of oxygen depletion in wastewater and potable water applications, and low temperatures (>140ºF) in food-related applications (sugars, etc.). The procedure described below is intended for in situ disinfection of carbon in an adsorber containing 20,000 pounds of GAC. By adjusting the amount of sodium hydroxide, larger or smaller carbon beds can be disinfected with this procedure.

Caution Due to the hazardous nature of sodium hydroxide (NaOH) and hydrochloric acid (HCl), appropriate protective clothing such as a face shield, goggles, gloves and impervious clothing must be worn when handling these chemicals. For specific instructions, refer to your plant procedures and/or material safety data sheets for these chemicals. Materials of construction must be compatible with NaOH and HCl.

Disinfection

1. Take the adsorber off line and make sure that a line on top of the adsorber is open to serve as a vent.
2. Drain the water from the adsorber through the adsorber effluent line.
3. Pump 5% sodium hydroxide into the adsorber through the effluent line. For Calgon Carbon's backwashable Model 10 and Model 12 adsorbers, the required volumes are 7,000 and 6,000 gallons, respectively. See step 9a for an alternate procedure.
4. Stop pumping when the NaOH solution overflows through the vent line.
5. Allow the carbon to soak in the sodium hydroxide for at least four hours.
6. Drain NaOH solution from the adsorber through the adsorber effluent line.

Neutralization

7. Wash the carbon by adding contaminant-free or clean water through the effluent line for 7-10 hours at a flow of 1.3-3 gpm/ft^2 in order to wash out the residual sodium hydroxide and neutralize the carbon. The disinfection is then complete.

8a. An alternate, faster procedure for neutralizing the carbon includes acid treatment. After the sodium hydroxide solution is drained from the adsorber, pump 5 gallons of reagent grade hydrochloric acid (37% HCl) into the adsorber through the effluent line.

8b. Fill the adsorber with clean water by backfilling through the effluent line at 3-5 gpm/ft^2 so as to thoroughly mix the content of the adsorber. Shut off the backfill water when it begins to overflow through the vent line.

8c. Allow the carbon to soak for 60 minutes, then drain the adsorber. Check the pH of the water, which should be in the range of 8 to 10.

8d. Wash the carbon by adding clean water through the effluent line at a rate of 1.3-3 gpm/ft^2 until the pH of the effluent water matches the influent water or within desired pH range. Disinfection is then complete.

Alternate Disinfection Procedure

9a. After step 2, add ~ 1,000 gallons of clear water through the effluent line.

9b. After completing step 9a, pump the contents of two 55-gallon drums of 50% sodium hydroxide into the adsorber through the effluent line.

9c. Fill the adsorber with clean water by backfilling through the effluent line at 3-5 gpm/ft^2 so as to thoroughly mix the contents of the adsorber.

9d. Shut off the backfill water when it begins to overflow through the vent line. Check the pH of the water exiting the vent line. It should be 13 or higher.

10. Go to step 5.

Safety Message

Wet activated carbon preferentially removes oxygen from air. In closed or partially closed containers and vessels, oxygen depletion may reach hazardous levels. If workers are to enter a vessel containing carbon, appropriate sampling and work procedures for potentially low oxygen spaces should be followed, including all applicable Federal and State requirements.

CALGON CARBON CORPORATION

Making Water and Air Safer and Cleaner

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Your local representative

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System
Pressure Drop

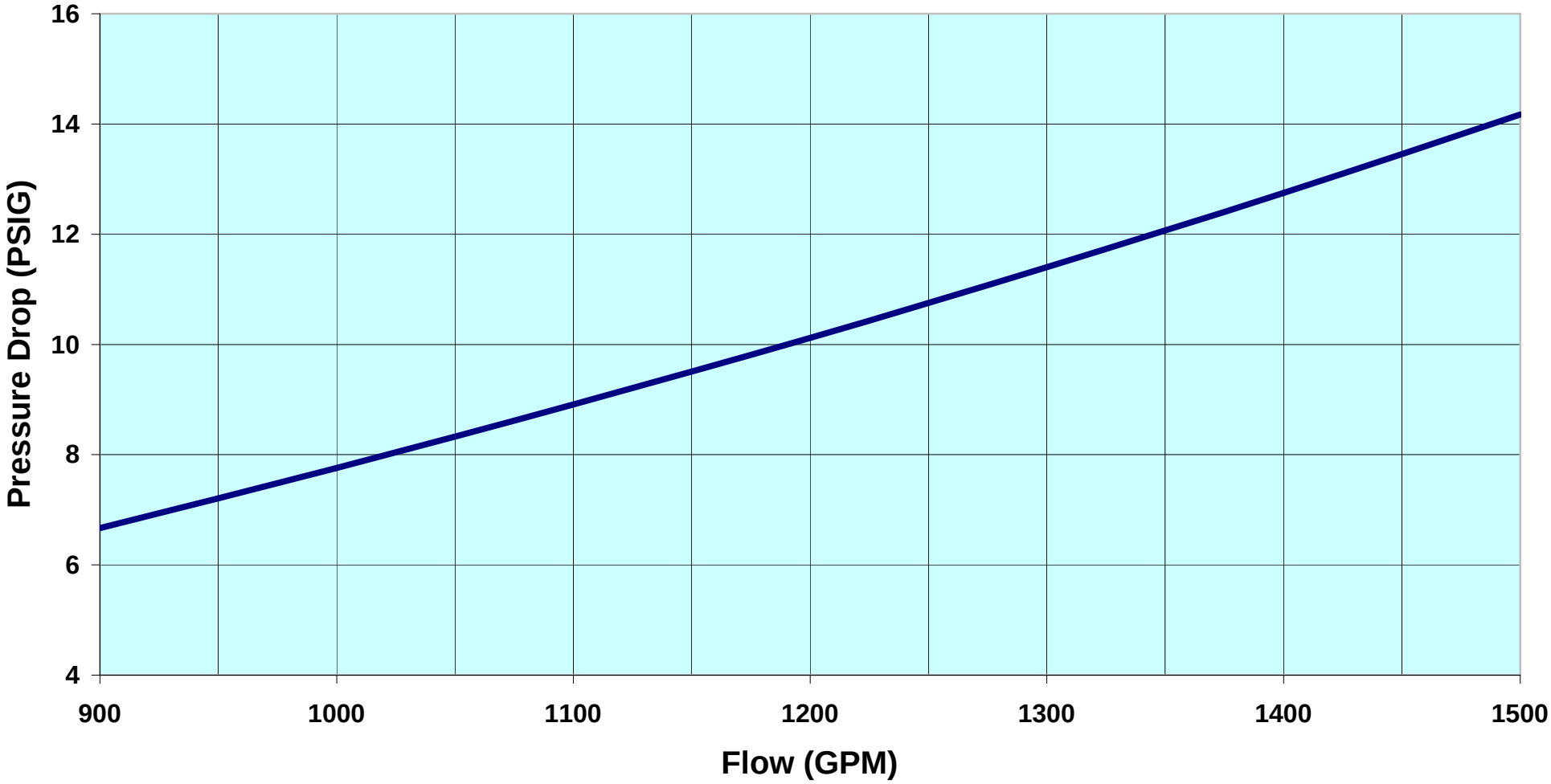
Project: IX-08089.MHLL
Revision: 0
Title: System Pressure Drop @ 60° F

	Filters Clean	Filters Dirty	See Note(s)
	psi	psi	
Total Pressure Drop @ 7,000 gpm	55.83	75.83	
Inlet Filters	5	25	1
(4) Model 12 Resin Systems @ 1,750 gpm	25.91	25.91	2,3
(5) Model 12 Carbon Systems @ 1,400 gpm	19.92	19.92	2
Header Piping (See Sheet 2)	5	5	4

Notes:
1) The inlet filter cartridges should be changed when the total pressure drop across them becomes 25 psid. If they are changed prior to this then the design pressure drop can be reduced.
2) This includes one (1) witch hat strainer in the 10" effluent line of each vessel.
3) Using 494 cubic feet of resin.
4) From the points where the 24" influent/effluent goes underground on the treatment pad.

Pressure Drop Curve for Monk Hills (One) Model 12 System, Series Flow with 40,000 lbs F300 Carbon, backwashed at 60 deg. F

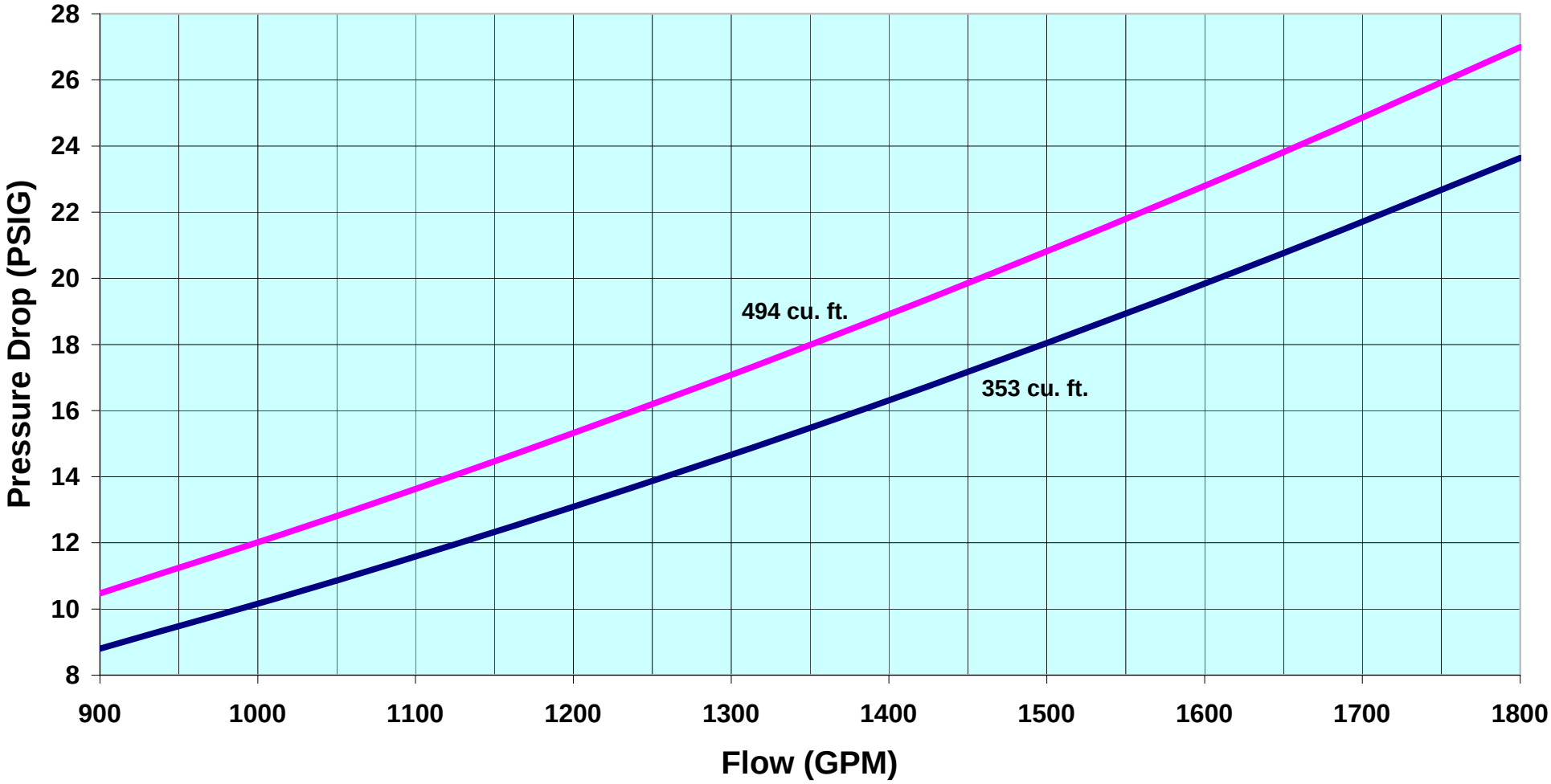
CALGON CARBON CORPORATION



MHS 01/21/2009

Pressure Drop Curve for Monk Hills (One) Model 12 System, Series Flow with CalRes 2109, at 60 deg. F (Resin Volume Above Top of Septa)

CALGON CARBON CORPORATION



MHS 01/21/2009

CALGON

CALGON CARBON CORPORATION

Section 11

ASME SECTION VIII U1A FORMS

CALGON CARBON CORPORATION

Section 12

SPECIFICATIONS AND CATALOG CUTSHEETS

CALGON CARBON CORPORATION	CARBON STEEL PIPE MATERIAL SPECIFICATION	SPEC NO:
	CARBON STEEL PIPE WITH STEEL FITTINGS	C02

MATERIAL:
Carbon steel pipe with steel fittings

RATING:
125 PSIG @ 350 DEG. F, 200 PSIG @ 150 DEG. F, Includes corrosion allowance of 0.050" min.

CONSTRUCTION:
Screwed for 1 1/2" and smaller, welded and/or flanged for 2" and larger.

PIPE:
Carbon steel, ASTM A53, Grade B: Threaded, schedule 80, seamless, 1 1/2" and smaller, plain end, schedule 40, seamless, 2" to 10", Plain end, 3/8" wall, seamless, 12" and above.

FITTINGS:
3000 lb ANSI B16.11, forged steel, threaded ends, 1 1/2" and smaller. Schedule 40, ANSI B16.9, ASTM A234, Grade WPB, carbon steel, butt welding ends, 2"-12". 3/8" wall, ANSI B16.9, ASTM A234, Grade WPB, carbon steel, butt welding ends, 14" to 24", or 125# flanged cast iron elbows and tees, ASTM A126, Class B with 125# ANSI B16.1 drilling with dimensions per ANSI A21.10 (AWWA C110). Location of tapped holes for drains shall be in accordance with ANSI B16.1. Use thread-o-lets on branch connections 1-1/2" and smaller, use stub-in or reducing tee connections for 2" and above.

UNIONS:
3000 lb forged steel, ASTM A105, Grade 2, integral steel seat, ground joint, threaded ends.

FLANGES:
150 lb ANSI B16.5, ASTM A105 forged carbon steel, slip-on, weld neck, or MSS lap joint/stub end for 2" and larger, threaded 1 1/2" and smaller. Where bolting to flat face cast iron flanges, flanges shall be furnished with a flat face. Others shall be raised face.

ORIFICE FLANGES:
Instrument item.

BOLTING:
See Fastener Specification F03 for Bolts, and F20 for Studs.

Issue Date: 12/01/89 Revision Date: 06/11/99

Approved by Matthew R. McGowan on 04/04/2000

CALGON CARBON CORPORATION	CARBON STEEL PIPE MATERIAL SPECIFICATION	SPEC NO:
	GALVANIZED CARBON STEEL PIPE	C13

MATERIAL: Galvanized carbon steel pipe with galvanized iron or steel fittings.

RATING: 300 PSIG @ -20 to 150 DEG. F
150 PSIG @ 350 DEG. F Includes corrosion allowance of 0.050" minimum.

CONSTRUCTION: Screwed 3" and smaller
No bending permitted

PIPE: Galvanized carbon steel, ASTM A120:
Threaded, schedule 40, butt welded seam 2" and smaller.
Threaded schedule 40, butt welded seam or seamless, 2 1/2" and 3".

FITTINGS: 150 lb., ANSI B16.3, ASTM A197, galvanized malleable iron, banded, threaded ends.

UNIONS: 150 LB., ASTM A197, galvanized malleable iron, integral iron seat, ground joint, threaded ends.

FLANGES: 150 lb., ANSI B16.5, ASTM A105, Grade 1, galvanized forged carbon steel, threaded.

Where bolting to flat face cast iron flanges, steel flanges shall be furnished with a flat face. Others shall be raised face

ORIFICE FLANGES: Instrument item.

BOLTING: See attached Fastener Specification F03.

Issue Date: 12/01/89 Revision Date: 04/10/92

Approved by Joseph P. McMahon on 07/24/98

CALGON CARBON CORPORATION	FASTENER MATERIAL SPECIFICATION	SPEC NO: F03

MATERIAL:
Hex Bolt, low or medium carbon steel, ASTM A307 Grade B.
1/4" through 4" Proof load 55,000 psi.
1/4" through 4" Tensile strength: 60,000 psi minimum, 100,000 psi maximum.
Zinc plated.
Threads to be UNC unless specified UNF bolts to include (1) heavy hex nut, ASTM A563, Grade A.

Issue Date: 01/01/89 Revision Date: 07/16/2001

Approved by Matthew R. McGowan on 07/16/2001

CALGON CARBON CORPORATION	FASTENER MATERIAL SPECIFICATION	SPEC NO: F20

MATERIAL: Stud bolts, alloy steel, ANSI B18.2, ASTM A193, Grade B7, with two heavy semi-finished hexagon 2H nuts per bolt, Zinc plated.

Issue Date: 07/10/91 Revision Date: 05/28/92

Approved by Matthew R. McGowan on 07/12/2001

CALGON CARBON CORPORATION	GASKET MATERIAL SPECIFICATION	SPEC NO:
	1/8" EPDM RUBBER	G-45

MATERIAL:	EPDM, Color: Black, 1/8" thick.
RATING:	Durometer (Shore A +/- 5): 60
MANUFACTURER:	Garlock or equal.
SIZES:	Pipe gasket flange dimension per ANSI B16.21
MODELS:	Garlock- 8314 or equal.

SERVICE CONDITIONS:
Temperature: -40 thru 300 degrees F. Pressure: 250 psig

Issue Date: 03/12/2008 Revision Date: 03/12/2008

Approved by Joseph P. McMahon on 03/12/2008

CALGON CARBON CORPORATION	LINED PIPE MATERIAL SPECIFICATION	SPEC NO:
	PLASTIC LINED STEEL PIPE WITH PLASTIC LINED FLANGED FITTINGS	L01

MATERIAL: Plastic lined steel pipe with plastic lined flanged fittings.

RATING: 150 PSIG @ minus 20 DEG. to plus 225 DEG. F.

CONSTRUCTION: Flanged 1" to 8", Dow Chemical Company's MORAF PPL brand piping system using polypropylene resin lined steel pipe and lined cast iron flanged fittings. Each spool piece and fitting to be furnished with ends of plastic liner formed over flanged ends to form a molded raised face.

PIPE: Schedule 40, ANSI B36.10, ASTM A53, steel pipe with lining.

FITTINGS: 125 lb., ANSI B16.1, ASTM A126, Class A, cast iron flanged with lining.

FLANGES: 125 lb., ANSI B16.1, ASTM A126, Class A, cast iron, threaded, flat face with smooth finish, drilled and chamfered.

BOLTING: See attached Fastener Specification F03.

FIELD FABRICATION: For piping not shop fabricated Contractor must have special tools and equipment to cut the lined pipe and form the molded raised face on the job. See Dow's Form 178-103 "Field Installation of Dow Plastic Lined Piping Products" for necessary equipment and instructions.

LINING: Thermally stabilized polypropylene resin.

Issue Date: 12/01/89 Revision Date:

Approved by Joseph P. McMahon on 07/24/98

CALGON CARBON CORPORATION	STAINLESS STEEL PIPE MATERIAL SPECIFICATION	SPEC NO:
	INSTRUMENT PIPING, HEAT TRACING, ETC.	S06

MATERIAL: Stainless steel tubing and flareless compression fittings, and stainless steel pipe and fittings.

RATING: 150 PSIG @ 365 DEG. F.
300 PSIG @ 100 DEG. F.

CONSTRUCTION: For tubing systems 1" and smaller. Pipe and screwed pipe fittings to be used for take-off connections on larger pipe, manifolding, connections to screwed instruments, equipment, etc. Tubing to be used for all other piping in the system.

PIPE NIPPLES: ASTM A312, Type 316, seamless, Schedule 80S, ANSI B36.19, annealed and pickled.

PIPE FITTINGS: Type 316 stainless steel screwed fittings, dimensions per ANSI B16.3, forged, wrought or cast material rated 150 lb. Camco Fittings Co., or equal.

TUBING: Type 316 stainless steel seamless tubing, 0.035" wall thickness, annealed and pickled, hardness 70-74 Rockwell "B", 1/4 O.D.

TUBE FITTINGS: Type 316 stainless steel, flareless compression fittings, Crawford Fitting Company "Swagelok", or equal.

Issue Date: 01/01/89 Revision Date:

Approved by Joseph P. McMahon on 07/24/98

CALGON CARBON CORPORATION	STAINLESS STEEL PIPE MATERIAL SPECIFICATION	SPEC NO:
	TYPE 316 STAINLESS STEEL PIPE AND FITTINGS	S15

MATERIAL: Type 316 stainless steel pipe and fittings.

RATING: 150 PSIG @ 365 DEG. F.
300 PSIG @ 100 DEG.F.

CONSTRUCTION: Screwed for 3" and smaller

PIPE: Threaded, Schedule 40S, ASTM A312, Type316, welded, ANSI B36.19, annealed and pickled.

FITTINGS: Type 316 stainless steel screwed fittings, general dimensions to conform to ANSI B16.3 for malleable iron screwed fittings. Forged, wrought or cast material rated 150 Lb. @ 365 DEG.F., Camco Fittings Co., or equal.

FLANGES: Type 316 stainless steel, threaded, MSS-SP-51, 150 Lb. flat face, serrated finish.

ORIFICE FLANGES: Instrument Item.

BOLTING: See attached Fastener Specification F03.

GASKETS: See attached Gasket Specification G02.

Issue Date: 12/01/89 Revision Date: 06/20/2001

Approved by Gerald Kirner on 06/21/2001

CALGON CARBON CORPORATION	STAINLESS STEEL PIPE MATERIAL SPECIFICATION	SPEC NO:
	TYPE 304L STAINLESS STEEL	S25

MATERIAL: Type 304L stainless steel.

RATING: 150 PSIG @ 500 DEG. F.

CONSTRUCTION: Flanged and welded for 2" and larger.
Threaded for 1 1/2" and smaller.

PIPE: Plain end, stainless steel pipe ASTM A-312, Grade TP 304L, welded, annealed and pickled. Pipe dimensions to conform with Schedule 10S, ANSI B36.19. For 1 1/2" and smaller, use SCH. 40.

FITTINGS: ASTM A-403, Grade WP 304L stainless steel, ANSI B16.9 butt weld, Schedule 10S ANSI wall thickness, for 2" and larger. For 1 1/2" and smaller use screwed fittings, Type 304L, dimensions per ANSI B16.3, forged, wrought or cast material rated 150 lb.

FLANGES: ASTM A-182 Grade F304 forged stainless steel,
150# ANSI B16.5, raised face slip-on or weld neck type. Where bolting to flat face flanges on instruments or equipment, flanges shall be furnished with a flat face.

ORIFICE FLANGES: Instrument Item.

BOLTING: See attached Fastener Specification F03.

GASKETS: See attached Gasket Specification G10 for 1/16", or G11 for 1/8".

Issue Date: 03/28/95 Revision Date:

Approved by Joseph P. McMahon on 07/24/98

CALGON CARBON CORPORATION	BUTTERFLY VALVES MATERIAL SPECIFICATION	SPEC NO:
	ONE-PIECE CAST IRON BUTTERFLY VALVE	3.44

MATERIAL: One-piece cast iron wafer style body, epdm or buna-n seat material, gasket type seal, torque plug connection, 416 stainless steel stem (or of greater corrosion resistance), bronze or aluminum bronze disc material, bronze upper and lower bushings. Lever operator for valve sizes 2" through 6", weatherproof worm gear wheel operator for sizes 8" through 12" (handwheel diameter shall not exceed 9"). Valves shall comply with section 5: Inspection Testing and Rejection of AWWA specification C-504-87 with one exception; test pressure shall be 200 psig.

RATING: 200 psig @ 180 Deg. F.

CONSTRUCTION: Shaft: 1 piece, through shaft construction.

MANUFACTURER: Centerline, Pratt, Xomox, Crane, Apollo, Sure-Seal, or equal.

SIZES: 2" through 12"

MODELS: Centerline Series 200, Pratt Series 396, Xomox Series 700, Crane Series 42, Apollo Series 141, Sure-Seal Series 600 or equal.

Issue Date: 10/29/92 Revision Date: 04/04/2007

Approved by Joseph P. McMahon on 04/05/2007

Spec. 3.44



CENTER LINE®

Resilient Seated Butterfly Valves

CRANE®
THE VALVE EXPERTS



Spec. 3.44

Center Line has been a market leader in quarter-turn valves for more than 40 years, and we have earned a reputation as a supplier of superior valves at competitive prices. Our goal is to exceed industry requirements and customer expectations.

We are committed to offering products that meet a wide range of applications and requirements. We continually improve our product line by introducing new products and enhancing existing designs, providing our customers with the best products on the market.

Our complete line of resilient seated butterfly valves provides you with the reliability you need, backed by the guarantee that comes with using valves designed and produced in company-owned manufacturing facilities.

Center Line Resilient Seated Butterfly Valves Product Features

- Qualified for both gaseous and liquid service
- Positive shut-off bi-directionally
- Phenolic backed cartridge seat
- Three-position PTFE bushing standard
- Locking handle standard
- End of line service optional
- Ease of automation
- Field repairable
- Complete size range: 2 through 48 inches

Typical Applications

- HVAC
- Chemical/ Petrochemical Processing
- Food and Beverage
- Power and Utilities
- Pulp and Paper

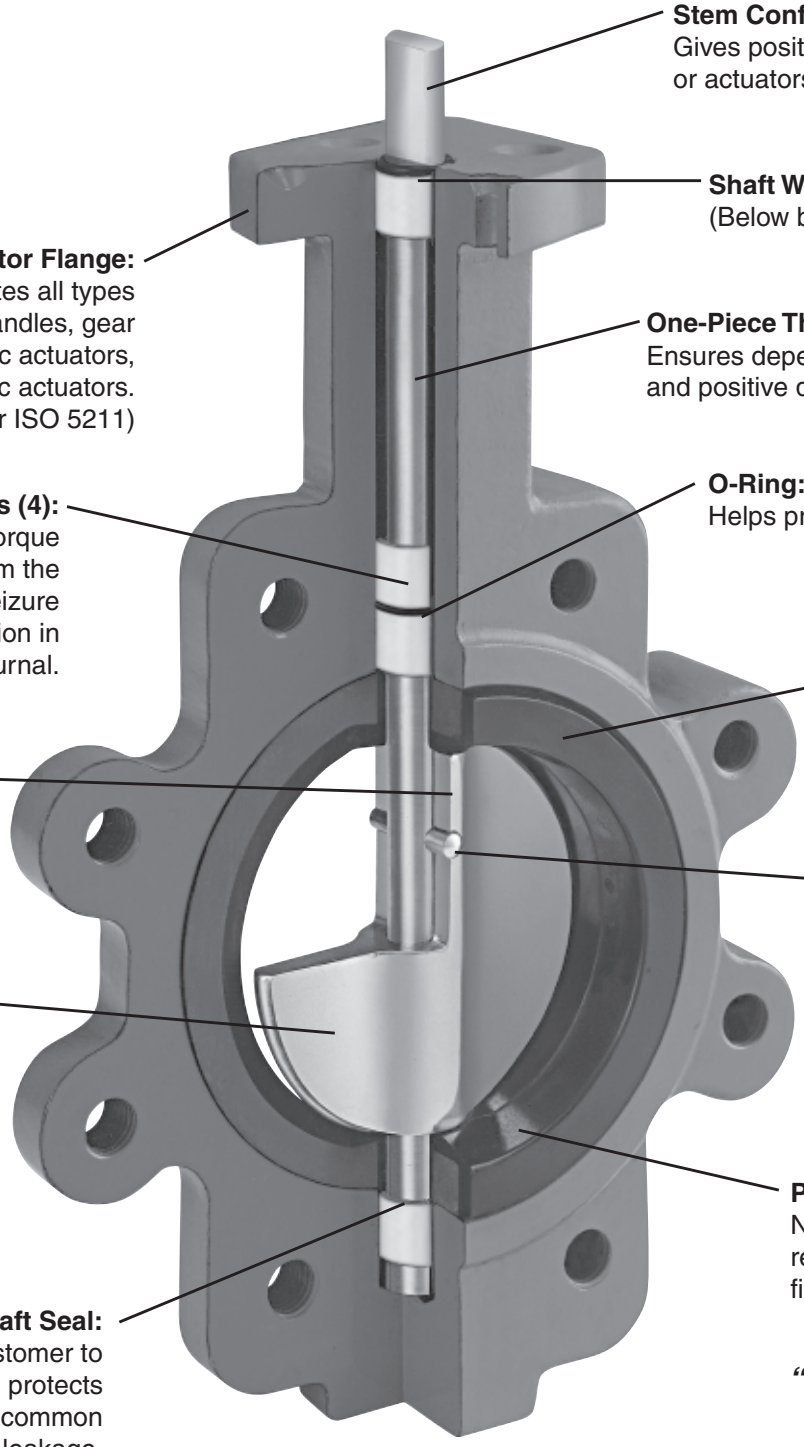
NOTE: In keeping with our policy of continuing improvement, we reserve the right to institute changes in design, material, dimensions, or specifications without notice and without incurring any obligation to make such changes and modifications on product previously or subsequently sold.

T: 936-588-8380 • F: 936-588-8381 • www.cranevalve.com

CENTER LINE

Spec. 3.44

Quality is designed into Series 200, 225, and 250 butterfly valves from Center Line. These valves feature a phenolic-backed cartridge seat and precision-machined parts to assure years of dependable operation.



Stem Configuration:
Gives positive attachment for handles or actuators. (Double "D", 2"-24")

Shaft Weather Seal:
(Below bushing on some models.)

Actuator Flange:
Accommodates all types of actuators: handles, gear operators, electric actuators, and pneumatic actuators. (2"-24" per ISO 5211)

One-Piece Thru Shaft:
Ensures dependability and positive disc positioning.

Bushings (4):
Stem bushing reduces torque and isolates the stem from the valve body, preventing seizure of the stem due to corrosion in the stem journal.

O-Ring:
Helps prevent stem leakage.

Seat Face:
Negates need for flange gaskets.

Smooth Finished Disc Flats:
These "mate" with seat flats to give a highly efficient seal; prevents leakage into shaft areas.

Precision Taper Pin (two pins on Series 225 and 250):
Ensure positive, vibration proof, shaft to disc connection. Field replaceable.

Precision Profile Disc:
Provides bubble-tight shut-off and assures minimum torque and longer seat life.

Phenolic Backed Seat:
Non-collapsible, stretch resistant, blow out proof, field replaceable.

Supported Shaft Seal:
Bonding of elastomer to phenolic backing ring protects against distortion, a common cause of shaft leakage.

"Representative Cutaway"

Spec. 3.44

- Available in sizes 2" to 48".
- Available in Wafer or Lug style body (2" to 30").
- Full flange style body for 36" to 48" valves.
- Wafer body features four alignment holes.
- Pressure ratings for tight shut-off at temperatures up to the maximum limit of the seat material:
  - 2" to 12" — 200 psi, 125 psi for PTFE seat.
  - 14" to 48" — 150 psi.
- Ideal for on-off or throttling services.
- Available with handles (2" to 12"), manual gear operators (2" to 48"), and electric or pneumatic actuators (2" to 48").
- Refer to Crane automation bulletin for details of pneumatic and electric actuators.
- Designed to comply with MSS SP-67.
- Compatible with ASME 125/150 flanges.
- Valves 2" to 20" meet the intent and have passed the AWWA C-504-87 Section 5 proof of design tests.
- Type approval certification from ABS for marine applications (2" to 14").
- Bi-directional dead-end capability to 200 psi (2" to 12") and 150 psi (14" to 24") is standard on lug valves.
- Operators mounted perpendicular to pipe.
- For bolting information, consult the Center Line Installation and Maintenance Manual.
- Vacuum Service Rating: zero leakage at 24" of mercury.
- Commercial cleaning available for non-silicone and O_2 service.

Valve Seating Torques (In-Lbs.) 2" to 30"

Valve Size	Standard Disc Differential Pressure								Undercut Diff. Press.	
	50 PSI ΔP Bushing		100 PSI ΔP Bushing		150 PSI ΔP Bushing		200 PSI ΔP Bushing		75 PSI ΔP Bushing	
	Bronze	PTFE	Bronze	PTFE	Bronze	PTFE	Bronze	PTFE	Bronze	PTFE
2"	106	100	117	106	129	111	140	117	-	-
2 1/2"	152	150	166	163	181	176	195	189	-	-
3"	213	207	230	220	248	232	265	244	-	-
4"	321	290	386	323	450	357	515	390	-	-
5"	481	423	598	481	715	540	832	598	-	-
6"	692	599	878	691	1,063	783	1,248	875	-	-
8"	1,326	1,060	1,716	1,183	2,106	1,307	2,496	1,430	1,124	819
10"	2,239	1,671	3,010	1,872	3,780	2,074	4,550	2,275	1,363	909
12"	3,959	2,568	4,953	2,795	5,948	3,023	6,942	3,250	2,457	1,445
14"	4,881	2,640	6,226	3,070	7,570	3,500	-	-	4,400	2,300
16"	7,020	4,260	8,580	4,880	10,140	5,500	-	-	5,900	3,600
18"	10,105	6,287	12,202	7,243	14,300	8,200	-	-	8,300	5,500
20"	13,923	8,360	16,582	9,180	19,240	10,000	-	-	11,100	6,700
24"	23,617	15,427	26,953	16,813	30,290	18,200	-	-	17,300	12,100
30"	39,721	27,313	43,391	29,407	47,060	31,500	-	-	27,300	21,100

Valve Seating Torques (In-Lbs.) 28" to 48" Double Flanged

Valve Size	Standard Disc Differential Pressure		
	50 PSI Wet / Dry	100 PSI Wet / Dry	150 PSI Wet / Dry
28"	23,718	26,639	28,957
30"	28,320	30,860	33,338
32"	32,418	35,073	38,126
36"	40,622	43,480	46,524
40"	68,924	74,048	78,995
42"	69,747	74,632	79,862
48"	96,598	103,837	111,112

All torques shown in these charts were derived from test data using water at 60°F. For torques using dry gases, multiply these numbers by 2.0. For torques involving other media, please consult the factory.

There is no safety factor included in the numbers shown on these charts. For actuator sizing, Crane recommends that these values be multiplied by 1.5 for single valve applications, or 2.0 for 3-way ("tee") applications.

For PTFE seats multiply the numbers shown by 2.0.

Under certain conditions, hydrodynamic torque can meet or exceed seating and unseating torques. When designing valve systems, hydrodynamic torque must be considered to help assure correct selection for the application.

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Spec. 3.44

Seat Temperature Ratings

Material	Temperature Ratings °F
Buna-N	+10 to 180
Abrasive Resistant Buna-N	+10 to 180
Neoprene	+20 to 200
EPDM (2"- 16")	-30 to 275
EPDM (18" & Above)	-30 to 225
EPDM, Food Grade (2" - 12")	-30 to 225
Hypalon	0 to 275
Viton	+10 to 275
High Temp. Viton	+10 to 400
PTFE over Buna-N (125 psi, 2" - 12")	+40 to 250
PTFE over Buna-N (75 psi, 2" -12")	+40 to 275

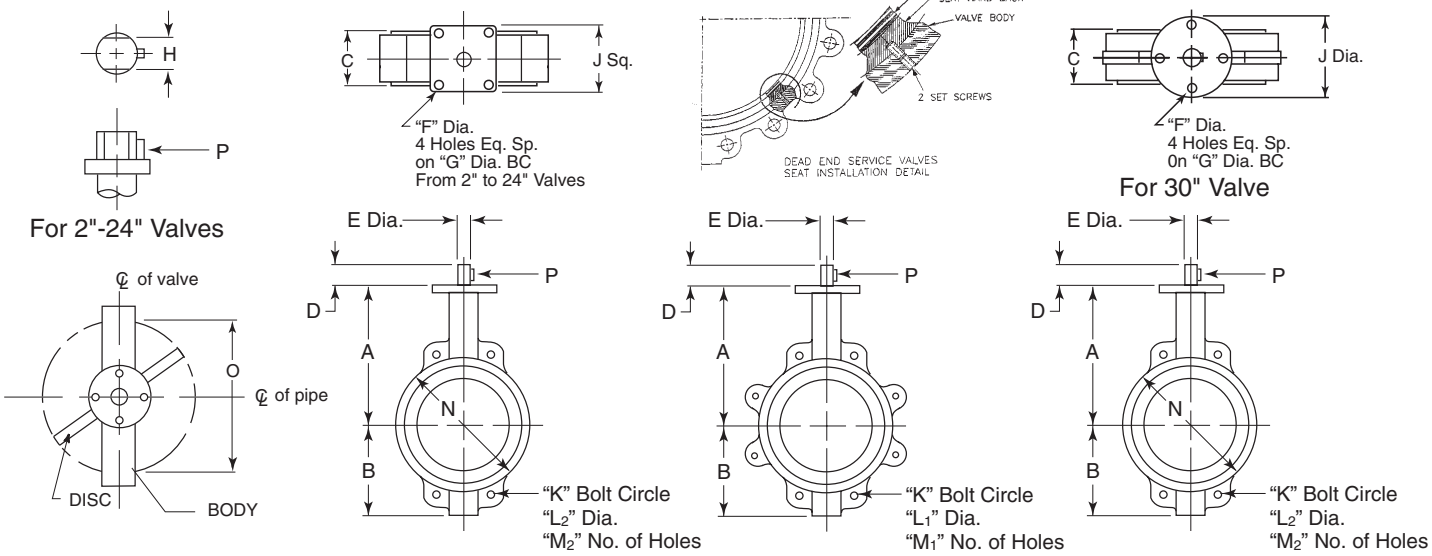
Although elastomers have an effective operating temperature range, when used in valves, these ranges may have to be modified. The temperature ranges shown in the table have been adjusted accordingly.

For Low Temperature: While the seat materials selected for use in Center Line butterfly valves are capable of withstanding lower temperatures without damage, the durometer of the elastomer is changed. This "hardening" of the seat may increase the operating torque beyond the structural limits of the stem and/or the disc to stem configuration.

For High Temperature: When using High Temperature Viton, the operating pressure of the valve is reduced above 275°F.

C_V Values – Valve Sizing Coefficients (US-GPM @ 1ΔP) 2" to 48"

Size	10°	20°	30°	40°	50°	60°	70°	80°	90°
2"	0.06	3	7	15	27	44	70	105	115
2 1/2"	0.10	6	12	25	45	75	119	178	196
3"	0.20	9	18	39	70	116	183	275	302
4"	0.30	17	36	78	139	230	364	546	600
5"	0.50	29	61	133	237	392	620	930	1022
6"	0.80	45	95	205	366	605	958	1437	1579
8"	2	89	188	408	727	1202	1903	2854	3136
10"	3	151	320	694	1237	2047	3240	4859	5340
12"	4	234	495	1072	1911	3162	5005	7507	8250
14"	6	338	715	1549	2761	4568	7230	10844	11917
16"	8	464	983	2130	3797	6282	9942	14913	16388
18"	11	615	1302	2822	5028	8320	13168	19752	21705
20"	14	791	1647	3628	6465	10698	16931	25396	27908
24"	22	1222	2587	5605	9989	16528	26157	39236	43116
28"	36	1813	3639	6636	10000	14949	22769	34898	49500
30"	37	2080	4406	9546	17010	28147	44545	66818	73426
32"	45	2387	4791	8736	13788	20613	31395	48117	38250
36"	260	3050	6730	12740	20220	32500	52500	79600	87500
40"	84	4183	8395	15307	24159	36166	55084	84425	119750
42"	350	4095	9040	17108	27150	43640	70500	106890	117500
48"	455	5365	11840	22400	30600	51200	92300	140000	154000



Dimensions 2" - 30"

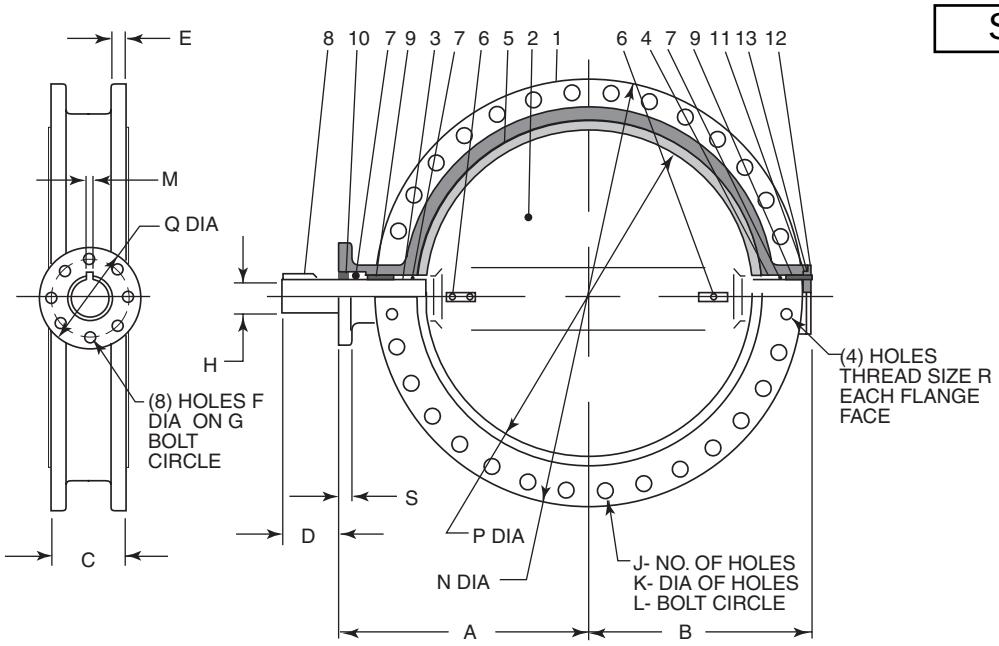
Inches / mm	A	B	C	D	E	F	G	H	J	K	L_1	L_2	M_1	M_2	N	O	P
2"	6 3/8	3 1/4	1 3/4	1 1/4	1/2	3/8	2.76	0.39	2 3/4	4 3/4	5/8-11	11/16	4	4	4.	1.26	Wooduff #3
50	161.93	82.55	44.45	31.75	12.70	9.53	70	10	69.85	120.65		17.46			101.60	32.0	
2 1/2"	6 7/8	3 3/4	1 7/8	1 1/4	1/2	3/8	2.76	0.39	2 3/4	5 1/2	5/8-11	11/16	4	4	4 3/4	1.83	Wooduff #3
65	174.63	95.25	47.63	31.75	12.70	9.53	70	10	69.85	139.70		17.46			120.65	46.5	
3"	7 1/8	4	1 7/8	1 1/4	1/2	3/8	2.76	0.39	2 3/4	6	5/8-11	11/16	4	4	5 1/8	2.54	Wooduff #3
75	180.98	101.60	47.63	31.75	12.70	9.53	70	10	69.85	152.40		17.46			130.18	64.5	
4"	7 7/8	4 7/8	2 1/8	1 1/4	5/8	3/8	2.76	0.47	2 3/4	7 1/2	5/8-11	11/16	8	4	6 3/4	3.54	Wooduff #9
100	200.03	123.83	53.98	31.75	15.88	9.53	70	12	69.85	190.50		17.46			171.45	89.9	
5"	8 3/8	5 3/8	2 1/4	1 1/4	3/4	3/8	2.76	0.55	2 3/4	8 1/2	3/4-10	13/16	8	4	7 3/4	4.36	Wooduff #9
125	212.73	136.53	57.15	31.75	19.05	9.53	70	14	69.85	215.90		20.64			196.85	110.7	
6"	8 7/8	5 7/8	2 1/4	1 1/4	3/4	3/8	2.76	0.55	2 3/4	9 1/2	3/4-10	13/16	8	4	8 5/8	5.72	Wooduff #9
150	225.43	149.23	57.15	31.75	19.05	9.53	70	14	69.85	241.30		20.64			219.08	145.3	
8"	10 1/4	7 3/4	2 1/2	1 3/4	7/8	7/16	4.02	0.67	3 3/4	11 3/4	3/4-10	13/16	8	4	10 5/16	7.6	Wooduff #9
200	260.35	196.86	63.50	44.45	22.23	11.11	102	17	95.33	298.45		20.64			268.29	193.0	
10"	11 1/2	8 1/4	2 3/4	1 3/4	1 1/8	7/16	4.02	0.87	3 3/4	14 1/4	7/8-9	15/16	12	4	13 1/16	9.5	Wooduff #15
250	292.10	209.55	69.85	44.45	28.58	11.11	102	22	95.33	361.95		23.81			331.79	241.3	
12"	13 1/4	9 3/4	3 1/8	1 3/4	1 1/4	7/16	4.02	0.95	3 3/4	17	7/8-9	15/16	12	4	16 1/8	11.45	Wooduff #15
300	336.55	247.65	79.38	44.45	31.75	11.11	102	24	95.33	431.80		23.81			409.58	290.8	
14"	14 1/2	11	3 1/8	1 3/4	1 1/4	7/16	4.02	0.95	3 3/4	18 3/4	1-8	1 1/16	12	4	17 1/8	12.78	Wooduff #15
350	368.30	279.40	79.38	44.45	31.75	11.11	102	24	95.33	476.25		26.99			434.98	324.6	
16"	15 3/4	12	3 1/2	2	1 5/16	7/8	6.50	1.06	6 1/2	21 1/4	1-8	1 1/16	16	4	20	14.97	5/16" Sq. x 1 3/4"
400	400.05	304.80	88.90	50.80	33.34	22.23	165	27	165.10	539.75		26.99			508.00	380.2	
18"	16 5/8	15	4 1/4	2	1 1/2	7/8	6.50	1.06	6 1/2	22 3/4	1 1/8 - 7	1 1/4	16	4	21 3/8	16.83	3/8" Sq. x 1 1/2"
450	422.28	381.00	107.95	50.80	38.10	22.23	165	27	165.10	577.85		31.75			542.93	427.5	.
20"	18 7/8	14 5/8	5 1/4	2 1/2	1 5/8	7/8	6.50	1.26	6 1/2	25	1 1/8 - 7	1 1/4	20	4	23 5/16	18.67	3/8" Sq. x 1 3/4"
500	479.43	371.48	133.35	63.50	41.28	22.23	165	32	165.10	635.00		31.75			592.14	474.2	
24"	22 1/8	18	6 1/8	2 3/4	2	7/8	6.50	1.42	6 1/2	29 1/2	1 1/4 - 7	1 1/4	20	4	27 7/8	22.62	1/2" Sq. x 2 1/4"
600	561.98	457.20	155.58	69.85	50.80	22.23	165	36	165.10	749.30		31.75			708.03	574.5	
30"	25 1/2	24 1/4	6 3/4	3 1/4	2 1/2	7/8	8 1/2	N/A	11 1/4	36	1 1/4 - 7	1 1/4	28	4	34 3/8	28.6	5/8" Sq. x 2 5/8"
750	647.70	615.95	171.45	82.55	63.50	22.23	215.90		285.75	914.40		31.75			873.13	726.4	

L_1 and M_1 refer to Lug style valves, L_2 and M_2 refer to Wafer Style. "C" dimension is listed with elastomer in the relaxed condition. Approximately 1/8" total compression is required for proper sealing with pipe flanges. Valves are designed for installation between ASME B16.1 Class 125 (Iron) and B16.5 Class 150 (Steel) flanges. Gaskets are not needed, and should not be used since the seat face seals against the mating flange. If the valve is to be installed in plastic or fiberglass flanges, flange rings, or Van Stone style flanges, consult your Center Line agent or the factory for additional information. Center Line recommends that a blind flange be used on end of line applications.

Consult factory for dimension to 2 1/2" and 5" PTFE seated valves. "O" dimension is the valve clearance dimension.

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Spec. 3.44



*Dimensions 28" - 48" Double Flanged

		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S
28	in	20.8	25	6.6	3.3	2.2	0.7	10	2.5	24	1.4	34.5	0.7 Sq.	37.1	27.8	11.8	1.25 - 7	1.3
	mm	520	624	165	85	54	18	254	63.4	24	35	863.4	18 Sq.	927.1	695	300	–	33
30	in	26.4	22.4	6.7	3.4	2.2	0.7	10	2.5	24	1.4	36.6	0.7 Sq.	39.4	29.8	11.8	1.25 - 7	1.1
	mm	660	560	167	86	54	18	254	63.4	24	35	914.4	18 Sq.	984	744	300	–	28
32	in	23.6	26.9	7.6	3.3	2.4	0.7	10	2.5	24	1.6	39.1	0.8 Sq.	42.4	31.8	11.8	1.5 - 6	1.3
	mm	591	672	190	85	60.3	18	254	63.4	24	41.3	977.9	20 Sq.	1060.4	795	300	–	33
36	in	28.8	25.8	8.1	4.6	2.4	0.7	10	3	28	1.6	43.4	0.8 Sq.	47	34.0	11.8	1.5 - 6	1.3
	mm	720	656	203	118	60.3	18	254	75	28	41.3	1085.8	20 Sq.	1169	864.7	300	–	33
40	in	28.8	32	8.7	5.1	2.4	0.7	10	3.3	32	1.6	48	0.9 Sq.	51.6	38.6	11.8	1.5 - 6	1.5
	mm	721	800	218	130	60.3	18	254	85	32	41.3	1200.1	22 Sq.	1289	965	300	–	38
42	in	34.3	30.6	10	5.9	2.6	0.7	10	3.3	32	1.6	49.4	0.9 Sq.	53	40.5	11.8	1.5 - 6	1.4
	mm	858	777.2	251	150	66	18	254	85	32	41.3	1257.3	22 Sq.	1346	1030	300	–	35
48	in	37.6	34	10.9	5.9	2.8	0.9	11.7	4.1	40	1.6	56	1.1 Sq.	59.5	45.7	13.8	1.5 - 6	1.5
	mm	941	864	276.4	150	70	22	298	105	40	41.3	1422.4	28 Sq.	1511	1160	350	–	38

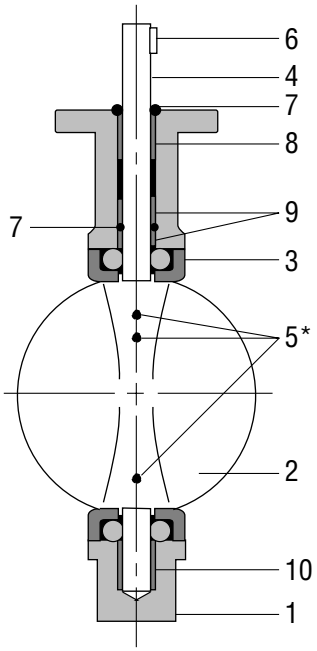
* Please note that dimensions apply to standard product only. For custom/domestic product dimensions, please consult factory.

Weights 2" - 48" – lbs (kg)

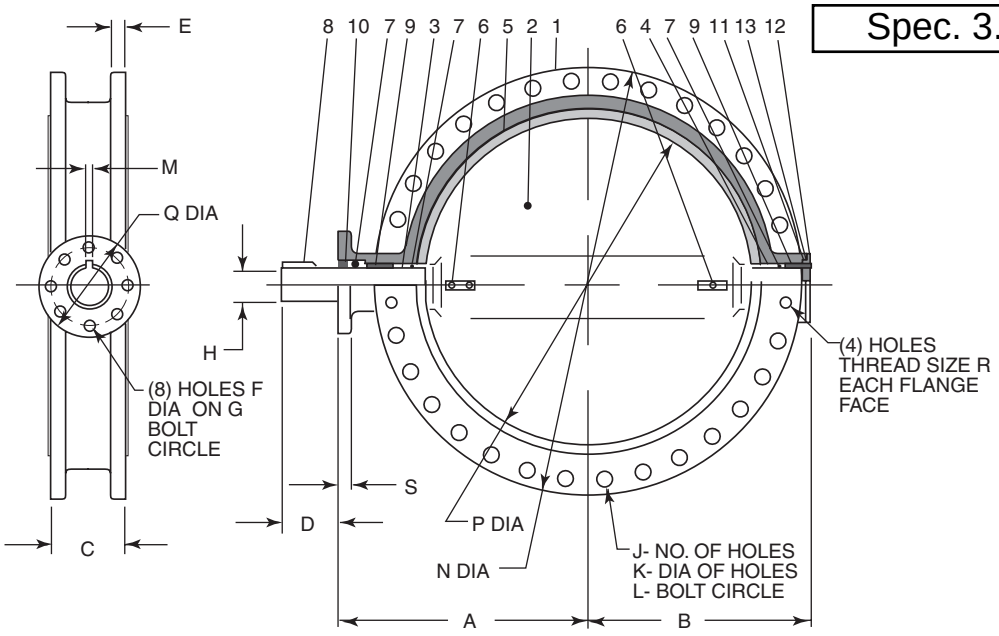
	2"	2 1/2"	3"	4"	5"	6"	8"	10"	12"	14"	16"	18"	20"	24"	28"	30"	32"	36"	40"	42"	48"
Wafer	6 (2.7)	7 (3.2)	10 (4.5)	13 (5.9)	18 (8.2)	20 (9.1)	32 (14.5)	42 (19.1)	70 (31.7)	95 (43.1)	117 (53.1)	165 (74.8)	275 (124.7)	440 (199.6)	–	740 (335.7)	–	1660 (754)	–	2145 (975)	3023 (1374)
Lug	7 (3.2)	8 (3.6)	14 (6.4)	26 (11.8)	28 (12.7)	31 (14.1)	49 (22.2)	72 (32.7)	105 (47.6)	155 (70.3)	195 (88.5)	230 (104.3)	396 (179.6)	610 (276.7)	–	1050 (476.3)	–	–	–	–	–
Flanged	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	1173 (533)	1173 (533)	1525 (693)	1949 (886)	2141 (973)	2495 (1134)	3711 (1687)

NOTE: TECHNICAL DATA SUBJECT TO CHANGE WITHOUT NOTICE.

Spec. 3.44



Sizes 2"-30"
*Quantity of 3 pins required for sizes 30" and above



Sizes 36"-48"

Bill of Materials 2" - 30"

Item	Description	Materials	Optional Materials
1	Body	Cast Iron	Ductile Iron
2	Disc	Ductile Iron†	Aluminum Bronze, 316 SS, Monel
3	Seat	Buna-N or EPDM	Neoprene, Hypalon, Viton, PTFE, FDA, Abrasion Resistant
4	Shaft	416 Stainless Steel	316 Stainless Steel, Monel
5	Taper Pin	300 Series Stainless	Monel
6	Key	Carbon Steel	No Option Available
7	O-Ring	Buna-N	No Option Available
8	Bushing	PTFE	Luberized Bronze
9	Bushing	PTFE	Luberized Bronze
10	Bushing	PTFE	Luberized Bronze

†ENP plated for 2"-12" valves

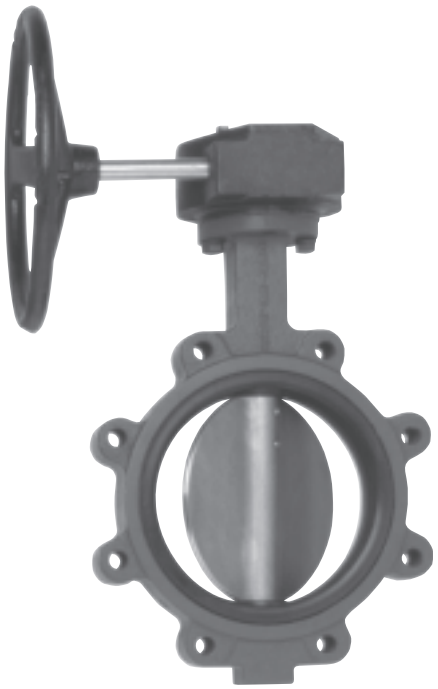
Bill of Materials 36" - 48"

Item	Description	Materials	Optional Materials
1	Body	Ductile Iron	No Option Available
2	Disc	Ductile Iron	Aluminum Bronze, 316 Stainless Steel, Monel
3	Upper Shaft	416 Stainless Steel	316 Stainless Steel, Monel
4	Lower Shaft	416 Stainless Steel	316 Stainless Steel, Monel
5	Seat	Buna-N or EPDM	Hypalon, Viton
6	Taper Pin	300 Series Stainless	Monel
7	O-Ring	Buna-N	No Option Available
8	Key	Carbon Steel	No Option Available
9	Bushing	Luberized Bronze	No Option Available
10	Bushing	Luberized Bronze	No Option Available
11	Thrust Washer	Luberized Bronze	No Option Available
12	End Plate	Ductile	No Option Available
13	O-Ring	Buna-N	No Option Available

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Spec. 3.44

Gear operators can be used for on/off and throttling control of Center Line resilient seated butterfly valves. All models are weatherproof and usable for above ground or buried service. For manual operation of valves, gear operators are required for valves 14" and larger and are recommended for valves 8" and larger.



Features

Gear operators from Center Line are 90° manual actuators, and they come with a handwheel, chainwheel, or square nut input device. The durable housing completely encloses the worm gear (on the input shaft) and the segment gear (on the output). Adjustable stops are standard and factory set when installed at the factory. Fully adjustable memory stops are available as an option. A position indicator is standard on all models for above ground service. An optional version is available for buried service applications. Contact customer service for more information.

Specifications

Operation Handwheel or chainwheel (12" standard, others available) or 2" square nut. Input shaft extension available.

Mounting Available with bolt patterns and bore/keyway for direct mount to all 2" through 30" Center Line resilient seated butterfly valves. Dual bolt patterns accommodate different pad designs.

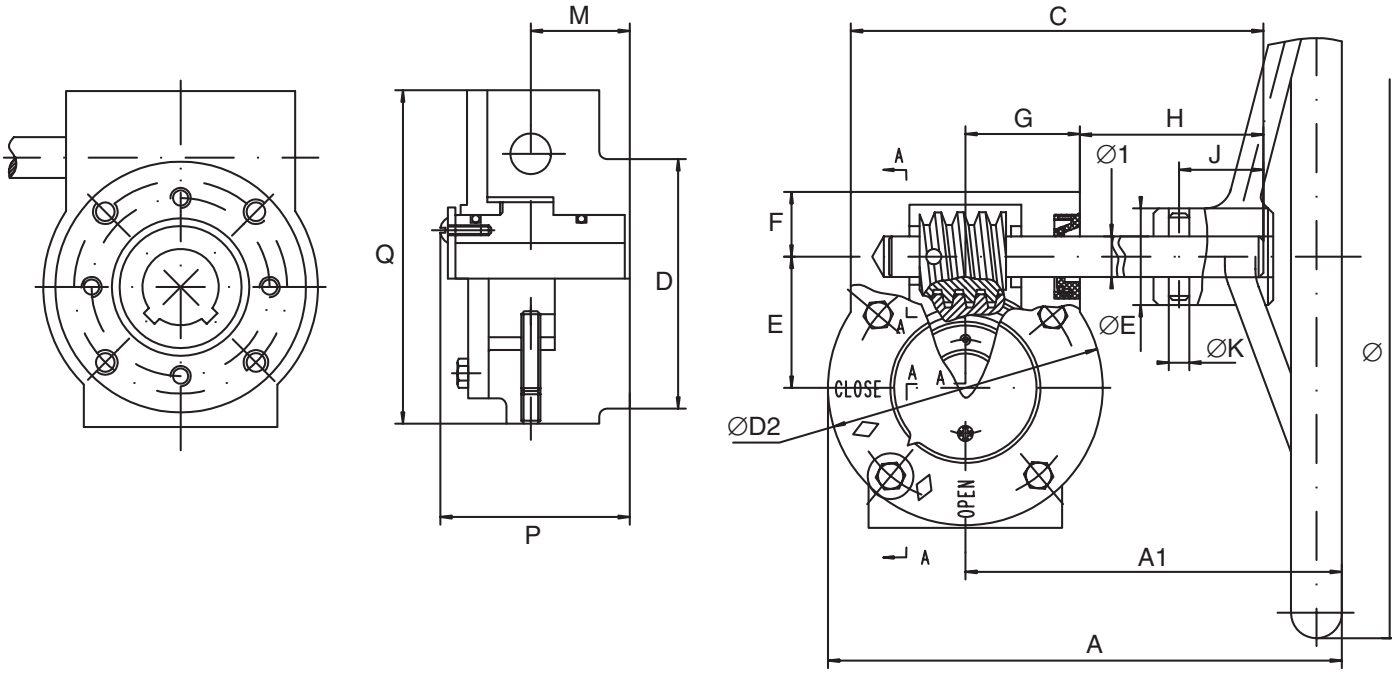
Dimensions and Weights

Valve Size		Oper.	A	A1	C	E	F	G	H	∅1	J	∅K	M	D	P	Q	∅	∅D2	∅3	Wt.
2–6	in.	XJ30	12.56	9.52	10.72	2.52	14.80	2.36	6.00	0.76	1.36	0.24	1.66	3.68	3.36	7.06	12.00	6.08	1.52	27.1
50–150	mm		314.00	238.00	268.00	63.00	37.00	59.00	150.00	19.00	34.00	6.00	41.50	92.00	84.00	176.50	300.00	152.00	38.00	12.3
8–14	in.	XJ50	12.28	9.04	10.60	3.12	1.54	2.74	5.12	0.76	1.36	0.24	1.53	5.60	3.36	7.90	12.00	6.48	1.52	31.7
200–350	mm		307.00	226.00	265.00	78.00	38.50	68.50	128.00	19.00	34.00	6.00	38.20	140.00	84.00	197.50	300.00	162.00	38.00	14.4
16–18	in.	XJ80	16.28	11.08	13.76	4.80	1.60	4.08	5.60	1.00	1.36	0.32	2.28	7.88	5.00	11.60	18.00	10.40	2.00	77.4
400–450	mm		407.00	277.00	344.00	120.00	40.00	102.00	140.00	25.00	34.00	8.00	57.00	197.00	125.00	290.00	450.00	260.00	50.00	35.2

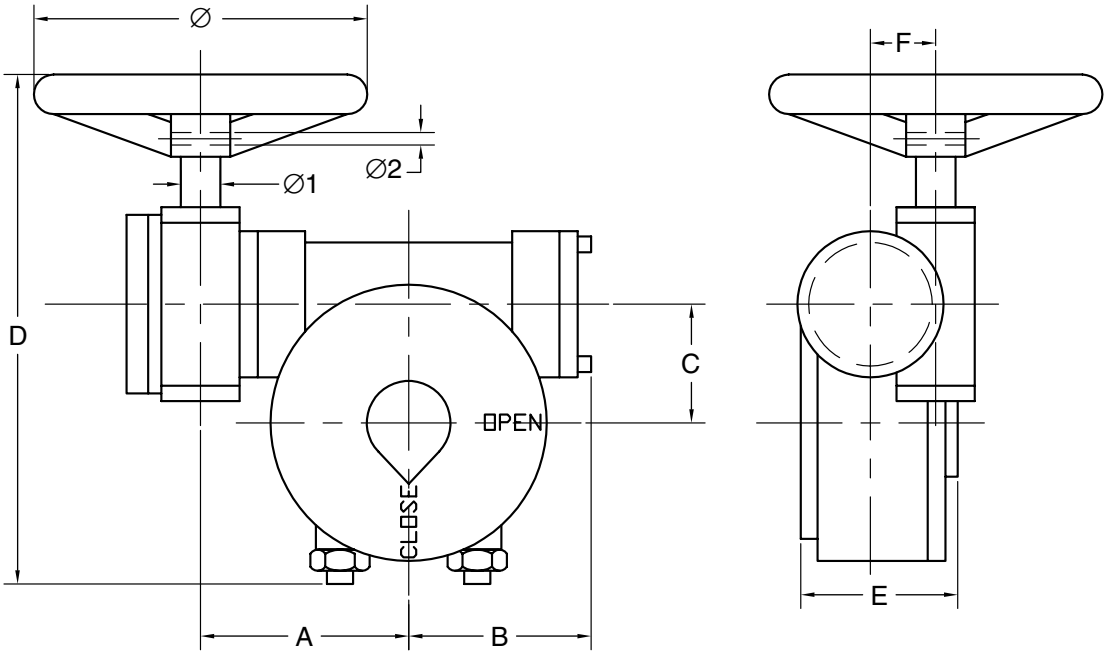
Valve Size		Oper.	A	B	C	D	E	F	∅	∅1	∅2	Wt.
20	in.	XJ300	7.40	6.40	4.40	18.90	4.60	2.50	18.00	0.98	0.32	121.0
500	mm		185.00	160.00	110.00	473.00	115.00	63.00	450.00	25.00	8.00	55.0
24	in.	XJ300	7.40	6.40	5.00	20.00	4.80	2.50	18.00	0.98	0.32	132.0
600	mm		185.00	160.00	125.00	500.00	120.00	63.00	450.00	25.00	8.00	60.0
30	in.	BA800	10.60	6.60	6.40	21.80	5.12	3.12	18.00	0.98	0.32	198.0
750	mm		265.00	165.00	160.00	545.00	128.00	78.00	450.00	25.00	8.00	90.0
32	in.	3D-60	9.72	6.92	6.48	21.20	6.56	3.52	17.40	0.98	0.32	292.6
800	mm	800	243.00	173.00	162.00	530.00	164.00	88.00	435.00	25.00	8.00	133.0
36	in.	3D-120	11.12	8.04	7.84	21.44	10.32	5.04	17.40	0.98	0.32	424.6
900	mm	1200	278.00	201.00	196.00	611.00	258.00	126.00	435.00	25.00	8.00	193.0
42	in.	3D-120	16.72	10.20	9.60	25.56	12.40	5.04	17.40	0.98	0.32	792.0
1050	mm	1500	418.00	255.00	240.00	611.00	310.00	126.00	435.00	25.00	8.00	360.0
48	in.	3D-120	16.72	10.20	9.60	25.56	12.40	5.04	17.40	0.98	0.32	792.0
1200	mm	1500	418.00	255.00	240.00	639.00	310.00	126.00	435.00	25.00	8.00	360.0

XJ30–50–80

Spec. 3.44



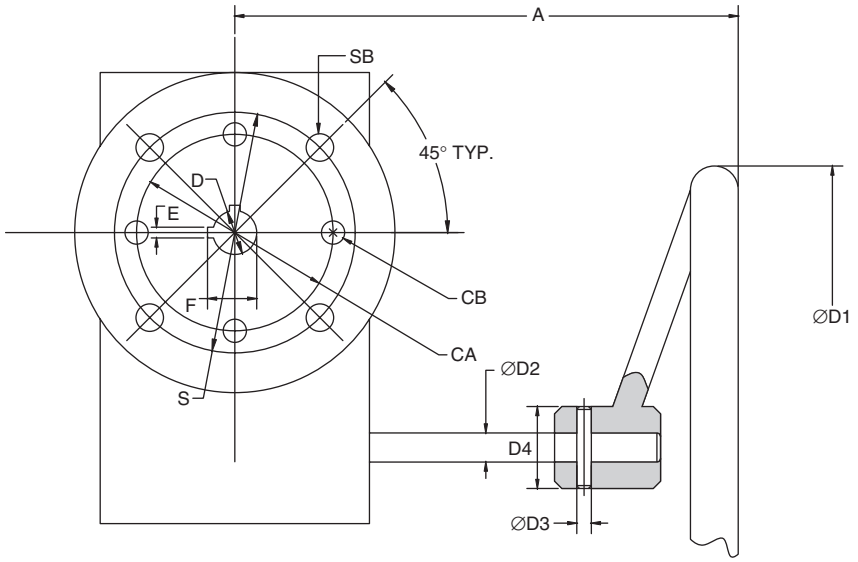
XJ300–BA800–3D-60–3D-120



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Spec. 3.44

Gear Operator Drilling Patterns



Dimensions

Valve Size		Operator Model	CA	CB	SA	SB	D	D1	D2	D3	D4	A	E	F
2	in.	XJ30	2.25		2.76		0.50	11.81	0.75	0.24	1.50	9.37	0.13	0.56
50	mm		57.15	M6-1	70.00	M8-1.25	12.70	300.00	19.00	6.00	38.00	238.00	3.18	14.30
3	in.	XJ30	2.25		2.76		0.50	11.81	0.75	0.24	1.50	9.37	0.13	0.56
75	mm		57.15	M6-1	70.00	M8-1.25	12.70	300.00	19.00	6.00	38.00	238.00	3.18	14.30
4	in.	XJ30	2.75		2.76		0.63	11.81	0.75	0.24	1.50	9.37	0.13	0.72
100	mm		69.85	M8-1.25	70.00	M8-1.25	15.90	300.00	19.00	6.00	38.00	238.00	3.18	18.30
5	in.	XJ30	2.75		2.76		0.75	11.81	0.75	0.24	1.50	9.37	0.13	0.84
125	mm		69.85	M8-1.25	70.00	M8-1.25	19.05	300.00	19.00	6.00	38.00	238.00	3.18	21.40
6	in.	XJ30	2.75		2.76		0.75	11.81	0.75	0.24	1.50	9.37	0.13	0.84
150	mm		69.85	M8-1.25	70.00	M8-1.25	19.05	300.00	19.00	6.00	38.00	238.00	3.18	21.40
8	in.	XJ50	3.50		4.02		0.87	11.81	0.75	0.24	1.50	8.89	0.19	0.97
200	mm		88.90	M12-1.75	102.00	M10-1.5	22.20	300.00	19.00	6.00	38.00	226.00	4.76	24.50
10	in.	XJ50	3.50		4.02		1.13	11.81	0.75	0.24	1.50	8.89	0.25	1.25
250	mm		88.90	M12-1.75	102.00	M10-1.5	28.60	300.00	19.00	6.00	38.00	226.00	6.35	31.80
12	in.	XJ50	4.25		4.02		1.25	11.81	0.75	0.24	1.50	8.89	0.25	1.39
300	mm		107.95	M12-1.75	102.00	M10-1.5	31.80	300.00	19.00	6.00	38.00	226.00	6.35	35.00
14	in.	XJ50	4.25		4.02		1.25	11.81	0.75	0.24	1.50	8.89	0.25	1.39
350	mm		107.95	M12-1.75	102.00	M10-1.5	31.80	300.00	19.00	6.00	38.00	226.00	6.35	35.00
16	in.	XJ80	6.25		6.50		1.31	18.00	0.98	0.32	1.99	10.90	0.31	1.49
400	mm		158.75	M18-2.5	165.00	M20-2.5	33.30	450.00	25.00	8.00	50.00	277.00	7.90	37.30
18	in.	XJ80	6.25		6.50		1.50	18.00	0.98	0.32	1.99	10.90	0.38	1.69
450	mm	(42/44)	158.75	M18-2.5	165.00	M20-2.5	38.10	450.00	25.00	8.00	50.00	277.00	9.53	42.80
18	in.	XJ300	6.25		6.50		1.63	18.00	0.98	0.32	1.99	12.64	0.38	1.81
450	mm	(21/23)	158.75	M18-2.5	165.00	M20-2.5	41.30	450.00	25.00	8.00	50.00	321.00	9.53	46.00
20	in.		6.25		6.50		1.63	18.00	0.98	0.32	1.99	12.64	0.38	1.81
500	mm	XJ300	158.75	M18-2.5	165.00	M20-2.5	41.30	450.00	25.00	8.00	50.00	321.00	9.53	46.00
24	in.	XJ300	8.50		6.50		2.00	18.00	0.98	0.32	1.99	13.19	0.50	2.24
600	mm	(42/44)	215.90	M20-2.5	165.00	M20-2.5	50.80	450.00	25.00	8.00	50.00	335.00	12.70	56.80
24	in.	XJ300	8.50		6.50		2.00	18.00	0.98	0.32	1.99	13.19	0.50	2.24
600	mm	(21/23)	215.90	M20-2.5	165.00	M20-2.5	50.80	450.00	25.00	8.00	50.00	335.00	12.70	56.80

Series 200

1	1	2	3	4	5	6	7	8	9	–	10

1. Size	Code
2"	02
2.5"	25
3"	03
to	
48"	48

2. Series/Style	Code
Wafer (2"-30")	A
Lug (2"-30")	B
Lug/Deadend (2"-30")	C
Flange (36"-48")	D

3. Body	Code
Epoxy Coated CI (A536) (2"-12")	S
Epoxy Coated DI (A536) (2"-12")	V
Cast Iron (2"-30")	1
Ductile Iron (A536)	2
Ductile Iron (A395)	G

4. Pressure	Code
200 PSI (2"-12")	0
75 PSI Undercut	3
150 PSI (14"-42")	6
125 PSI (PTFE seat) (2"-12")	8

5. Disc	Code
Ductile Iron-ENP (2"-12")	2
316 SS	4
Ductile Iron (14"-42")	5
Aluminum Bronze (2"-42")	6
Monel 400	7

6. Shaft	Code
416 SS	1
316 SS*	4
Monel 400	7
17-4 PH	9

*Standard with 316SS Disc only

7. Bushing	Code
Bronze	0
PTFE	3

8. Seat/Liner	Code
Buna-N	1
Abrasion Resistant Buna-N	2
Black Neoprene	3
EPDM	5
Viton (275° F)	6
Hypalon	7
Perox. Cured Buna-N	8
PTFE/Buna-N**	L
Viton (400° F)	P
EPDM (FDA)	V
White Buna-N (FDA)	W
Potable water EPDM	D
White Buna-N	B

** 2½" & 5" PTFE/Buna-N not available

9. Actuator	Code
Handle	2
Infinite/Lockable (2"-6")	3
Infinite (8")	4
Gear Operator	5
Double Acting	6
Fail Close (SR)	7
Fail Open (SR)	8
Electric	9
Gear Operating/Balancing	G
Buried Gear/2" Nut	C
Chain Wheel	U
None	X

10. Special Features	Code
Custom Product	D

*Standard with 316SS Disc only

The nomograph on the opposite page gives the relationships of valve size, flow, velocity, and pressure drop for various disc positions.

Sample Calculation, Liquid (see dark green line on chart)

Given:

Water (1.0 specific gravity) at 60°F is flowing through a 6-inch valve at a rate of 1000 gpm.

Find:

Line velocity (ft./sec.) and pressure drop when valve is in full-open (disc at 90°) position.

Solution:

From the 6-inch valve size at lower left of nomograph, go diagonally up to the intersecting horizontal line for 1000 gpm. From that point, proceed directly down to determine line velocity as 11 ft./sec.

For pressure drop, return to the 1000 gpm intersection and continue up vertically to "90° disc open" intersecting diagonal line. From this point, go horizontally to the left to determine pressure drop as 0.5 psi.

Sample Calculation, Gas (see light green line on chart)

Given:

Gas (0.8 lb/cu. ft. density) is flowing through an 8-inch valve at a rate of 1500 cu. ft./min.

Find:

Line velocity (ft./min.) and pressure drop when valve is in full-open (disc at 90°) position.

Solution:

From 8-inch valve size at lower left of nomograph, go diagonally up to the intersecting horizontal line for 1500 cu. ft./min. From that point, proceed directly down to the bottom line of the nomograph to determine line velocity as 4000 ft./min.

For pressure drop, return to the 1500 cu. ft./min. intersection and continue up vertically to "90° disc open" intersecting diagonal line. From this point, go horizontally to the left to determine pressure drop as 17 psi. Now, convert pressure drop to gas by dividing gas density by liquid density and multiplying by 17.

$$\frac{0.8}{62.34} \times 17.0 = 0.22 \text{ psi}$$

General Notes

1. Liquid flow data is based on pressure drop and flow rate with viscosity similar to water at 60° F using flow coefficient.
2. Velocities for liquids with densities similar to water should be less than 16 ft./sec.
3. Nomograph flow rate for gases is in cubic feet per minute (CFM) at flowing conditions. To convert flow rate from standard cubic feet per minute to CFM, use the following formula:

$$\text{CFM} = \frac{(\text{SCFM} \times 14.7) \times (460 + °\text{F})}{(\text{line pressure, psia}) \times 520}$$

4. Gas density in lbs./cu. ft. equals:

$$\frac{\left(\begin{matrix}270 \times \\ \text{line pressure, psia}\end{matrix}\right) \times \left(\begin{matrix}\text{specific gravity of} \\ \text{gas (relative to air)}\end{matrix}\right)}{460 + °\text{F}}$$

Size	Cv at Full-Open
2"	115
2 1/2"	196
3"	302
4"	600
5"	1022
6"	1579
8"	3136
10"	5340
12"	8250
14"	11917
16"	16388
18"	21705
20"	27908
24"	43116
30"	73426

Definitions

C_V = Flow coefficient for valves; expresses flow rate in gallons per minute of 60°F water with 1.0 psi pressure drop across valve.

C_V = $Q\sqrt{\frac{P}{62.4\,\Delta P}}$

K = resistance coefficient.

K = $d\sqrt{\frac{29.9}{C_V}}$

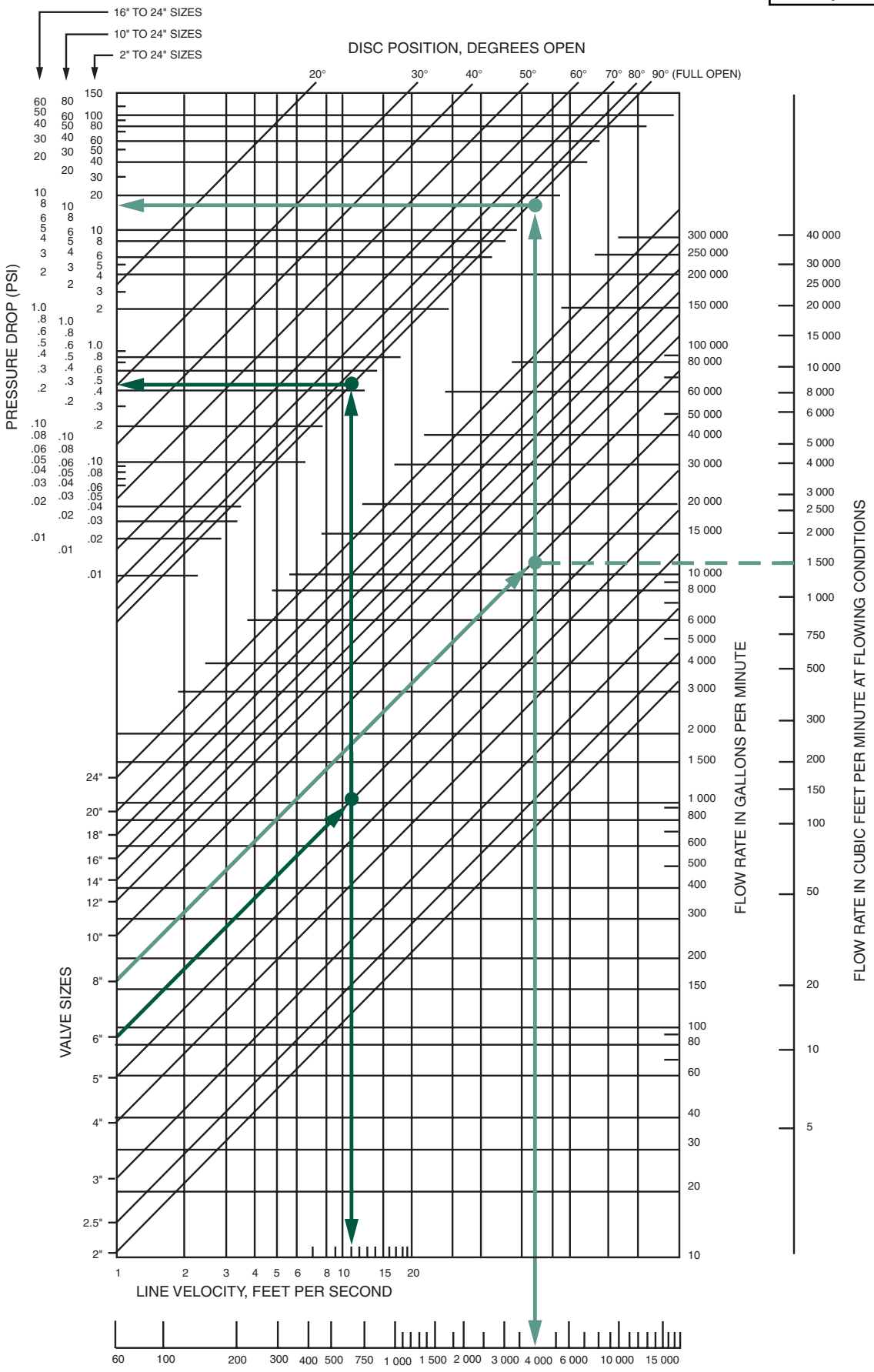
P = weight density of fluid, in pounds per cubic foot.

d = internal diameter of Schedule 40 pipe, in inches.

Q = rate of flow, in gallons per minute.

ΔP = differential pressure, in pounds per square inch gauge.

Spec. 3.44


16" TO 24" SIZES
10" TO 24" SIZES
2" TO 24" SIZES
DISC POSITION, DEGREES OPEN
20° 30° 40° 50° 60° 70° 80° 90° (FULL OPEN)
PRESSURE DROP (PSI)
VALVE SIZES
24" 20" 18" 16" 14" 12" 10" 8" 6" 5" 4" 3" 2.5" 2"
FLOW RATE IN GALLONS PER MINUTE
FLOW RATE IN CUBIC FEET PER MINUTE AT FLOWING CONDITIONS
LINE VELOCITY, FEET PER SECOND
LINE VELOCITY, FEET PER MINUTE

Spec. 3.44

Center Line®

Global Headquarters
9200 New Trails Drive
The Woodlands, Texas 77381-5219
Tel: 281-298-5463
Fax: 281-292-1749

Thomastown, Australia Operations
322 Settlement Road
Thomastown, VIC 3074
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Sydney, Australia Operations
146-154 Dunheved Circuit
St. Mary's, N.S.W. 2760
Sydney, Australia
Tel: +61-29-623-0234
Fax: +61-29-673-3870

W. Sussex UK Operations
Gerrard House, Worthing Road
East Preston, Littlehampton
West Sussex, BN16 1AW
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Fax: +441-903-779222

Ningjin Operations
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Hebei Province, China 055550
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CALGON CARBON CORPORATION	BALL VALVES MATERIAL SPECIFICATION	SPEC NO:
	FORGED BRONZE, BRASS, OR BARSTOCK BRASS BODY REGULAR PORT BALL VALVE	4.03

MATERIAL: Bronze or forged brass or barstock brass body regular port ball valve, blow-out proof stem, ball and seat retainer design to permit valve to be dead ended in either flow direction, bronze or brass ball and stem, PTFE seats and seals (furnish glass fiber reinforced PTFE seats and graphited stem seal if required to meet pressure and temperature rating), wrench handle operated, threaded ends.

RATING: 500 PSIG @ 100 DEG. F.
150 PSIG @ 366 DEG. F.

MANUFACTURER: Grinnell, Powell, Worcester, Clayton Mark-Pacific Valve, Jamesbury, Conbraco Industries, Rockwood, Milwaukee or equal.

SIZES: 1/4" thru 2"

MODELS: Grinnell figure 171N,
Powell "CRESCENT" figure 421OR,
Worcester "WOVCO" 600, Figure No. 5811R,
Clayton Mark-Pacific Valve Figure No. BR-880-I-T,
Jamesbury Figure 351,
Conbraco Industries "APOLLO" 70-100 Series,
Rockwood Figure 105S,
Milwaukee BA-100

GENERAL REQUIREMENTS:

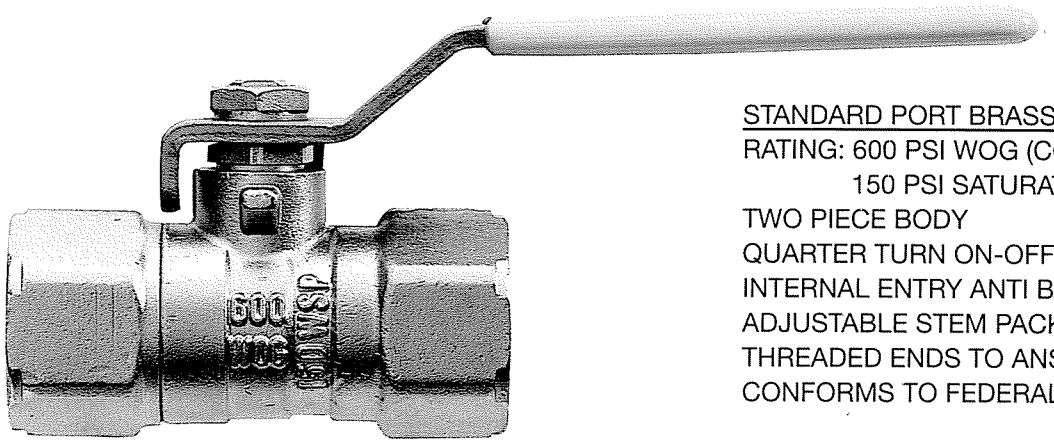
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Issue Date: 01/01/89 Revision Date: 08/14/2003

Approved by Gerald Kirner on 08/14/2003

FORGED BRASS BALL VALVE MODEL NO VRN 5000
STANDARD PORT THREADED ENDS

Spec. 4.03



STANDARD PORT BRASS BALL VALVES
RATING: 600 PSI WOG (COLD- NON SHOCK)
150 PSI SATURATED STEAM
TWO PIECE BODY
QUARTER TURN ON-OFF
INTERNAL ENTRY ANTI BLOW-OUT STEM
ADJUSTABLE STEM PACKING GLAND
THREADED ENDS TO ANSI B 2.1
CONFORMS TO FEDERAL SPEC WWV-35B

SIZE	PART NUMBER	A	B	C	D	E	F	CV *	WT LBS
1/4"	50500 A	.29	1.74	.87	.66	2.62	1.25	7.3	.18
3/8"	50500 B	.29	1.80	.95	.82	2.62	1.25	6.9	.22
1/2"	50500 C	.39	2.38	1.19	.98	3.75	1.60	10	.41
3/4"	50500 D	.55	2.52	1.26	1.22	3.75	1.62	20	.55
1"	50500 E	.75	3.00	1.50	1.53	4.50	2.05	32	1.00
1" 1/4	50500 F	.95	3.38	1.69	1.89	4.50	2.16	48	1.84
1" 1/2	50500 G	1.18	3.70	1.85	2.12	6.00	2.87	80	2.07
2"	50500 H	1.50	4.36	2.18	2.63	6.00	2.87	135	3.10

CV *= GALLONS OF WATER PER MINUTE THROUGH THE VALVE WITH A I PSI PRESSURE DROP

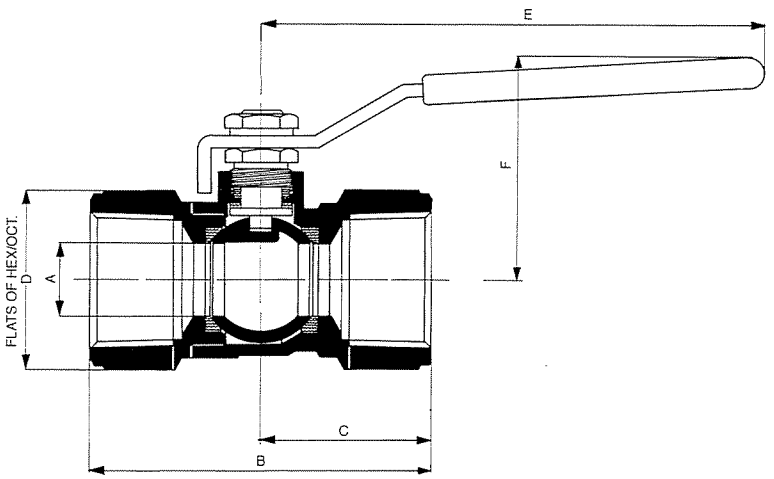
RATING 500WOG

2" 1/2	50500 J	1.85	5.35	2.68	3.38	6.90	3.60	310	6.03
3"	50500 K	2.44	6.14	3.07	3.94	8.50	4.00	420	9.58

RATING 250WOG

4"	50500 L	3.00	7.00	3.50	5.00	9.25	5.00	810	15.60

UL LISTED
1/4" - 2" SIZE



CALGON CARBON CORPORATION	BALL VALVES MATERIAL SPECIFICATION	SPEC NO:
	STAINLESS STEEL AND ENTRY FULL BORE BALL VALVE	4.08

MATERIAL: Stainless steel and entry full bore ball valve 1/2" thru 4" size (Reduced Port for 6" & 8" Acceptable) with blow-out proof stem and seat retainer design to permit valve to be dead ended in either flow direction. Valve has lockable feature to lock the valve in either the open or shut position. Type 316 stainless steel body, ball and stem, TFE seats and seals, wrench operated, 150 lb. ANSI B16.5 flanged ends, raised face, 1/2" thru 4" size Face-to-face dimensions to conform to ANSI B16.10 for steel gate valves. Screwed body inserts not acceptable. Gear Operator for 6" and 8" size valves. No asbestos allowed.

RATING: 275 PSIG @ 100 DEG. F. or 110 PSIG @ 353 DEG. F.

MANUFACTURER: Modentic VL-11, Sharpe Valve #50116-R, or equal

SIZES: 1/2" thru 8"

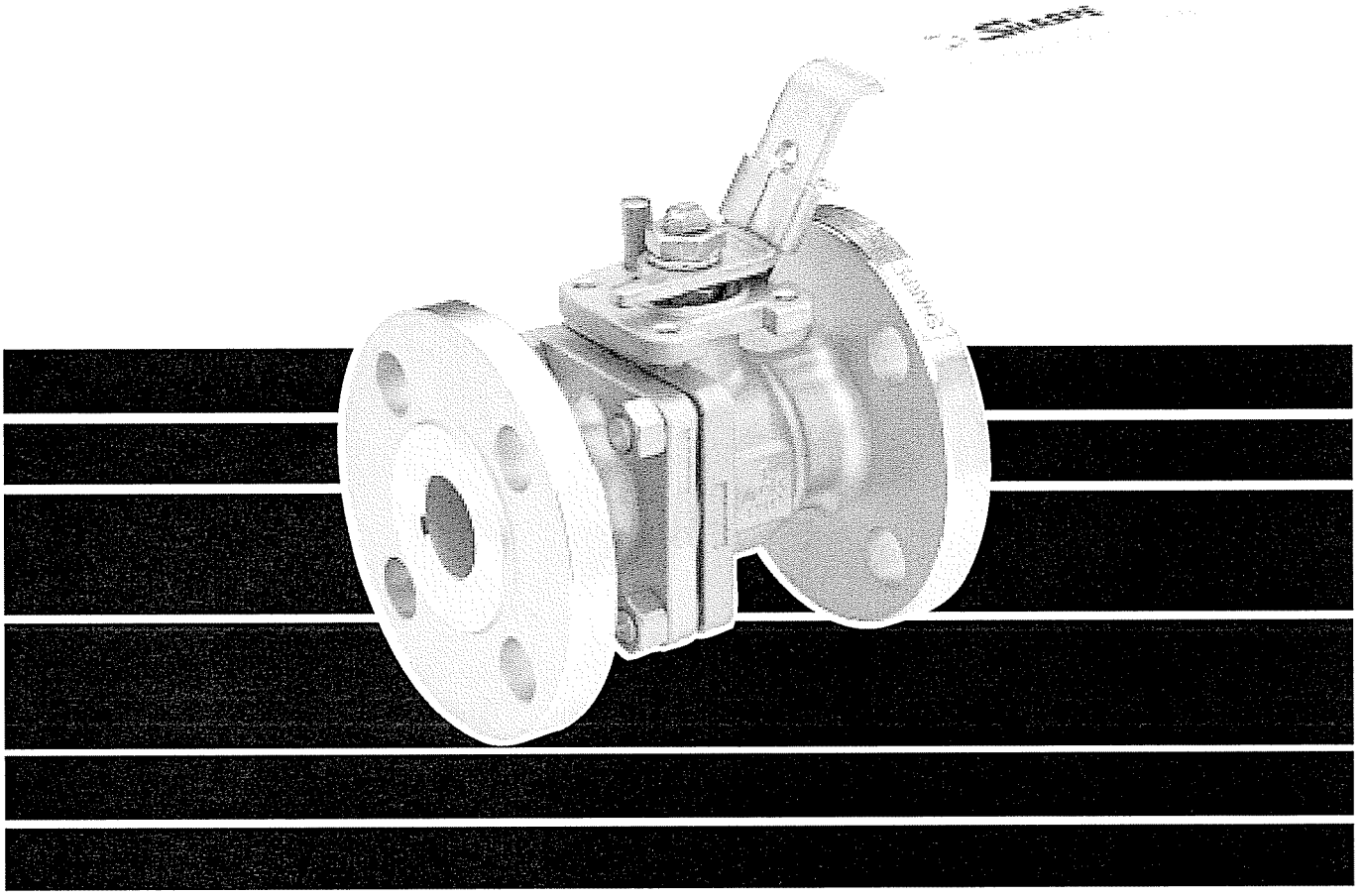
MODELS: Modentic Figure No. VL-11-150 , Figure No. BV-150, or equal.

Issue Date: 01/01/89 Revision Date: 09/15/99

Approved by Joseph P. McMahon on 07/17/2001

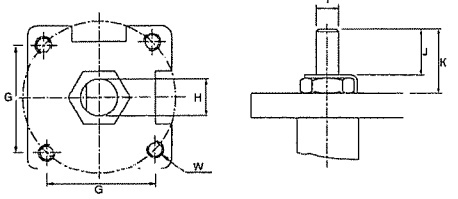
Spec. 4.08

SHARPE® VALVES

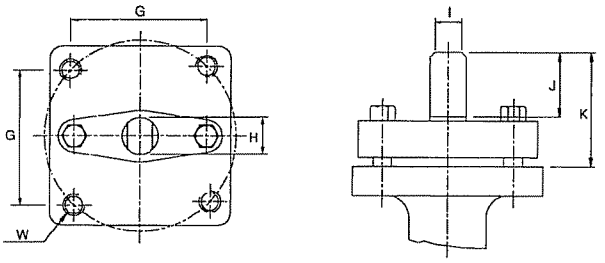


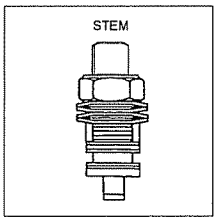
FLANGED FULL PORT BALL VALVE SERIES 50 / CLASS 150

1/2" - 4"



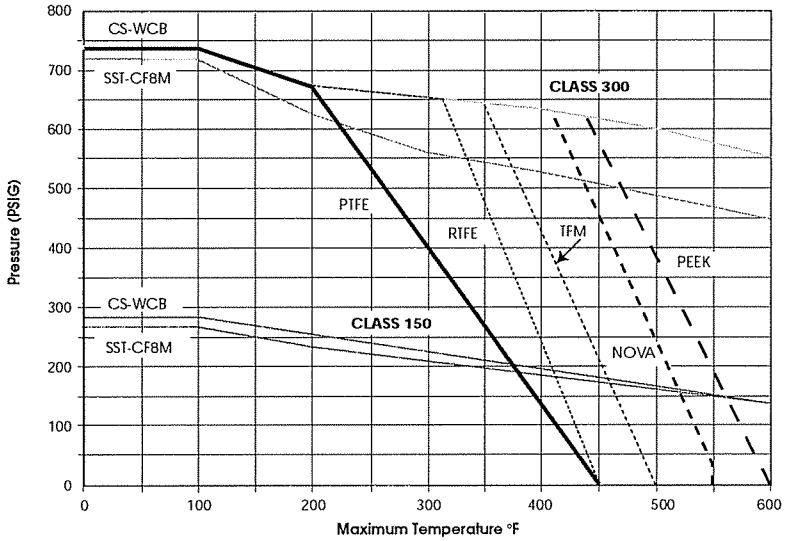
6" - 8"





1/2" - 4"
STEM ARRANGEMENT
FOR ACTUATORS

SEAT PRESSURE/TEMPERATURE RATING SERIES 50



HOW TO ORDER

VALVE SIZE	VALVE SERIES	CLASS	ALLOY	SEATS	OPTIONS
1/2" 3/4" 1" 1-1/2" 2" 2-1/2" 3" 4" 6" 8"	50	150# = 11	2 = Alloy 20 4 = Carbon Steel 6 = Stainless Steel 5 = Hastelloy C 3 = Monel	T = TFE R = RTFE N = NOVA P = Peek M = TFM™	X = Oxygen Service OH = Oval Handle F = Fugitive Emissions Certified ANSI 593 00 01 E = Extended Stem L = Lockable Extended Stem D = Leak detection Stem GO = Gear Operator 7 = 17- 4PH Stem A = Nace

3/4" 50 11 6 T X

SHARPE® VALVES
A DIVISION OF Sharon Piping & Equipment, Inc.

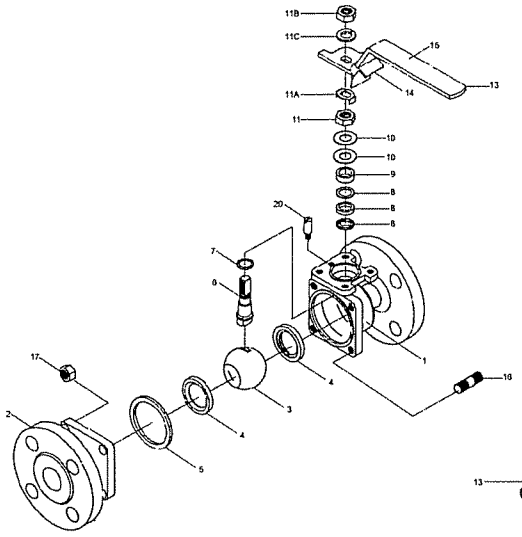
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www.sharpevalves.com

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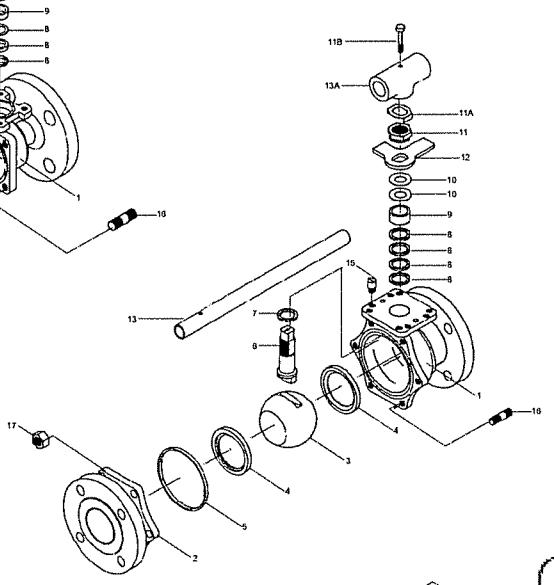
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CLASS 150
BLOW OUT PROOF STEM LOCKING DEVICE

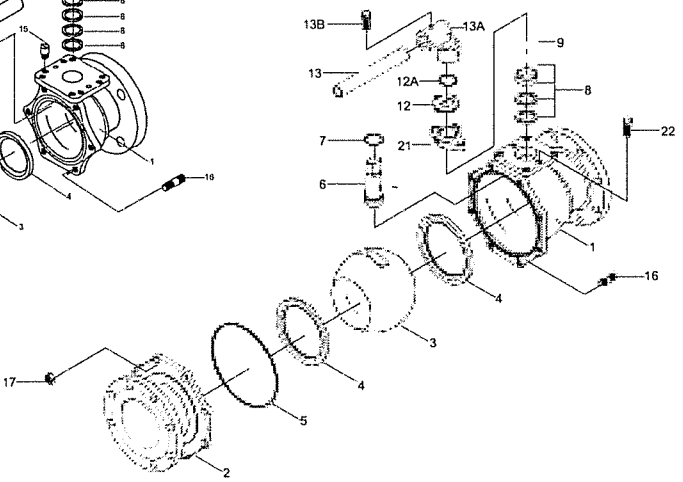
APPLICABLE STANDARDS	
Wall Thickness	ASME B 16.34
Face to Face Dimensions	ASME B 16.10
Flange Dimensions	ASME B 16.5
Pressure Tests	ASME B 16.34 API 598 (Optional)
Basic Design	ASME B16.34



1/2" - 2"



2-1/2" - 4"



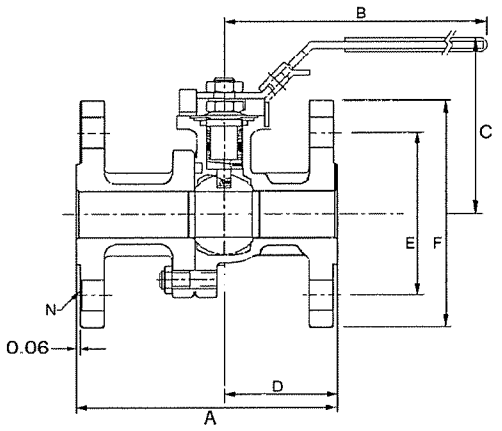
6" - 8"

PART NO.	PART	QTY.	MATERIAL
1	Body	1	316 Stainless Steel ASTM A351 CF8M Alloy 20 ASTM A351 CN7M Carbon Steel ASTM A216 WCB Hastelloy C ASTM A494 GR CW-12MW Monel ASTM A494 GR M35-1
2	End Connector	1	316 Stainless Steel ASTM A351 CF8M Alloy 20 ASTM A351 CN7M Carbon Steel ASTM A216 WCB Hastelloy C ASTM A494 GR CW-12MW Monel ASTM A494 GR M35-1
3	Ball	1	316 Stainless Steel Alloy 20 Hastelloy C
4	Seat	2	TFM(Super TFE) TFE Reinforced TFE NOVA PEEK
5	Body Seal	1	TFE
6	Stem	1	316 Stainless Steel Alloy 20 Hastelloy C 17-4PH (Option)
7	Thrust Bearing	2	Reinforced TFE
8	Stem Packing	3/4	Reinforced TFE
9	Gland Packing	1	304 Stainless Steel
10	Belleville Washer (1/2"-4")	2/4	304 Stainless Steel
11	Packing Nut (1/2"-4")	1	304 Stainless Steel
11A	Lock Tab	1	Stainless Steel
11B	Handle Nut	1	304 Stainless Steel
11C	Lock Washer	1	304 Stainless Steel (1/2"-2")

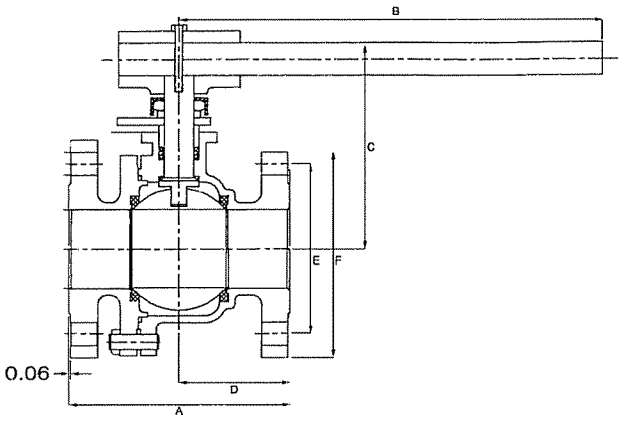
PART NO.	PART	QTY.	MATERIAL
12	Stopper	1	304 Stainless Steel
12A	Snap Ring	1	Stainless Steel (6"-8")
13	Handle	1	304 Stainless Steel (1/2"-2") Galvanized Steel (2-1/2"-4") Ductile Iron (6"-8")
13A	Wrench Block	1	Stainless Steel
13B	Hex Head Bolt	1	304 Stainless Steel
14	Locking Device (1/2"-2")	1	304 Stainless Steel
15	Sleeve	1	Vinyl
16	Body Stud	SEE* A193 B8 (SST) N A193 B7 (CS)	
17	Nut	SEE* A194 8 (SST) N A194 2H (CS)	
20	Stop Pin (1/2"-2") (2-1/2"-4")	1 2	304 Stainless Steel 304 Stainless Steel
21	Gland Flange (6"-8")	1	304 Stainless Steel
22	Gland Bolts (6"-8")	2	304 Stainless Steel

*See Dimensions

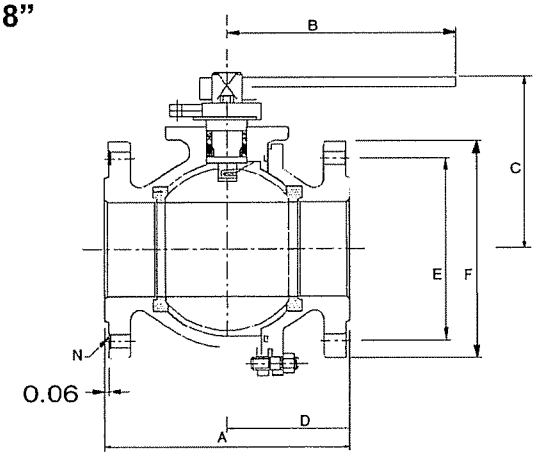
1/2" - 2"



2-1/2" - 4"



6" - 8"



CV DATA	
1/2"	26
3/4"	50
1"	94
1-1/2"	260
2"	480
2-1/2"	750
3"	1300
4"	2300
6"	5400
8"	10000

PORT	
1/2"	0 59
3/4"	0.78
1"	1.00
1-1/2"	1.50
2"	2.00
2-1/2"	2.55
3"	3.00
4"	4.00
6"	6.00
8"	7.88

WEIGHT (lbs.)	
1/2"	4
3/4"	6
1"	8
1-1/2"	15
2"	20
2-1/2"	36
3"	45
4"	75
6"	135
8"	290

SIZE	A	B	C	D	E	F	N	G	H	I	J	K	W
1/2"	4.25	4.75	3.60	1.80	2.38	3.50	4	1.39	3/8-24 UNF	.22	.28	.63	M5
3/4"	4.62	4.75	3.75	2.00	2.75	3.85	4	1.39	3/8-24 UNF	.22	.28	.63	M5
1"	5.00	6.22	3.75	2.12	3.13	4.25	4	1.39	7/16-20 UNF	.30	.30	.90	M6
1-1/2"	6.50	9.00	4.50	2.76	3.56	5.00	4	1.94	9/16-18 UNF	.35	.42	1.18	M8
2"	7.00	9.00	4.80	3.08	4.75	6.00	4	1.94	9/16-18 UNF	.35	.42	1.18	M8
2-1/2"	7.50	13.75	6.70	3.09	5.50	7.00	4	2.84	M20	.55	.55	1.83	M10
3"	8.00	13.75	7.00	3.74	6.00	7.48	4	2.84	1-14 UNS	.745	.66	1.83	M10
4"	9.00	13.75	7.70	4.46	7.50	9.01	8	2.84	1-14 UNS	.745	.66	1.83	M10
6"	15.50	38.97	11.22	7.61	9.50	10.98	8	3.89	1.02	1.64	1.46	3.00	M12
8"	18.00	38.97	11.57	8.34	11.75	13.50	8	4.59	1.02	1.64	1.46	3.00	M12

CALGON CARBON CORPORATION	BALL VALVES MATERIAL SPECIFICATION	SPEC NO:
	STAINLESS STEEL END ENTRY REGULAR PORT BALL VALVE	4.57

MATERIAL: Stainless steel end entry regular port ball valve with blowout proof stem and seat retainer design to permit valve to be dead ended in either flow direction. ASTM A-296, Grade CF8M Type 316 stainless steel body, ball and stem, TFE seats and seals, wrench operated, threaded ends. Screwed body inserts or tail pieces not acceptable.

RATING: 80 PSIG @ 400 DEG. F. or 1500 PSIG @ 150 DEG. F.

MANUFACTURER: Modentic, Sharpe Valve #54576, Jamesbury, or equal.

SIZES: 1/4" thru 2"

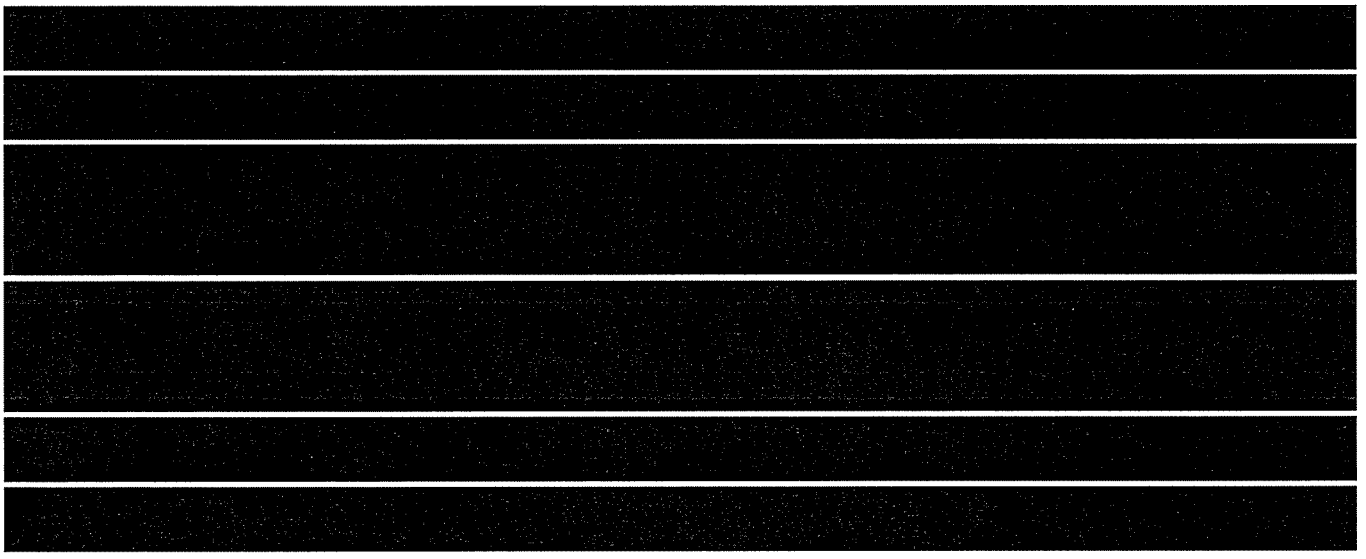
MODELS: Modentic Figure No. V-008, Jamesbury Bulletin 210, Trueline - N600LL, or equal

Issue Date: 01/01/89 Revision Date: 09/15/99

Approved by Joseph P. McMahon on 07/17/2001

Spec. 4.57

SHARPE® VALVES

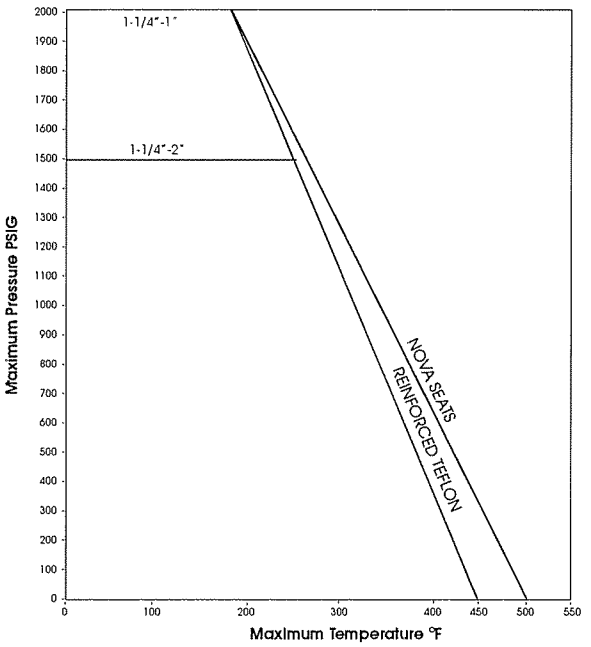


SERIES 5457
THREADED STANDARD PORT BALL VALVE

SHARPE® VALVES

Spec. 4.57

PRESSURE TEMPERATURE RATINGS



HOW TO ORDER

VALVE SIZE	VALVE SERIES	BODY & ENDS	SEAT & SEAL
1/4" 3/8" 1/2" 3/4" 1" 1-1/4" 1-1/2" 2"	5457	4 = Carbon Steel 6 = Stainless Steel	RT Seats PTFE Seals as Standard N = Nova Seats/ Graphoil Seal

3/4" **5457** **4** **N**

Sharon PIPING & EQPT., INC.

Toll-Free 1-877-7SHARPE
Web Site: www.sharpevalves.com

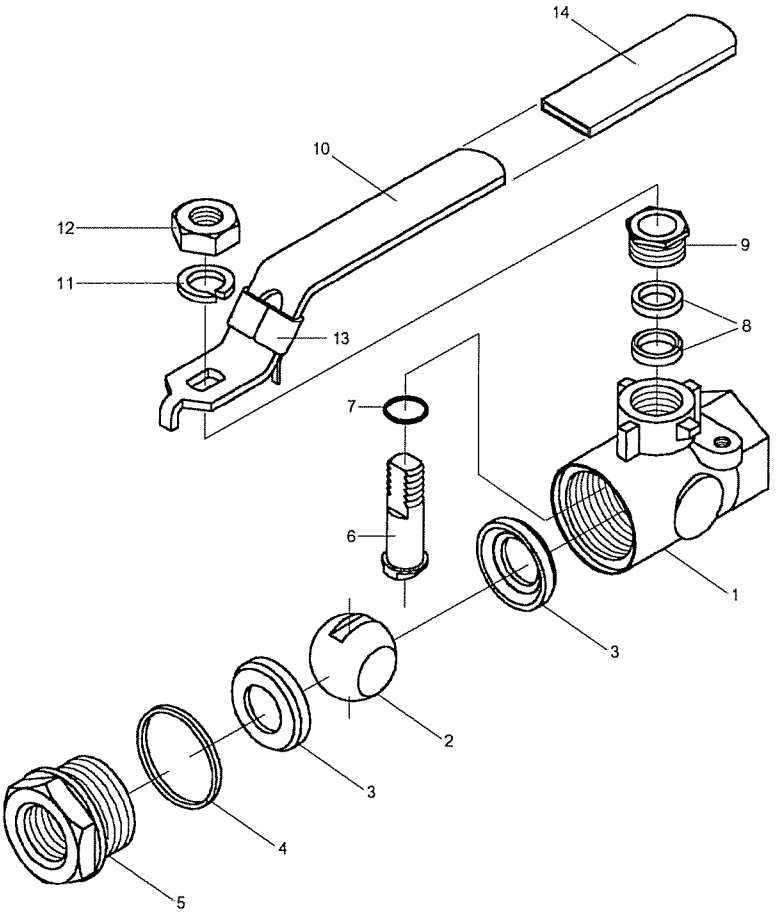
1260 Garnet Drive
Northlake, Illinois 60164 U.S.A

Due to continuous development of our product range we reserve the right to change the dimensions and information contained in the leaflet as required.

SERIES 5457
VALVE PARTS AND IDENTIFICATION

Spec. 4.57

ASTM-A216
ASTM-A351
1/4" - 1" 2000 lb. WOG
1-1/4" - 2" 1500 lb. WOG
LOCKING DEVICE
ACTUATOR MOUNTING PAD
STANDARD PORT
BLOWOUT PROOF STEM
STEAM RATINGS: (SATURATED)
WITH REINFORCED TEFLON
SEATS 150 WSP
WITH NOVA SEATS 250 WSP

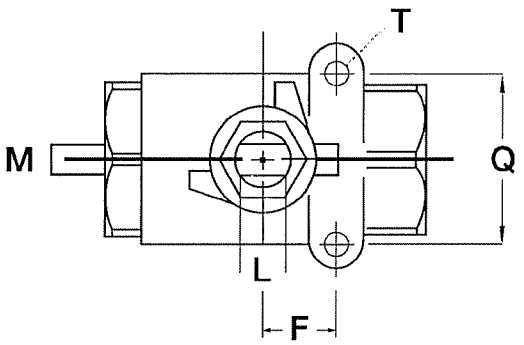


PART NO.	PART	QTY.	MATERIAL
1	Body	1	ASTM-A216 WCB ASTM-A351 CF8M
2	Ball	1	316 Stainless Steel
3	Seat	2	RPTFE / NOVA
4	Body Seal	1	PTFE / Graphite
5	End Plug	1	ASTM-A216 WCB ASTM-A351 CF8M
6	Stem	1	316 Stainless Steel
7	Thrust Washer	1	PTFE
8	Stem Packing	2	PTFE / Grapholl
9	Packing Nut	1	Stainless Steel - 316
10	Handle	1	Stainless Steel - 304
11	Lock Washer	1	Stainless Steel - 304
12	Handle Nut	1	Stainless Steel - 304
13	Locking Device	1	Stainless Steel - 304
14	Handle Sleeve	1	Plastic

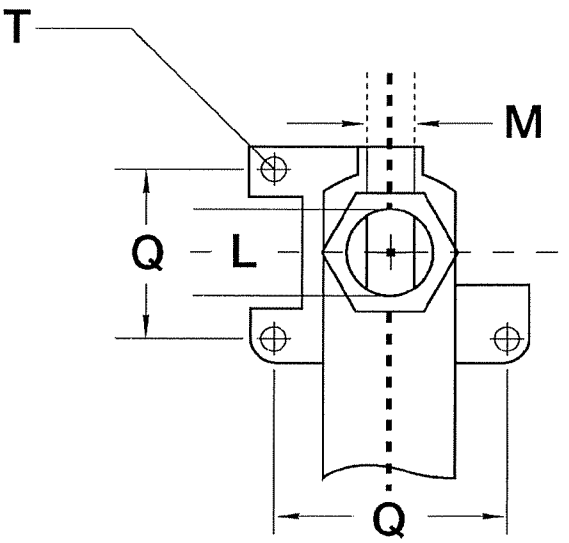
SERIES 5457
VALVE DIMENSIONS

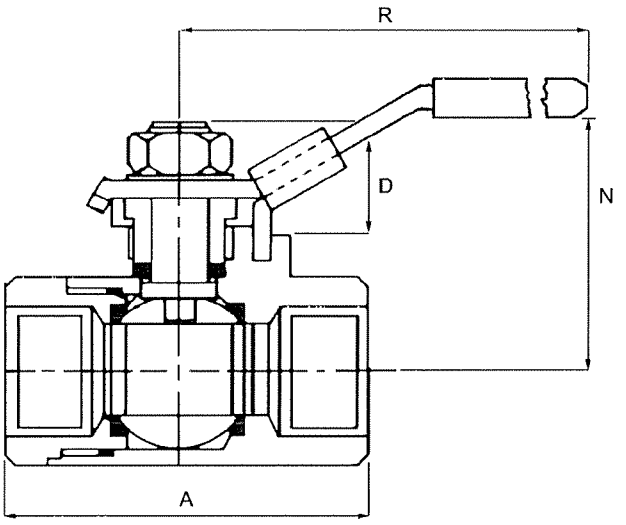
Spec. 4.57

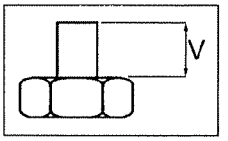
1/4" - 1"



1-1/4" - 2"







1/4" - 2"
STEM ARRANGEMENT
FOR SERIES 5457

SIZE	A	D	N	R	Q	F	M	L	T	V	PORT SIZE	APPROX. WEIGHT
1/4"	2.25	0.95	1.75	4.00	1.10	0.45	0.22	0.30	10 - 24	0.30	0.50	0.60
3/8"	2.25	0.95	1.75	4.00	1.10	0.45	0.22	0.30	10 - 24	0.30	0.50	0.60
1/2"	2.32	1.12	2.00	4.00	1.10	0.45	0.22	0.30	10 - 24	0.32	0.50	0.55
3/4"	3.12	1.20	2.20	5.00	1.35	0.85	0.25	0.42	10 - 24	0.35	0.70	1.10
1"	3.37	1.20	2.45	5.00	1.35	0.85	0.25	0.42	10 - 24	0.35	0.88	1.50
1-1/4"	4.10	1.06	3.40	5.75	1.40*	---	0.37	0.61	1/4 - 20	0.50	1.00	2.75
1-1/2"	4.35	1.10	3.40	5.75	1.40*	---	0.37	0.61	1/4 - 20	0.50	1.25	3.50
2"	5.40	1.10	3.75	5.75	1.40*	---	0.37	0.61	1/4 - 20	0.50	1.50	5.25

CV* DATA

1/4"	6
3/8"	6
1/2"	9
3/4"	24
1"	35
1-1/4"	47
1-1/2"	81
2"	105

***CV:** The volume of water in gal./min. that will pass through a given valve with a pressure drop of 1 PSI.

CALGON CARBON CORPORATION	STEAM TRAPS, DRAINERS, AIR ELIMINATORS MATERIAL SPECIFICATION	SPEC NO:
	AUTOMATIC AIR VENT AND VACUUM BREAKER	21.94

MATERIAL:
Automatic Air Vent and Vacuum Breaker. Cast iron body with stainless steel float, brass and stainless steel trim, female NPT threaded inlet and outlet.

MANUFACTURER:
Multiplex Manufacturing Company, 600 Fowler Ave., Berwick, Pa. 18603, or equal.

SIZES:

SIZES	MODEL NO.	ORIFICE DIAMETER	WORKING PRESSURE
1"	U-10	3/16"	0-125 PSIG
1"	U-10	5/32"	0-200 PSIG
1"	U-10	1/8"	0-250 PSIG
1"	U-10	3/32"	0-300 PSIG
2"	U-20	1/4"	0-165 PSIG
2"	U-20	3/16"	0-250 PSIG
2"	U-20	1/8"	0-300 PSIG
3"	U-30	1/8"	0-300 PSIG
4"	U-40	1/8"	0-300 PSIG

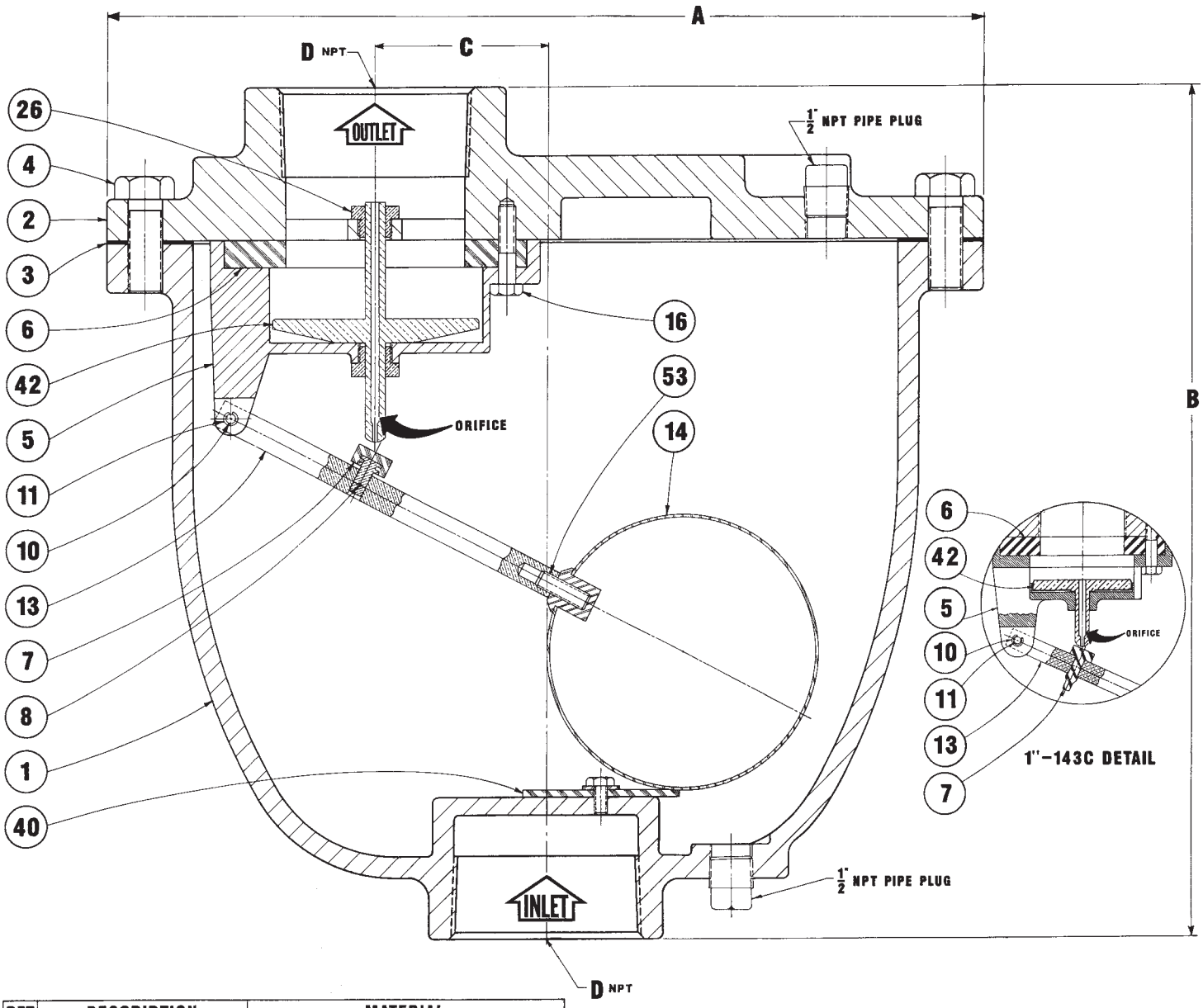
MODELS: Crispin Universal Air Valve, or equal.

Issue Date: 01/01/89 Revision Date: 06/25/90

Approved by Matthew R. McGowan on 07/24/2000

COMBINATION AIR VALVE

Spec. 21.94



DET	DESCRIPTION	MATERIAL
1	BODY	CAST IRON ASTM A126 GR. B
2	COVER	CAST IRON ASTM A126 GR. B
3	COVER GASKET	LEXIDE (non-asbestos)
4	COVER BOLTS	STEEL ASTM A307 GR. B
5	LEVERAGE FRAME[1]	CAST IRON ASTM A126 GR. B
6	SEAT	BUNA-N
7	NEEDLE	BUNA-N
8	NEEDLE PIN[2]	STAINLESS STEEL ASTM A581 T416 H.T.
10	LEVER PIN	STAINLESS STEEL ASTM A581 T303
11	RETAINING RING	STAINLESS STEEL PH15-7Mo
13	FLOAT LEVER	BRASS ASTM B16
14	FLOAT	STAINLESS STEEL ASTM A240 T304
16	LEVERAGE FRAME SCREW	STAINLESS STEEL 18-8
26	GUIDE BUSHING	BRASS ASTM B16
40	BUMPER ASSEMBLY	BUNA-N
42	PLUG	BRASS ASTM B124
53	FLOAT RETAINING SCREW	STAINLESS STEEL 18-8

1 STANDARD MATERIAL ON SIZE 1" AND 2" IS DELRIN ASTM D2133 AND GUIDE BUSHING IS NOT REQUIRED ON THE FRAME.
2 NEEDLE PIN IS NOT REQUIRED ON SIZES 1" AND 2".

AVAILABLE WITH 125 LB. OR 250 LB. FLANGE INLET
SPECIFY WORKING PRESSURE_____PSI
DESIGN FOR 300 PSI MAX. NON-SHOCK SERVICE

SIZES	MODEL No	A	B	C	D	WIDTH	LARGE ORIFICE	SMALL ORIFICE	APPROX. WT., LB.
1"	143C	11	10	$2\frac{1}{2}$	1	7	1	$\frac{5}{64}$	35
2"	145C	14	$12\frac{3}{16}$	3	2	8	2	$\frac{3}{32}$	75
3"	147C	16	$15\frac{7}{16}$	$3\frac{1}{8}$	3	10	3	$\frac{3}{32}$	100
4"	149C	18	$17\frac{1}{16}$	$3\frac{3}{4}$	4	11	4	$\frac{3}{32}$	170

CERTIFIED BY: _____

DATE: _____

DATE
09-01-03

APCO Willamette
VALVE AND PRIMER CORPORATION

DRWG. NO.
S-140C

SPECIFICATIONS OTHER SIDE

September 1, 2003

Spec. 21.94

SPECIFICATIONS

SERIES 140C COMBINATION AIR VALVES

Combination Air Valve (single body, double orifice) allows large volumes of air to escape out the larger diameter air vacuum orifice when filling a pipeline and closes water tight when the liquid enters the valve. During large orifice closure, the smaller diameter air release orifice will open to allow small pockets of air to escape automatically and independently of the large orifice.

The large air & vacuum orifice shall also allow large volumes of air to enter through the orifice during pipeline drainage to break the vacuum. The body inlet must be baffled to protect the lower float from direct contact of the rushing air and water to prevent premature valve shut-off. The top large orifice plug must be protected in similar manner for the same purpose.

The Buna-N seat must be fastened to the valve cover without distortion, for drop tight shut-off. The float shall be heavy stainless steel, hermetically sealed, designed to withstand a minimum of 1000 psi (static). The top plug shall be center guided thru hex bushings for positive shut-off.

Valve exterior to be painted Universal Primer for high resistance to corrosion.

The cross sectional area of the discharge orifice must be equal to the cross sectional area of the valve inlet size.

All materials of construction shall be certified in writing to conform to A.S.T.M. specifications as follows:

Body & Cover	Cast iron	ASTM A126 Gr.B
Float*	Stainless Steel	ASTM A240 T304
Needle & Seat	Buna-N	
Plug	Brass	ASTM B124
Leverage Frame [1”&2”]	Delrin	ASTM D4181
[3”&4”]	Cast iron	ASTM A126 Gr. B

*** Float design may vary on certain sizes**

Note: Other materials available.

Valve to be APCO Series 140C Combination Air Valve, as maunufactured by Valve & Primer Corporation, Schaumburg, Illinois, U.S.A.

APCO Willamette
VALVE AND PRIMER CORPORATION

1420 S. Wright BLVD. Schaumburg, IL 60193-4599
847-524-9000 FAX 847-524-9007 800-323-6969
WEBSITE: www.apcovalves.com EMAIL: factory@apcovalves.com

CALGON CARBON CORPORATION	STRAINERS MATERIAL SPECIFICATION	SPEC NO:
	SAMPLE PORT SEPTUM, TYPE 316 STAINLESS STEEL	22.27

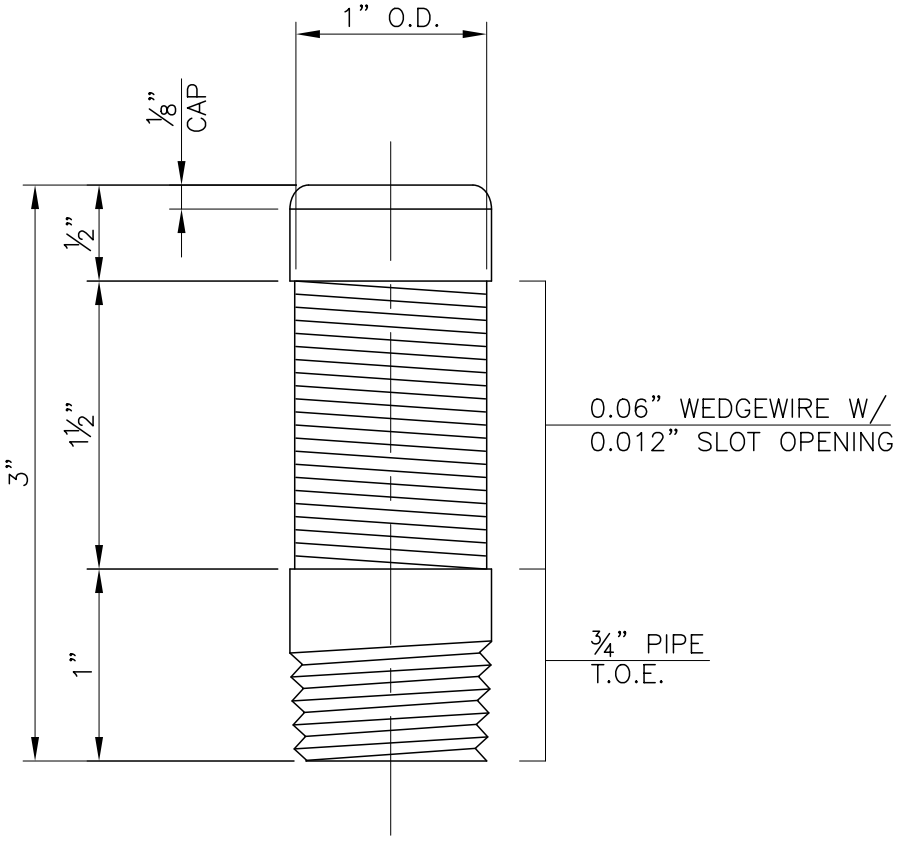
MATERIAL: Sample port septum, Type 316 stainless steel, 0.060" wedge wire with 0.012" slot openings. Septum to be 1".O.D. x 1-1/2" long with 3/4" MNPT end fitting 1" long, TOL 2-3/4".

MANUFACTURER: Johnson Division - UOP Co., Orthos or approved equal.

Issue Date: 04/06/90 Revision Date: 07/14/93

Approved by Matthew R. McGowan on 06/11/99

Spec. 22.27



MATERIAL: 316 STAINLESS STEEL

REV	DESCRIPTION	APP	DATE
0			10-3-07

REVISIONS

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	NAME	DATE
DRAFTER	JFS	5-12-05
DESIGNER		
CHECKER		
APPROVAL		
PROJECT No.	STANDARD	

CALGON

CALGON CARBON CORPORATION

CLIENT

TITLE

SAMPLE PORT
SEPTA DETAIL
CCC SPEC.: 22.27

DWG. Size	SHEET No.	SCALE
A	1 OF 1	NONE

DWG. No. 90-07-0014 REV. 0

V:\Products\Septa\90070014 Spec 22.27.dwg Oct 09, 2007 - 8:24am

CALGON CARBON CORPORATION	STRAINERS MATERIAL SPECIFICATION	SPEC NO:
	BASKET STRAINER, TYPE 316 STAINLESS STEEL	22.53

MATERIAL: Perforated basket strainer (Carbon Retainer) for 150 lb. Raised Face Flanges, type 316 stainless steel construction. Basket is to be Fabricated from 14 Gage 316 stainless steel with 1/8" holes drilled on 3/16" centers and covered with 40 mesh 316 stainless steel screen, this will then be covered by a 4 mesh 316 stainless steel support screen (0.063" wire diameter).

RATING: Support Screen is to be designed for 125 PSIG if plugged in forward or reverse flow.

MANUFACTURER: Mack Iron Works Company, or equal.

SIZES: 2" thru 12"

MODELS: Mack Iron Works Company Series PB-R/FF, Style PBL or equal.

Issue Date: 01/01/90 Revision Date: 08/23/90

Approved by Matthew R. McGowan on 06/16/99

CALGON CARBON CORPORATION	EXPANSION JOINTS MATERIAL SPECIFICATION	SPEC NO:
	RUBBER EXPANSION JOINT, DOUBLE ARCH TYPE	24.06

MATERIAL: Rubber expansion joint, double arch type, molded neoprene reinforced with multiple plies of nylon. Joint allows 4 way movement and 30 DEG. angular misalignment. Has loose steel backing flanges to be galvanized or zinc plated, 150 # drilling. No gaskets required. Control unit assemblies for pressures specified as 135 psi or greater.

RATING: 225 psi @ 170 DEG. F.

MANUFACTURER: Dynex, Inc., Proco Products, Inc., or Approved Equal.

SIZES: 1" thru 12"

MODELS: Dynex Series 702, Proco Products, Inc., Model 242-A-NN-4, with "blue" I.D. label or Approved Equal.

Issue Date: 01/01/89 Revision Date: 08/30/99

Approved by Matthew R. McGowan on 08/30/99

PROCO™

Spec. 24.06

SERIES 240/242

molded expansion joints



PROCO Series 240 and Series 242 Non-Metallic Expansion Joints are designed for tough demanding industrial applications as found in: Air Conditioning-Heating and Ventilating Systems, Chemical-Petrochemical and Industrial Process Piping Systems, Power Generating Systems, Marine Services, Pulp & Paper Systems, Water-Waste-water-Sewage and Pollution Control Systems. Installed next to mechanical equipment or between the anchor points of a piping system, specify the PROCO Series 240 or 242 to: (1) Absorb Pipe/Movement/Stress, (2) Reduce System Noise, (3) Isolate Vibration, (4) Compensate Alignment/Offset, (5) Eliminate Electrolysis, (6) Protect Against Start-Up/Surge Forces. Our history in the manufacturing of expansion joint products dates back to 1930. When you need an engineered rubber solution to a piping system problem, call PROCO.

Spherical Shapes-Stronger-More Efficient. Featuring an engineered molded style single or twin sphere designed bellows, the PROCO Series 240 and Series 242 are inherently stronger than the conventional hand-built Spool Type arch. Internal pressure within a sphere is exerted in all directions, distributing forces evenly over a larger area The spherical design "flowing-arch" reduces turbulence, sediment buildup, thrust area and the effects of thrust on the piping system equipment when compared to the "high-arch" design of hand-built standard products.

Greater Movements Are Available with the PROCO Series 240 and Series 242 when compared to the movements of conventional hand-built products. Axial compression, elongation, deflection and angular movements in the system are more readily absorbed by spherical types. These products are more forgiving and can be compressed or extended to install in non-standard openings, caused by equipment shifting or settling (Pre-compressing/extending the expansion joints for installation, may result in reduced pressure, vacuum and movement capabilities of the expansion joints. See Tables 2 and 3.)

Easy Installation With Alignable Metallic Flanges. The floating metallic flanges freely rotate on the bellows, compensating for mating flange misalignment, thus speeding up installation time (see Figures 1, 2, 3 & 4). Gaskets are also not required with the Series 240 or Series 242, provided the expansion joints are mated against a flat face flange as required in the installation instructions.

Less System Strain With Thin Wall Design. Manufactured by high pressure molding of elastomer and high-tensile fabric reinforcement, the Series 240 and Series 242 have a thinner wall section and lighter weight when compared to conventional hand-built products. Lower spring forces are therefore required, reducing piping/flange/equipment stress-strain-damage. PROCO Styles 240-C and 240-A are acceptable for use with plastic piping systems where even lower deflection forces are required.

Specifications Met. The PROCO Series 240 and Series 242 are designed to meet or exceed the pressure, movement and dimensional rating of the Spool Type arch as shown in the Rubber Expansion Joint Division, Fluid Sealing Association "Technical Handbook - Sixth Edition" Tables IV & V.

Absorbs Vibration-Noise-Shock. The PROCO quiet operating Series 240 and Series 242 are a replacement for "sound transmitting" metallic expansion joints. Sound loses energy traveling axially through the elastomer bellows. Water hammer pumping impulses and water-borne noises are cushioned and absorbed by the molded lightweight thin-wall structure. Install the Series 240 or Series 242 in a system to enable isolated equipment to move freely on its vibration mountings; or to reduce vibration transmission when the piping section beyond the expansion joint is anchored or sufficiently rigid.

Flange Materials/Drilling. All PROCO Spherical 240 and 242 connectors are furnished complete with plated carbon steel flanges for corrosion protection. Series 240 and 242 Neoprene connectors — 12" and below — are tapped to ANSI 125/150# drilling. All other connectors come with standard drilled holes to the ANSI 125/150# standards (see Table 7 and Figures 3 & 4). Stainless steel flanges and other drilling standards such as: ANSI 250/300#, BS-10, DIN NP-10 and DIN NP-16 are also available from stock and are listed on Table 7. JIS-5K and JIS-10K are also available upon request.

Chemical Service Capability At Minimal Cost. Expensive, exotic metal expansion joints for chemical service can be replaced with the PROCO Series 240 or Series 242. Molded with low cost chemical resistant elastomers such as Neoprene, Nitrile, Hypalon®, EPDM and Chlorobutyl insures an expansion joint is compatible with the fluid being pumped or piped. (See Table 1 below). Use the PROCO "Chemical/Rubber Guide" to specify an elastomer recommendation compatible for your requirement.

Wide Service Range With Low Cost. Engineered to operate up to 300 PSIG and 265°F, the PROCO Series 240 and Series 242 can be specified for a wide range of piping requirements. Compared to conventional hand-built Spool Type arch, you will invest less money when specifying the mass-produced, consistent high quality, molded single or twin sphere expansion joints.

Large Inventories Mean Same-Day Shipment. PROCO maintains the largest inventory of spherical expansion joints in the Americas. Every size listed is in stock in several elastomers and comes with a choice of drilling patterns. Shipment is based on customer need. PROCO can ship same day as order placement. In fact, when it comes to rubber expansion joints, **if PROCO doesn't have your requirement…nobody does!**

Information • Ordering • Pricing • Delivery. Day or night, weekends and holidays … the PROCO phones are monitored 24 hours around the clock. When you have a question, you can call us.

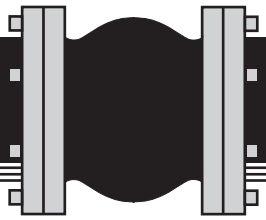
Toll-Free Phone	800 / 344-3246 USA/CANADA
International Calls	209 / 943-6088
Fax	209 / 943-0242
E-mail	sales@procoproducts.com
Website	www.procoproducts.com

Weekday office hours are 5:30 a.m. to 5:15 p.m. (Pacific Time)

Table 1: Available Styles • Materials

For Specific Elastomer Recommendations, See: **PROCO™ "Chemical To Elastomer Guide"**

240-A	240-C	240-AV,D,E,M	242-A,B,C	PROCO™ Material Code [1]	Cover Elastomer [2]	Tube Elastomer	Maximum Operating Temp. °F	Identifying Color Band/Label
		X	X	/BB	Chlorobutyl	Chlorobutyl	250°	Black
	X	X	X	/EE	EPDM	EPDM	250°	Red
	X			/EE-9	EPDM	EPDM	265°	Red
	X			/ET-9 [3]	EPDM	Teflon®	265°	Red
	X			/HH	Hypalon®	Hypalon®	230°	Green
		X	X	/NH	Neoprene	Hypalon®	230°	Green
	X			/NJ	Neoprene	FDA-Nitrile	230°	White
		X	X	/NN	Neoprene	Neoprene	230°	Blue
X	X	X	X	/NP	Neoprene	Nitrile	230°	Yellow
X	X			/NT [3]	Neoprene	Teflon®	230°	



Protecting Piping And Equipment Systems From Stress/Motion

NOTES: Hypalon® is a registered trademark of DuPont Dow Elastomers. Teflon® is a registered trademark of the DuPont Company.

1. All elastomers include nylon reinforcing, except EE-9 which is steel cord.
   All materials meet or exceed the Rubber Expansion Joint Division, Fluid Sealing Association-REJ Division requirements for Standard Class I and II. EE-9 also meets Special Class II. For more information see The FSA Technical Handbook, Table 1.
   Materials NN, NP and NH meet all requirements of U.S.C.G.
   EPDM Materials good for up to 300°F for pressures 15 PSI or less.
2. Expansion joint "cover" (outside) can be Hypalon® painted on special order.
3. Products with Teflon® "tube" (inside) are not to be used for vacuum service.

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Rev. 03 2/04

series 242 twin sphere expansion joints

Table 3: Sizes • Movements • Pressures • Flange Standards • Weights

Spec. 24.06

NOMINAL PIPE Size I.D.	Neutral Length	PROCO Style Number [1]	242 Movement Capability: From Neutral Position [2]					Pressure [4]		Standard Flange Bolting Dimensions					Weight in lbs [8]	
			Axial Compression Inches	Axial Extension Inches	Lateral Deflection Inches	Angular Deflection Degrees	Thrust [3] Factor	Positive [5] PSIG	Vacuum [6] Inches of Hg	Flange O.D. Inches	Bolt Circle Inches	Number of Holes	Size of Holes Inches	Bolt Hole [7] Thread	Exp. Joint & Flanges	Control Unit Set (2 Rod)
1	10.00	242-C	2.000	1.188	1.750	45	4.43	225	26	4.25	3.13	4	0.500	—	5.2	3.6
1.25	**7.0** 7.0 10.00	**242-A** 242-HA 242-C	2.000	1.188	1.750	45	6.34	225 300 225	26	4.63	3.5	4	0.500 0.500 0.500	1/2-13 UNC — —	5.3 6.5 6.2	3.5 3.5 3.6
1.5	6.00 6.00 **7.00** 7.00 10.00	242-B 242-HB **242-A** 242-HA 242-C	2.000	1.188	1.750	45	6.49	225 300 225 300 225	26	5.0	3.88	4	0.500 0.500 0.500 0.500 0.500	— — 1/2-11 UNC — —	6.1 7.6 6.8 8.3 7.7	4.6 4.6 4.8 4.8 5.1
2	6.00 6.00 **7.00** 7.00 10.00	242-B 242-HB **242-A** 242-HA 242-C	2.000	1.188	1.750	45	7.07	225 300 225 300 235	26	6.0	4.75	4	0.625 0.625 0.625 0.625 0.625	— — 5/8-11 UNC — —	9.0 10.5 9.0 10.5 10.2	6.6 6.6 7.0 7.0 7.3
2.5	6.00 6.00 **7.00** 7.00 10.00	242-B 242-HB **242-A** 242-HA 242-C	2.000	1.188	1.750	43	11.05	225 300 225 300 225	26	7.0	5.5	4	0.625 0.625 0.625 0.625 0.625	— — 5/8-11 UNC — —	12.9 15.3 13.3 15.8 14.5	7.6 7.6 8.0 8.0 8.4
3	**7.00** 7.00 9.00 10.00 12.00	**242-A** 242-HA 242-B 242-C 242-C	2.000	1.188	1.750	38	13.36	225 300 225 225 300	26	7.5	6.0	4	0.625 0.625 0.625 0.625 0.625	5/8-11 UNC — — — —	14.3 18.2 15.2 15.8 16.0	8.6 8.6 9.0 9.1 9.9
3.5	10.00	242-C	2.000	1.188	1.750	34	18.67	225	26	8.5	7.0	8	0.625	—	20.6	8.1
4	**9.00** 9.00 10.00 12.00	**242-A** 242-HA 242-C 242-C	2.000	1.375	1.562	34	22.69	225 300 225 225	26	9.0	7.5	8	0.625 0.750 0.750 0.750	5/8-11 UNC — — 3/4-10 UNC	20.3 26.4 21.3 22.0	8.0 8.0 8.2 8.2
5	**9.00** 9.00 10.00 12.00	**242-A** 242-HA 242-C 242-C	2.000	1.375	1.562	29	30.02	225 300 225 225	26	10.0	8.5	8	0.750 0.750 0.750 0.750	— — — —	24.5 31.4 25.5 26.0	8.3 8.3 9.1 9.1
6	**9.00** 9.00 10.00 12.00 14.00	**242-A** 242-HA 242-C 242-C 242-C	2.000	1.375	1.562	25	41.28	225 300 225 225 225	26	11.0	9.5	8	0.750 0.750 0.750 0.750 0.750	3/4-10 UNC — — — —	29.5 38.6 30.5 31.0 32.0	11.7 11.7 11.9 12.0 12.0
8	9.00 9.00 10.00 12.00 **13.00** 13.00 14.00	242-B 242-HB 242-C 242-C **242-A** 242-HA 242-C	2.375	1.375	1.375	19	63.62	225 300 225 225 225 300 225	26	13.5	11.75	8	0.750 0.750 0.750 0.750 0.750 0.750 0.750	— — — — 3/4-10 UNC — —	42.3 55.4 43.4 44.0 43.8 57.5 46.0	14.5 14.5 15.0 15.2 15.4 15.4 16.0
10	12.00 12.00 **13.00** 13.00 14.00	242-B 242-HB **242-A** 242-HA 242-C	2.375	1.375	1.375	15	103.87	225 275 225 275 225	26	16.0	14.25	12	0.875 0.875 0.875 0.875 0.875	— — 7/8-9 UNC — —	64.1 86.5 65.5 88.4 66.7	23.5 23.5 24.5 24.5 24.5
12	12.00 12.00 **13.00** 13.00 14.00	242-B 242-HB **242-A** 242-HA 242-C	2.375	1.375	1.375	13	137.89	225 275 225 275 225	26	19.0	17.00	12	0.875 0.875 0.875 0.875 0.875	— — 7/8-9 UNC — —	94.0 110.0 95.0 110.0 99.1	30.0 30.0 31.0 31.0 31.0
14	12.00 **13.75** 13.75	242-C **242-A** 242-HA	1.750	1.118	1.118	9	182.65	150 150 200	26	19.0	18.75	12	1.000 1.000 1.000	— — —	110.0 112.0 144.0	30.5 32.0 32.0
16	12.00 12.00 **13.75** 13.75	242-C 242-HC **242-A** 242-HA	1.750	1.118	1.118	8	240.53	125 175 125 175	26	23.5	21.25	16	1.000 1.000 1.000 1.000	— — — —	124.0 160.0 132.0 170.2	28.8 28.8 30.8 30.8
18	12.00 **13.75** 13.75	242-C **242-A** 242-HA	1.750	1.118	1.118	7	298.65	125 125 175	26	25.0	22.75	16	1.125 1.125 1.125	— — —	138.0 146.0 181.2	35.1 36.1 36.1
20	12.00 **13.75** 13.75	242-C **242-A** 242-HA	1.750	1.118	1.118	7	363.05	125 125 175	26	27.5	25.0	20	1.125 1.125 1.125	— — —	172.0 182.0 182.0	35.0 35.5 35.5
22	12.00	242-C	1.750	1.118	1.118	6	433.74	115	26	29.5	27.25	20	1.125	—	181.0	35.5
24	12.00 **13.75** 13.75	242-C **242-A** 242-HA	1.750	1.118	1.118	5	510.70	110 110 160	26	32.5	29.5	20	1.125 — 1.125	— — —	190.0 220.0 266.2	47.0 48.0 48.0
26	12.00	242-C	1.750	1.118	1.118	5	593.96	110	26	34.25	31.75	24	1.125	—	243.0	52.0
30	12.00	242-C	1.750	1.118	1.118	4	779.31	110	26	38.75	36.0	28	1.125	—	270.0	62.0

Standard PROCO Style 242-A Expansion Joints shown in Bold Type are considered Standards and inventoried in large quantities.

NOTES:
1. "HA", "HB", and "HC" denote Heavy Weight Construction.
2. Movements stated are non-concurrent.
3. To determine End Thrust: Multiply Thrust Factor by Operating Pressure of System. This is End Thrust in pounds.
4. Pressure rating is based on 170°F operating temperature. The pressure rating is reduced slightly at higher temperatures.
5. Pressures shown are maximum "operating pressure." Test pressure is 1.5 times "operating pressure." Burst pressure is approximately 4 times "operating pressure."
6. Vacuum rating is based on neutral installed length, without external load. Products should not be installed "extended" on vacuum applications.
7. Style 240-AV/NN (Neoprene elastomer only) expansion joints 1.25" I.D. – 12.0" I.D. come with tapped holes in lieu of drilled holes.
8. All expansion joints are furnished complete with flanges. Control units are required on applications where movements could exceed rated capabilities.

Installation Note:
Install at the neutral length dimension as shown in Tables 2 & 3.Make sure the mating flanges are **FLAT-FACE TYPE.** When attaching beaded end flanged expansion joints to raised face flanges, the use of ring gaskets are required to prevent metal flange faces from cutting rubber bead during installation. ***Care must be taken when pushing the joint into the breech between the mating flanges so as not to roll the leading edge of the joint out of its flange groove.***

Precompression Note:
Joint must be precompressed approximately 1/8" to 3/16" in order to obtain a correct installed face-to-face dimension.

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Table 4: Control Units/Unanchored

Control Units must be installed when pressures (test • design • surge • operating) exceed rating below:

Pipe Size	Series 240 P.S.I.G.	Series 242 P.S.I.G.
1" thru 4"	180	135
5" thru 10"	135	135
12" thru 14"	90	90
16" thru 24"	45	45
26" thru 30"	35	35

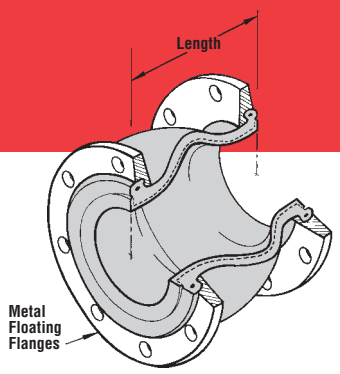


Figure 1.
Style 240
Single Sphere Connector

Table 5: Control Units

Control Rod Plate O.D.[1] (in)	Control Rod Plate Thickness (in)	Rod Diameter[2] (in)	Nominal Pipe Size (in)	Maximum Surge or Test Pressure of System/PSIG[3] Number of Rods Required: 2	3	4
8.375	0.375	0.625	1	949	—	—
8.750	0.375	0.625	1.25	830	—	—
9.125	0.375	0.625	1.5	510	—	—
10.125	0.375	0.625	2	661	—	—
11.125	0.375	1.000	2.5	529	—	—
11.625	0.375	1.000	3	441	—	—
12.625	0.375	1.000	3.5	365	547	729
13.125	0.375	1.000	4	311	467	622
14.125	0.500	1.000	5	235	353	470
15.125	0.500	1.000	6	186	278	371
19.125	0.500	1.000	8	163	244	326
21.625	0.750	1.000	10	163	244	325
24.625	0.750	1.000	12	160	240	320
26.625	0.750	1.000	14	112	167	223
30.125	0.750	1.250	16	113	170	227
31.625	0.750	1.250	18	94	141	187
34.125	0.750	1.250	20	79	118	158
36.125	1.000	1.250	22	85	128	171
38.625	1.000	1.250	24	74	110	147
40.825	1.000	1.250	26	62	93	124
44.125	1.250	1.500	28	65	98	130
46.375	1.250	1.500	30	70	105	141

NOTES:
1. Control Rod Plate O.D. installed dimension is based on a **maximum** O.D. PROCO would supply. (See Figures 3 & 4)
2. Control Rod diameter is based on a **maximum** diameter PROCO would use to design a Control Rod.
3. Rod pressure ratings are based on metal conforming to F.S.A. standards and dimensions.

Table 6: Special Construction Pressures

Pipe Size	Series 240 & 242 Heavyweight P.S.I.G.
1" thru 8"	300
10" thru 12"	275
14"	200
16" thru 20"	175
22" thru 30"	160

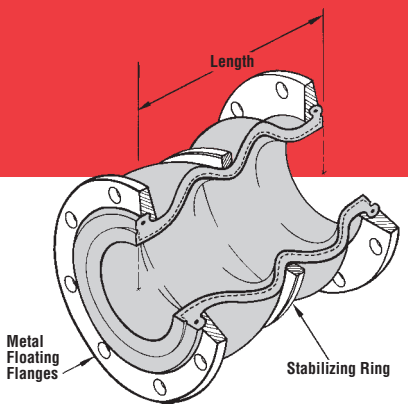
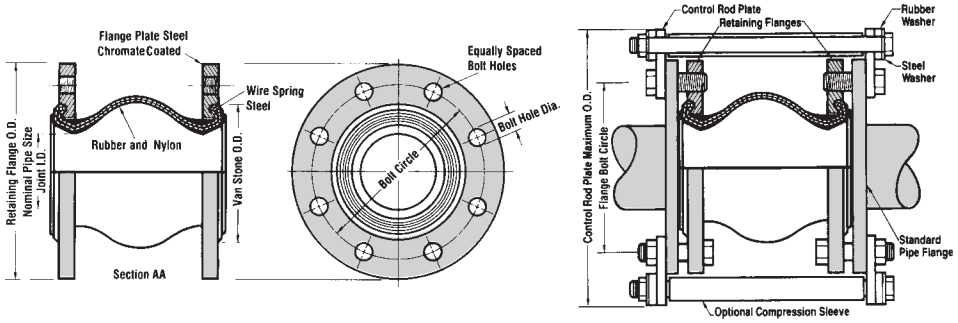


Figure 2.
Style 242
Twin Sphere Connector

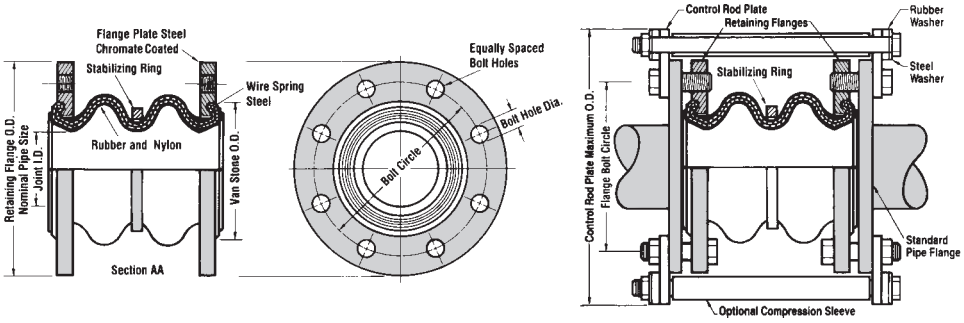
Style 240 Single Sphere Connector

Figure 3.



Style 242 Twin Sphere Connector

Figure 4.



Control Rod/Unit Applications. Control unit assemblies are designed to absorb static pressure thrust developed at the expansion joint. When used in this manner, control unit assemblies are an additional safety factor, minimizing possible failure of the expansion joint or damage to equipment. (See Tables 4 & 5).

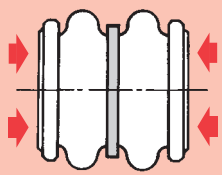
1. **Anchored Systems:** Control unit assemblies are not required in piping systems that are anchored on both sides of the expansion joint, provided piping movements are within the rated movements as shown in Tables 2 & 3.
2. **Unanchored Systems:** Control unit assemblies are always required in unanchored systems. Additionally, control unit assemblies must be used when maximum pressure exceeds the limits shown in Table 4 & 5, or the movement exceeds the rated movements as shown in Tables 2 & 3.
3. **Spring-Mounted Equipment:** Control unit assemblies are always recommended for spring-mounted equipment. Additionally, control unit assemblies must be used when maximum pressure exceeds the limits shown in Tables 4 & 5, or the movement exceeds the rated movements as shown in Tables 2 & 3.

Special Applications. Certain Style 240 (Single Sphere) and 242 (Twin Sphere) expansion joints are available in High-Pressure Designs. For specific pressures, see Table 6. Style designations are listed as 240-HW (sizes stocked in Table 2) and 242-HA, 242-HB & 242-HC (sizes stocked in Table 3.) The High-Pressure Design is recommended when the connector is to be installed into ANSI 250/300# piping systems.

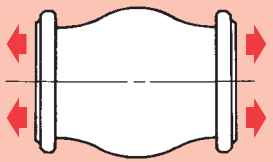
drilling for series 240 and series 242 expansion joints

Table 7: Flange Drilling

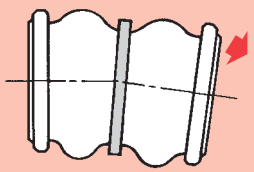
NOMINAL PIPE SIZE Inch/ mm	American 125/150# Conforms to ANSI B16.1 and B16.5						American 250/300# Conforms to ANSI B16.1 and B16.5					British Standard 10:1962 Conforms to BS 10 Table E					Metric Series Conforms to I.S.O. 2084-1974 Table NP10 Holes to I.S.O. /R-273					Metric Series Conforms to I.S.O. 2084-1974 Table NP16 Holes to I.S.O. /R-273				
	Flange Thickness	Flange O.D.	Bolt Circle	No. of Holes	Drilled Hole Size	Threaded Hole Size	Flange Thickness	Flange O.D.	Bolt Circle	No. of Holes	Hole Size	Flange Thickness	Flange O.D.	Bolt Circle	No. of Holes	Hole Size	Flange Thickness	Flange O.D.	Bolt Circle	No. of Holes	Hole Size	Flange Thickness	Flange O.D.	Bolt Circle	No. of Holes	Hole Size
1 25	0.55 14.0	4.25 108.0	3.13 79.4	4 4	0.62 15.9	1/2 - 13 UNC	0.63 16.0	4.88 124.0	3.5 88.9	4 4	0.75 19.1	0.59 15.0	4.5 114.0	3.25 82.6	4 4	0.62 15.9	0.63 16.0	4.53 115.0	3.35 85.0	4 4	0.55 14.0	0.63 16.0	4.53 115.0	3.35 85.0	4 4	0.55 14.0
1.25 32	0.55 14.0	4.63 118.0	3.5 88.9	4 4	0.62 15.9	1/2 - 13 UNC	0.63 16.0	5.25 133.0	3.88 98.4	4 4	0.75 19.1	0.59 15.0	4.75 121.0	3.44 87.3	4 4	0.62 15.9	0.63 16.0	5.51 140.0	3.94 85.0	4 4	0.71 18.0	0.63 16.0	5.51 140.0	3.94 100.0	4 4	0.71 18.0
1.5 40	0.55 14.0	5.0 127.0	3.88 98.4	4 4	0.62 15.9	1/2 - 13 UNC	0.63 16.0	6.12 156.0	4.50 114.3	4 4	0.88 22.2	0.59 15.0	5.25 133.0	3.88 98.4	4 4	0.62 15.9	0.63 16.0	5.91 150.0	4.33 110.0	4 4	0.71 18.0	0.63 16.0	5.91 150.0	4.33 110.0	4 4	0.71 18.0
2 50	0.63 16.0	6.0 152.0	4.75 120.7	4 4	0.75 19.1	5/8 - 11 UNC	0.71 18.0	6.50 165.0	5.00 127.0	8 8	0.75 19.1	0.63 16.0	6.0 152.01	4.5 114.3	4 4	0.75 19.1	0.71 18.0	6.50 165.0	4.92 125.0	4 4	0.71 18.0	0.71 18.0	6.50 165.0	4.92 125.0	4 4	0.71 18.0
2.5 65	0.71 18.0	7.0 178.0	5.5 139.7	4 4	0.75 19.1	5/8 - 11 UNC	0.71 18.0	7.5 191.0	5.88 149.2	8 8	0.88 22.2	0.71 18.0	6.5 165.0	5.0 127.0	4 4	0.75 19.1	0.71 18.0	7.25 185.0	5.71 145.0	4 4	0.71 18.0	0.71 18.0	7.28 185.0	5.71 145.0	4 4	0.71 18.0
3 80	0.71 18.0	7.5 191.0	6.0 152.4	4 4	0.75 19.1	5/8 - 11 UNC	0.79 20.0	8.25 210.0	6.62 168.2	8 8	0.88 22.2	0.71 18.0	7.25 184.0	5.75 146.1	4 4	0.75 19.1	0.79 20.0	7.87 200.0	6.3 160.0	8 8	0.71 18.0	0.79 20.0	7.87 200.0	6.30 160.0	8 8	0.71 18.0
3.5 90	0.71 18.0	8.5 216.0	7.0 177.8	8 8	0.75 19.1	5/8 - 11 UNC	0.79 20.0	9.0 229.0	7.25 184.2	8 8	0.88 22.2	0.71 18.0	8.0 203.0	6.5 165.1	8 8	0.75 19.1	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
4 100	0.71 18.0	9.0 229.0	7.5 190.5	8 8	0.75 19.1	5/8 - 11 UNC	0.79 20.0	10.0 254.0	7.88 200.0	8 8	0.88 22.2	0.71 18.0	8.5 216.0	7.0 177.8	8 8	0.75 19.1	0.79 20.0	8.66 220.0	7.09 180.0	8 8	0.71 18.0	0.79 20.0	8.66 220.0	7.09 180.0	8 8	0.71 18.0
5 125	0.79 20.0	10.0 254.0	8.5 215.9	8 8	0.88 22.2	3/4 - 10 UNC	0.87 22.0	11.0 279.0	9.25 235.0	8 8	0.88 22.2	0.79 20.0	10.0 254.0	8.25 209.6	8 8	0.75 19.1	0.87 22.0	9.84 250.0	8.27 210.0	8 8	0.71 18.0	0.87 22.0	9.84 250.0	8.27 210.0	8 8	0.71 18.0
6 150	0.87 22.0	11.0 279.0	9.5 241.3	8 8	0.88 22.2	3/4 - 10 UNC	0.87 22.2	12.5 318.0	10.62 269.9	12 12	0.88 22.2	0.87 22.2	11.0 279.0	9.25 235.0	8 8	0.88 22.2	0.87 22.0	11.22 285.0	9.45 240.0	8 8	0.87 22.0	0.87 22.0	11.22 285.0	9.45 240.0	8 8	0.87 22.0
8 200	0.87 22.0	13.5 343.0	11.75 298.5	8 8	0.88 22.2	3/4 - 10 UNC	0.95 24.0	15.0 381.0	13.0 330.2	12 12	1.00 25.4	0.87 22.2	13.25 337.0	11.5 292.1	8 8	0.88 22.2	0.87 22.0	13.39 340.0	11.61 295.0	8 8	0.87 22.0	0.87 22.0	13.39 340.0	11.61 295.0	12 12	0.87 22.0
10 250	0.95 24.0	16.0 406.0	14.25 362.0	12 12	1.00 25.4	7/8 - 9 UNC	1.02 26.0	17.5 445.0	15.25 387.4	16 16	1.13 28.6	0.95 24.0	116.0 406.0	14.0 355.6	12 12	0.88 22.2	1.02 26.0	15.55 395.0	13.78 350.0	12 12	0.87 22.0	1.02 26.0	15.94 405.0	13.98 355.0	12 12	1.02 26.0
12 300	0.95 24.0	19.0 483.0	17.0 431.8	12 12	1.00 25.4	7/8 - 9 UNC	1.02 26.0	20.5 521.0	17.75 450.9	16 16	1.25 31.8	0.95 24.0	18.0 457.0	16.0 406.4	12 12	1.00 25.4	1.02 26.0	17.52 445.0	15.75 400.0	12 12	0.87 22.0	1.02 26.0	18.11 460.0	16.14 410.0	12 12	1.02 26.0
14 350	1.02 26.0	21.0 533.0	18.75 476.3	12 12	1.13 28.6	1 - 8 UNC	1.10 28.0	23.0 584.0	20.25 514.4	20 20	1.25 31.8	1.02 26.0	20.75 527.0	18.5 469.9	12 12	1.00 25.4	1.10 28.0	19.88 505.0	18.11 460.0	16 16	0.87 22.0	1.10 28.0	20.47 520.0	18.50 470.0	16 16	1.02 26.0
16 400	1.10 28.0	23.5 597.0	21.25 539.8	16 16	1.13 28.6	1 - 8 UNC	1.18 30.0	25.5 648.0	22.5 571.5	20 20	1.38 34.9	1.10 28.0	22.75 578.0	20.5 520.7	12 12	1.00 25.4	1.18 30.0	22.24 565.0	20.28 515.0	16 16	1.02 26.0	1.18 30.0	22.83 580.0	20.67 525.0	16 16	1.18 30.0
18 450	1.18 30.0	25.0 635.0	22.75 577.9	16 16	1.25 31.8	1 1/8 - 7 UNC	1.18 30.0	28.0 711.0	24.75 628.7	24 24	1.38 34.9	1.18 30.0	25.25 641.0	23.0 584.2	16 16	1.00 25.4	1.18 30.0	24.21 615.0	22.24 565.0	20 20	1.02 26.0	1.18 30.0	25.20 640.0	23.03 585.0	20 20	1.18 30.0
20 500	1.18 30.0	27.5 699.0	25.0 635.0	20 20	1.25 31.8	1 1/8 - 7 UNC	1.18 30.0	30.5 775.0	27.0 685.8	24 24	1.38 34.9	1.18 30.0	27.75 705.0	25.25 641.4	16 16	1.00 25.4	1.18 30.0	26.38 670.0	24.41 620.0	20 20	1.02 26.0	1.18 30.0	28.15 715.0	25.59 650.0	20 20	1.30 33.0
22 550	1.18 30.0	29.5 749.0	27.25 692.2	20 20	1.38 34.9	1 1/4 - 7 UNC	1.18 30.0	33.0 838.0	29.5 743.0	24 24	1.38 34.9	1.18 30.0	30.0 762.0	27.5 698.5	16 16	1.13 28.6	1.18 30.0	28.74 730.0	26.57 675.0	20 20	1.18 30.0	1.18 30.0	30.51 775.0	27.95 710.0	20 20	1.30 33.0
24 600	1.18 30.00	32.06 813.0	29.5 749.3	20 20	1.38 34.9	1 1/4 - 7 UNC	1.18 30.0	36.0 914.0	32.0 812.8	24 24	1.62 41.3	1.18 30.0	32.5 826.0	29.75 755.7	16 16	1.25 31.8	1.18 30.0	30.71 780.0	28.54 725.0	20 20	1.18 30.0	1.18 30.0	33.07 840.0	30.31 770.0	20 20	1.42 36.0
26 650	1.26 32.0	34.25 870.0	31.75 806.5	24 24	1.38 34.9	1 1/4 - 7 UNC	1.26 32.0	38.25 972.0	34.5 876.0	28 28	1.75 44.5	— —	— —	— —	— —	— —	1.26 32.0	32.87 835.0	30.71 780.0	24 24	1.18 30.0	1.26 32.0	33.86 860.0	31.10 790.0	24 24	1.42 36.0
30 750	1.26 32.0	38.75 984.0	36.0 914.4	28 28	1.38 34.9	1 1/4 - 7 UNC	1.26 32.0	43.0 1092.0	39.25 997.0	28 28	2.00 50.8	1.26 32.0	39.25 997.0	36.5 927.1	20 20	1.38 34.9	1.26 32.0	37.99 965.0	35.43 900.0	24 24	1.30 33.0	1.26 32.0	38.19 970.0	35.43 900.0	24 24	1.42 36.0



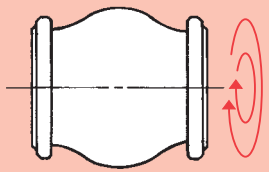
Axial Compression



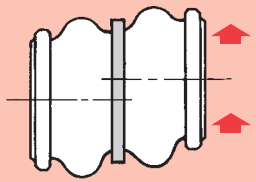
Axial Elongation



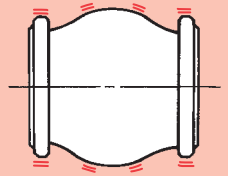
Angular Movement
Bending About the Centerline



Torsional Movement
Rotation About the Centerline (twist)



Lateral Movement
Shear or Perpendicular to Centerline



Absorbing Vibration

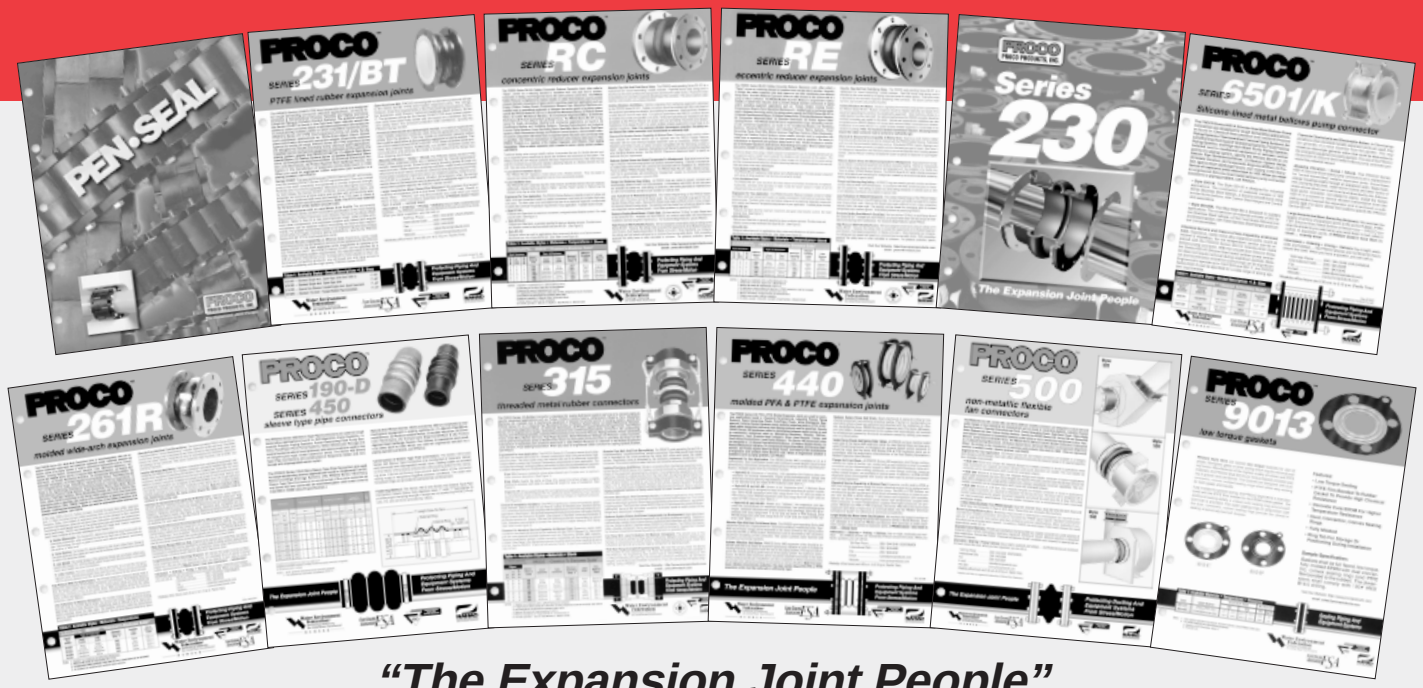
PROCO™ Series 240 and 242 are Designed to Absorb Different Movements Concurrently

The largest inventory in North America!

Spec. 24.06

PROCO™ PRODUCTS, INC.

PROCO has a vast array of Style/Elastomer configurations. We have an inventory to 72" diameter and can ship your requirement the same business day. With an average of over 20 years experience in the expansion joint industry, our sales staff can answer any of your questions and help to solve your problems.



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- Largest inventory in North America with warehouses in
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  Houston, TX
  Atlanta, GA



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PROCO PRODUCTS, INC.

2431 North Wigwam Dr. (95205)
P.O. Box 590 • Stockton, CA
95201-0590 • USA

TOLL-FREE PHONE: (800) 344-3246 NATIONWIDE AND CANADA
FACSIMILE: (209) 943-0242
(209) 943-6088 INTERNATIONAL
email: sales@procoproducts.com
website: http://www.procoproducts.com

DISTRIBUTED BY:

Warning: Expansion joints may operate in pipelines or equipment carrying fluids and/or gases at elevated temperatures and pressures. Normal precautions should be taken to make sure these parts are installed correctly and inspected regularly. Precautions should be taken to protect personnel in the event of leakage or splash. Note: Piping must be properly aligned and anchored to prevent damage to an expansion joint. Movement must not exceed specified ratings and control units are always recommended to prevent damage in the event other anchoring in the system fails. Properties applications shown throughout this data sheet are typical. This information does not constitute a warranty or representation and we assume no legal responsibility or obligation with respect thereto and the use to which such information may be put. Your specific application should not be undertaken without independent study and evaluation for suitability.

CALGON CARBON CORPORATION	HOSE FITTINGS MATERIAL SPECIFICATION	SPEC NO:
	UNIVERSAL HOSE COUPLING - MALLEABLE IRON	32.40

MATERIAL: Universal Hose Coupling, Malleable iron, male pipe thread on one end with other end for connecting to universal coupling.

RATING: 90 psig @ 140 DEG. F.

MANUFACTURER: Chicago Pneumatic, or equal.

SIZES:
1/4" - C-36844Y
3/8" - C-36843Y
1/2" - C-36842Y
3/4" - C-36841Y
1" - C-36840Y

NOTE: Above model number includes one standard type rubber gasket No. C-101158Y for air service. For water service use neoprene gasket No. C-101160Y.

Issue Date: Revision Date:

Approved by Joseph P. McMahon on 10/30/98



HOSE END



Ductile Iron (machined serrations)

hose size	part number	list each
3/8	UH-38	7.98
1/2	UH-2	4.99
5/8	UH-58	7.61
3/4	UH-3	5.15
1	UH-4	6.88

Brass (machined serrations)

3/8	UHB-38	–
1/2	UHB-2	12.60
5/8	UHB-58	–
3/4	UHB-3	14.49
1	UHB-4	18.59

316 Stainless (machined serrations)

1/2	UHSS-2	43.47
3/4	UHSS-3	36.71
1	UHSS-4	40.57

FEMALE NPT



Ductile Iron

npt size	part number	list each
3/8	UF-38	6.88
1/2	UF-2	6.30
3/4	UF-3	5.93
1	UF-4	7.72

Brass

3/8	UFB-38	–
1/2	UFB-2	–
3/4	UFB-3	–
1	UFB-4	–

316 Stainless

1/2	UFSS-2	44.71
3/4	UFSS-3	38.75
1	UFSS-4	41.73

MALE NPT



Ductile Iron

npt size	part number	list each
3/8	UM-38	6.88
1/2	UM-2	5.72
3/4	UM-3	6.09
1	UM-4	6.83

Brass

3/8	UMB-38	–
1/2	UMB-2	–
3/4	UMB-3	–
1	UMB-4	–

316 Stainless

1/2	UMSS-2	44.71
3/4	UMSS-3	38.75
1	UMSS-4	41.73

BLANK END



Ductile Iron

size	part number	list each
All	UB	9.82

Brass

All	UBB	–

THREE WAY



Ductile Iron

size	part number	list each
All	UTW	17.85

Brass

All	UTWB	–

UNIVERSAL WASHER



Nitrile

size	part number	list each
All	UG	0.53

Never use Universal Washers in UniversaLock Couplings

SAFETY CLIP



size	part number	list each
All	SC	0.26

TWO-BOLT UNIVERSAL CLAMP



Ductile Iron

hose o.d. min to max	part no.	list each
3/4 to 15/16	UC-2	5.78
1 to 1-1/4	UC-3	5.83
1-1/4 to 1-17/32	UC-4	10.08



DISTRIBUTOR AUTHORIZATION

Safety is of paramount concern to everyone. Due to the volatile nature of compressed air, and in accordance with our ISO 9000 quality system, we reserve the right to restrict sales of our UniversaLock® Couplings to only those distributors authorized by Campbell Fittings.

Please contact our customer service department for more information.

HOSE END



Ductile Iron (machined serrations)

hose size	part number	list each
1/2	ULH-2	19.10
3/4	ULH-3	19.10
1	ULH-4	19.10

MALE END



Ductile Iron

npt size	part number	list each
1/2	ULM-2	19.10
3/4	ULM-3	19.10
1	ULM-4	19.10

FEMALE END



Ductile Iron

npt size	part number	list each
1/2	ULF-2	19.10
3/4	ULF-3	19.10

UNIVERSALOCK WASHER

Nitrile

size	part number	list each
All	ULW	2.13

Never use UniversaLock Washers in standard Universal Couplings

CALGON CARBON CORPORATION	HOSE FITTINGS MATERIAL SPECIFICATION	SPEC NO:
	QUICK DISCONNECT ADAPTER - NYLON	32.45

MATERIAL: Quick Disconnect Adapter, nylon, male NPT on one end with other end for connecting to quick disconnect coupler.

RATING: 70 psig to 175 psig @ 0 DEG. F. to 150 DEG. F. depending on size.

MANUFACTURER: Dixon, NY-Last

SIZES: 1/2" thru 4"

MODELS: Dixon "Andrews" line - type F, NY-Last Style F, or equal

Issue Date: 01/01/89 Revision Date: 09/15/99

Approved by Matthew R. McGowan on 09/27/99

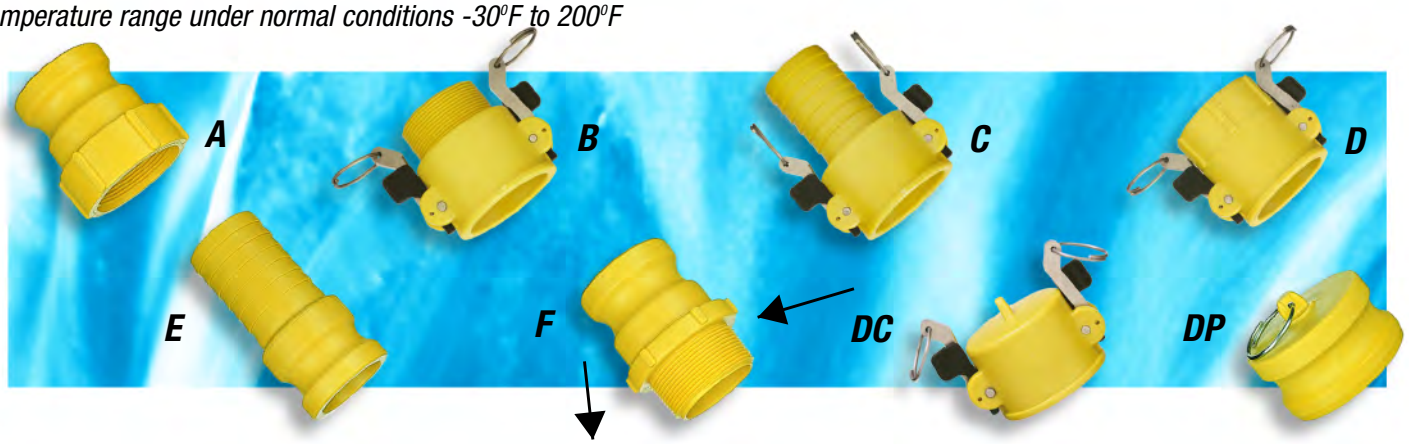
COUPLERS & ADAPTERS

Spec. 32.45

Nylon, Glass-Filled

FEATURES

- *Safety latches available on all couplers ranging in size from 1-1/4" to 4"*
- *Lightweight-1/2 the weight of aluminum*
- *Strong–resists cross threading, thread seizure and "out-of-round" condition*
- *Chemical resistant to most acids (Refer to chemical resistance table for specific recommendation)*
- *Non-conducting*
- *All couplers feature stainless steel handles & pins, blue nylon handles available*
- *Interchangeable with other couplers and adapters – manufactured to MIL-spec*
- *EPDM gaskets furnished standard. Buna-N, Viton and Neoprene also available*
- *Temperature range under normal conditions -30°F to 200°F*



Price Lookup

ITEM	DESCRIPTION	1/4"	3/8"	1/2"	5/8"	3/4"	1"	1-1/4"	1-1/2"	2"	3"	4"	3"x 4"
A	Male Adapter/Female Thread	025 A-N	037 A-N	050 A-N		075 A-N	100 A-N	125 A-N	150 A-N	200 A-N	300 A-N	400 A-N	
	Std. Package — Qty.	125	125	125		125	80	50	50	80	44	18	
	Std. Package — Wt.	7#	7#	7#		7#	7#	11#	9#	22#	18#	18#	
B	Female Coupler/Male Thread			050 B-N		075 B-N	100 B-N	125 B-N	150 B-N	200 B-N	300 B-N*	400 B-N	
	Std. Package — Qty.			100		100	80	60	60	50	25	20	
	Std. Package —Wt.			14#		15#	14#	27#	27#	26#	25#	28#	
C	Female Coupler/Hose Shank			050 C-N	062 C-N	075 C-N	100 C-N	125 C-N	150 C-N	200 C-N	300 C-N	400 C-N	430 C-N
	Std. Package — Qty.			100		90	60	65	65	44	18	12	—
	Std. Package — Wt.			15#		14#	11#	33#	32#	27#	22#	21#	—
D	Female Coupler/Female Thread	025 D-N	037 D-N	050 D-N		075 D-N	100 D-N	125 D-N	150 D-N	200 D-N	300 D-N*	400 D-N	
	Std. Package — Qty.	100	100	100		100	60	70	70	50	25	16	
	Std. Package — Wt.	16#	16#	16#		16#	11#	37#	35#	29#	21#	24#	
E	Male Adapter/Hose Shank			050 E-N	062 E-N	075 E-N	100 E-N	125 E-N	150 E-N	200 E-N	300 E-N	400 E-N	
	Std. Package — Qty.			125		75	45	50	45	30	32	16	
	Std. Package — Wt.			5#		5#	5#	9#	8#	9#	18#	18#	
F	Male Adapter/Male Thread			050 F-N		075 F-N	100 F-N	125 F-N	150 F-N	200 F-N	300 F-N	400 F-N	
	Std. Package — Qty.			90		90	100	120	120	75	33	12	
	Std. Package — Wt.			5#		5#	10#	23#	23#	22#	20#	11#	
DC	Female Coupler Cap					075 DC-N	100 DC-N		150 DC-N	200 DC-N	300 DC-N	400 DC-N	
	Std. Package — Qty.					125	80		80	70	30	20	
	Std. Package — Wt.					18#	13#		37#	35#	28#	22	
DP	Male Adapter Plug					075 DP-N	100 DP-N		150 DP-N	200 DP-N	300 DP-N	400 DP-N	
	Std. Package — Qty.					150	100		45	25	25	36	
	Std. Package — Wt.					8#	7#		6#	6#	10#	23#	

* Coupler supplied with rings only

Size	*Operating Pressure*
1/4"-1"	*175 psi max @ 70° F*
11/4"-2"	*150 psi max @ 70° F*
3"	*100 psi max @ 70° F*
4"	*50 psi max @ 70° F*

- On 1/4", 3/8" & 1/2" sizes the coupler and adapter portion is to 3/4" standard.
- On 1-1/4" size the coupler and adapter is to 1-1/2" standard.
- British thread also available.

WARNING: *Do not operate couplings under pressure or with liquid in the lines. To prevent accidental opening fully engage and secure handles prior to pressurizing.*

CALGON CARBON CORPORATION	HOSE FITTINGS MATERIAL SPECIFICATION	SPEC NO:
	QUICK DISCONNECT FEMALE COUPLER - ALUMINUM	32.61

MATERIAL: Quick disconnect female coupler, Aluminum, Buna-N gaskets, male NPT on one end with other end for connecting to quick disconnect male adapter.

RATING: 150 psig @ 100 DEG. F.

MANUFACTURER: Dixon, Ever-Tite

SIZES: 1/2" thru 4"

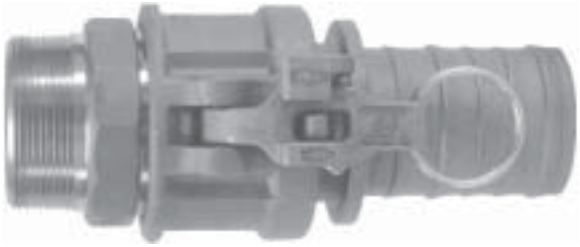
MODELS: Dixon "Andrews" line - type B, Ever-Tite Part B, or equal.

Issue Date: 07/16/92 Revision Date: 09/15/99

Approved by Matthew R. McGowan on 09/27/99

"EZ BOSS-LOCK"

No more fumbling with clamps, wire, clips or pins . . .
Just close the handles and the locking mechanism is engaged.

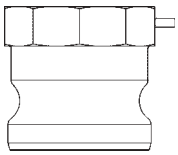


Unlike other safety couplings . . .

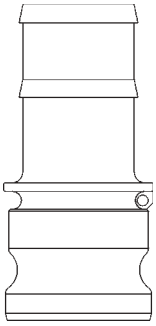
- **The EZ Boss-Lock is extremely EASY TO OPEN!!!** *The release lever is under your thumb when you want to open the fitting.* **ERGONOMIC.**
- **The EZ Boss-Lock is resistant to accidental disconnection when being dragged.** *The release lever opens in the direction opposite to the cam arm, so movements that tend to open the release lever also tend to close the cam arm!!!*
- **The EZ Boss-Lock alerts you if it is not properly engaged.** *If the rotating lever is not flush with the handle, it is not properly engaged.*
- **The EZ Boss-Lock has no sliding pins to jam.** *The EZ Boss-Lock's rotating action helps keep the locking device free of debris.*
- **The EZ Boss-Lock has no sliding pins to pop open.** *The EZ Boss-Lock is designed to protect critical parts from impact and to withstand rugged use.*
- **The EZ Boss-Lock can be supplied with special shanks custom suited to your needs.** *The EZ Boss-Lock is available with Swaged and PF shank designs, for hard to couple chemical hoses.*
- **The EZ Boss-Lock cam arm assemblies are made of investment cast Stainless Steel with plated Carbon Steel pull rings.**
- **The EZ Boss-Lock is easier to insert into the hose tubes on Tank Trucks, and easier to use in restricted spaces.** *This is due to the smaller maximum O.D. and a more snag free exterior.*
- **The EZ Boss-Lock Cam Arm assemblies can be retrofitted onto Undamaged Stainless Steel Boss-Lock.** *This allows you to protect your investment in Stainless Steel Boss-Lock couplings while you upgrade.*
- **The EZ Boss-Lock is Made in the USA.**

All measurements in this brochure are for reference only and are subject to change. Where dimensions are critical, please consult the factory. For products not shown or special application questions, please consult the factory.

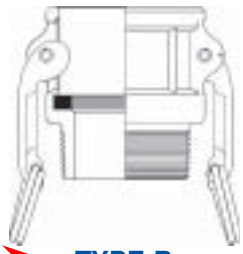
CAM & GROOVE LINE DRAWINGS



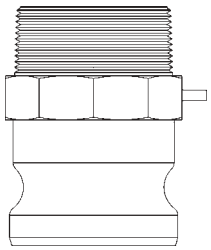
TYPE A
(male adapter x female NPT)



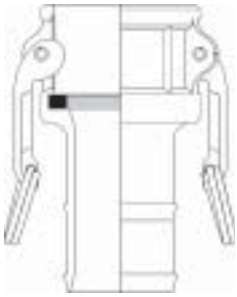
TYPE E
(male adapter x hose shank)



TYPE B
(female coupler x male NPT)



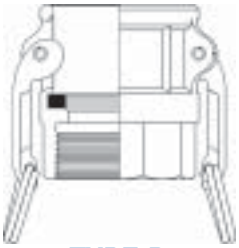
TYPE F
(male adapter x male NPT)



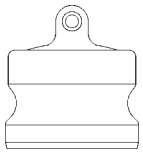
TYPE C
(female coupler x hose shank)



TYPE DC *
(dust cap)



TYPE D
(female coupler x female NPT)



TYPE DP *
(dust plug)

NOTE: Line drawings are representative of the Dixon / "Andrews" line of cam and groove.

** Dust Caps and Dust Plugs are NOT to be used in Pressure Applications for safety and environmental reasons.*

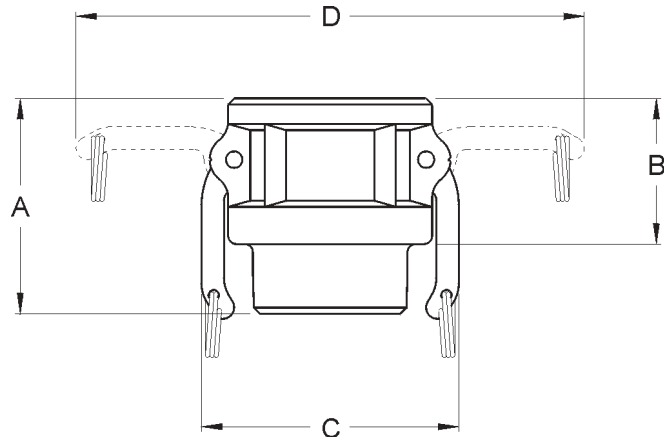
WARNING:
UNDER NO CIRCUMSTANCES should Cam and Groove couplings be used for compressed air or steam service!

SAFETY ALERT



Female Coupler x Male NPT

Size	Aluminum Part #	Aluminum Hard Coat Part #	Brass Part #	Unplated Malleable Iron Part #	Stainless Steel Part #
1/2"	50-B-AL	-----	50-B-BR	-----	50-B-SS
3/4"	75-B-AL	-----	75-B-BR	-----	75-B-SS
1"	100-B-AL	-----	100-B-BR	-----	100-B-SS
1 1/2"	150-B-AL	150-B-ALH	150-B-BR	150-B-MI	150-B-SS
2"	200-B-AL	200-B-ALH	200-B-BR	200-B-MI	200-B-SS
2 1/2"	-----	-----	-----	-----	250-B-SS
3"	300-B-AL	300-B-ALH	300-B-BR	-----	300-B-SS
4"	400-B-AL	400-B-ALH	400-B-BR	300-B-MI	400-B-SS
5"	500-B-AL	-----	-----	400-B-MI	600-B-SS
6"	600-B-AL	600-B-ALH	-----	-----	-----
8" *	800-B-AL	-----	-----	-----	-----



* "Andrews" and "Boss-Lock" Cam and Groove Couplings **DO NOT INTER CHANGE IN THE 8" SIZE.**

SAFETY ALERT

- See "Boss-Lock" for 1 1/4" and 2 1/2" couplers.
- The 8" "Andrews" design has 4 cam arms.
- **Finger rings are not supplied on 1/2" - 1" "Andrews" couplings.**
- 1/2" Andrews has only one cam arm.

ALUMINUM, BRASS and MALLEABLE IRON DIMENSIONS

Size	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"	8"
A Overall Length	2	2 3/16	2 17/32	2 7/8	2 13/16	3 9/32	------	3 15/16	4 1/32	4 3/16	4 7/16	8 7/16
B Coupler Length	1 7/32	1 3/8	1 19/32	1 31/32	1 29/32	2 7/32	------	2 15/16	2 11/32	2 5/16	2 5/8	3 13/16
C Distance Across Closed Cam Arms	1 17/32	2 1/8	2 7/16	3 1/4	3 9/16	3 15/16	------	5 15/32	6 9/16	7 9/16	10 3/32	12 1/32
D Distance Across Open Cam Arms	2 11/16	4 3/8	5 3/16	7 5/32	7 7/16	7 13/16	------	10 3/32	11 3/16	12 3/16	16 1/4	19 31/32

STAINLESS STEEL DIMENSIONS

Size	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"	8"
A Overall Length	1 7/8	2 1/8	2 9/16	2 27/32	2 31/32	3 9/32	3 7/16	3 59/64	4 1/64	------	4 35/64	------
B Coupler Length	1 1/4	1 1/4	1 9/16	1 29/32	1 29/32	2 7/32	2 1/4	2 9/32	2 9/32	------	2 19/32	------
C Distance Across Closed Cam Arms	1 17/32	2 1/8	2 7/16	3 1/4	3 9/16	3 15/16	4 7/16	5 15/32	6 9/16	------	10 3/32	------
D Distance Across Open Cam Arms	2 11/16	4 3/8	5 3/16	7 5/32	7 7/16	7 13/16	8 11/32	10 3/32	11 3/16	------	16 1/4	------

PRESSURE INDICATING GAGES
MATERIAL SPECIFICATION

SPEC NO:

CALGON CARBON CORPORATION

PI-213 TO PI-218; PI-448 TO PI-560

IS008

MATERIAL:	As listed below:
Case:	4-1/2" size, stainless steel, steel, brass, aluminum and phenol.
Socket:	1/2" NPT male bottom connection, stainless steel.
Dial:	White litho with black figures.
Pointer:	Balanced micrometer.
Bourdon Tube:	Stainless steel.
Movement:	Stainless steel and Delrin.
Accuracy:	1% of full range.
Liquid Fill:	None

RATING: Temperature range of -4 DEG. F. to +150 DEG. F.

MANUFACTURER: Ashcroft, WIKA

MODELS: Ashcroft "Duragauge" - 1279, WIKA 232.34

NOTES: As listed below:

1. Spec. IS008 replaces Spec. No. 7209A-CS263
2. This specification replaces the Specs. listed below.

RANGE: As listed below:

ITEM NO.	SCALE RANGE		REPLACES THESE ITEMS
PI-213	0-15 PSIG	PI-101,7	SPEC. No. 7209A-CS161,2 (IS001,2)
PI-214	0-30 PSIG	PI-102,8	SPEC. No. 7209A-CS161,2 (IS001,2)
PI-215	0-60 PSIG	PI-103,9	SPEC. No. 7209A-CS161,2 (IS001,2)
PI-216	0-100 PSIG	PI-104,10	SPEC. No. 7209A-CS161,2 (IS001,2)
PI-217	0-160 PSIG	PI-105,11	SPEC. No. 7209A-CS161,2 (IS001,2)
PI-218	0-200 PSIG	PI-106,12	SPEC. No. 7209A-CS161,2 (IS001,2)
PI-448	0-300 PSIG		
PI-557	0-300 PSIG *		
PI-449	0-400 PSIG		
PI-556	0-400 PSIG *		
PI-450	0-800 PSIG		
PI-558	0-800 PSIG *		
PI-559	0-1500 PSIG		
PI-560	0-1500 PSIG *		*With Steam Coil Siphon

GENERAL REQUIREMENTS:
Tag each assembly with Item No. and Service.

Issue Date: 01/01/89 Revision Date: 12/16/2005

Approved by Gerald Kirner on 03/21/2006

Bourdon Tube Pressure Gauges

Solid-Front Turret Style Thermoplastic Case

4½" & 6" Process Industry Series
316SS Wetted Parts • Type 23X.34

Pressure Gauges



Application
Industrial type suitable for corrosive environments where the fluid medium does not clog connection or corrode wetted part material. Field convertible to a liquid filled gauge for severe vibration conditions. Solid front, blow-out back case design meets safety requirements of ASME B40.1.

Size
4½"(115mm) & 6" (152 mm) dial size

Accuracy
± 0.5% of span (ASME B40.1 Grade 2A)

Ranges
Vacuum / Compound to 30"HG / 0 / 400 PSI
Pressure from 15 PSI to 30,000 PSI
or other equivalent units of pressure or vacuum
Receiver scale: 3...15psi

Working Range

Steady:	Full scale value
Fluctuating:	0.9 x full scale value
Short time:	1.5 x full scale value

Operating Temperature

Ambient:	-40°F to 150°F (-40°C to 65.6°C) Note 1
Media:	212°F- max. **500°F - dry gauge (intermittent) Optional **250°F - Liquid filled (intermittent) Optional **300°F - Dampened Movement (4½" only)

Temperature Error
Additional error when temperature changes from reference temperature of 68°F (20°C), approximately ±1.5% per 100°F (55.5°C Δ T) rising or falling. Percentage of span.

Standard Features

Connection
Material: 316 stainless steel
Lower mount (LM) + Lower back mount (LBM)
1/4" NPT and 1/2" NPT have M4 internal tap - STD.

Bourdon Tube
Material: 316 stainless steel
30" Hg (Vac) to 1000 PSI C-type
1500 PSI to 10,000 PSI helical type

Movement
Stainless steel
Internal stop pin at 1.3 times full scale value
Overload and underload stops- standard
Optional: dampened movement

Shock & Vibration
Shock resistance up to 100G
Optional: up to 400G
Optional: vibration resistance up to 10G

Cycle Testing
400,000-2,000,000*cycles, depending upon pressure range (4½" only)
*liquid filled

Dial
White aluminum with black lettering. Stop pin at 6 o'clock

Pointer
Adjustable black alu

Case
Black glass reinforced thermoplastic (PBTP)
Solid front, blow-out back
Turret style case with built in rear flange lugs

Weather Protection
Weather resistant (NEMA 3 / IP 54) - dry case
Weather tight (NEMA 4X / IP 65) - liquid-filled case

Standard Scale
PSI
Receiver scales 0/100% linear, 0/10 sq.rt.

Window Gasket
Buna-N

Window
Acrylic

Case Filling
None - 232.34
Glycerine - 233.34
Dampened movement - 239.34

Order Options (min. order may apply)

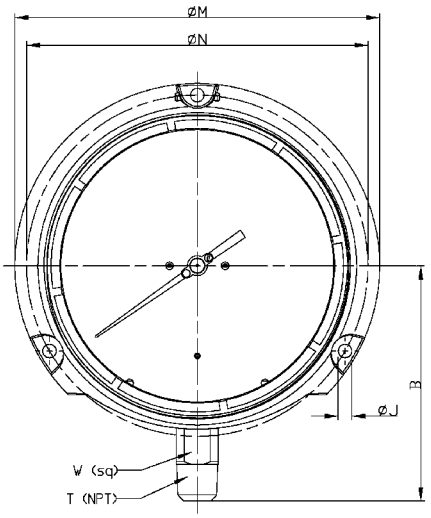
Overpressure protection up to 5x scale (limited ranges only)
Threaded restrictor
Silicone dampened movement
Panel mounting adaptor kit (field assembled) (4½" only)
Movement with PTFE coated gears
Glycerine, silicone, or fluorolube case filling Note 1
Field conversion kit for glycerine, silicone, or fluorolube fill
Cleaned for oxygen service
Glass window
Safety glass window
Externally adjustable red drag pointer (max. hand) (4½" only)
Externally adjustable red mark pointer (4½" only)
Special connections limited to socket square size
DIN standards
Custom dial layout
Other pressure scales available:
Bar, kPa, MPa, Kg/cm^2, and dual scales
Alarm contact switches (4½" only)
Shock resistant up to 400G
Vibration resistant up to 10G
Luminescent dial (4½" only)
Alloy steel socket connection (4½" only)
Chemical seals available

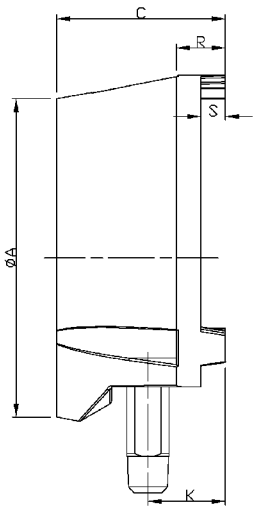
Note 1 Temperature Ranges (Liquid filled gauges)
Glycerine: -4°F to 150°F (-20°C to 65.6°C)
Silicone: -40°F to 150°F (-40°C to 65.6°C)

APM 23X.34
(Apm 02.10)

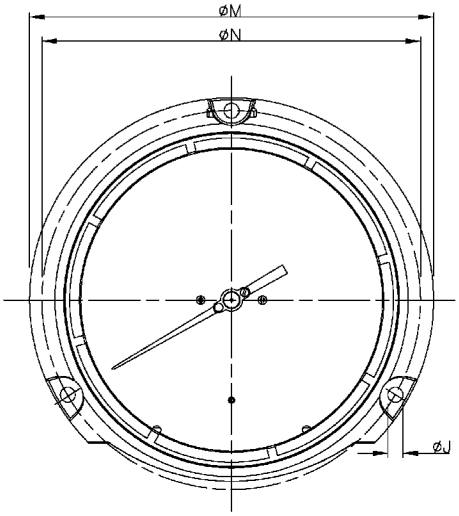
Dimensions:

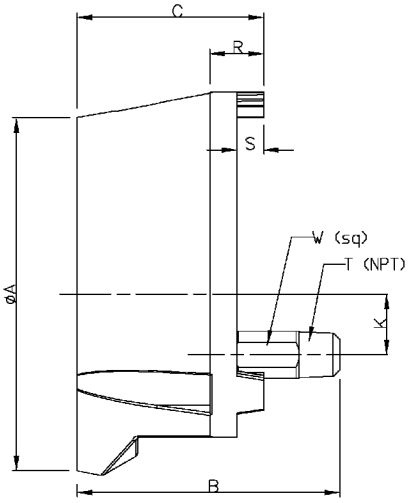
Spec. PI-217





TYPE	SIZE	WEIGHT	KEY	A	B	C	J	K	M	N	R	S	T	W	
2XX.34 LM	4.5"	2lbs.* (dry)	mm	128	103	84	6.3	40	148	136.5	25	12.5	--	22	
			inch	5	4.06	3.31	0.248	1.57	5.83	5.37	0.99	0.49	1/2"	0.87	* liquid filled 3lbs.
	6"	3lbs.* (dry)	mm	164	122.5	88	7.1	40.2	190	177.8	25.4	12.7	--	22	
			inch	6.46	4.82	3.46	0.28	1.58	7.5	7	1	0.5	1/2"	0.87	* liquid filled 4lbs.





TYPE	SIZE	WEIGHT	KEY	A	B	C	J	K	M	N	R	S	T	W	
2XX.34 LBM	4.5"	2lbs.* (dry)	mm	128	120.3	84	6.3	28.5	148	136.5	25.1	12.5	--	22	
			inch	5	4.736	3.31	0.248	1.122	5.83	5.37	0.99	0.49	1/2"	0.87	* liquid filled 3lbs
	6"	3lbs.* (dry)	mm	164	0.191	88	7.1	28.5	190	177.8	25.4	12.7	--	22	
			inch	6.46	4.86	3.46	0.28	1.122	7.5	7	1	0.5	1/2"	0.87	* liquid filled 4lbs

**Technical Note: Maximum continous media tempertures of 212°F is recommended. Maximum temperatures shown are for intermittent, short term exposure. User should consider temperature error and gauge component degradation when exposing gauge to any media or ambient temperature above 140 °F. For continous use in either ambient or media temperatures above 140 °F, a diaphragm seal or other heat dissipating means is recommended. Consult factory for technical inquiries and application assistance.

Ordering Information:
State computer part number (if available) / type number / size / range / connection size and location / options required.

Specifications given in this price list represent the state of engineering at the time of printing. Modifications may take place and the specified materials may change without prior notice

06/02

WIKA Instrument Corporation
1000 Wiegand Boulevard
Lawrenceville, Georgia 30043-5868
Tel: 770-513-8200 Fax: 770-338-5118
http://www.wika.com e-mail: info@wika.com

CALGON CARBON CORPORATION	RUPTURE DISKS MATERIAL SPECIFICATION	SPEC NO:
	PSE-155 TO PSE-157;PSE-252;PSE-301 TO PSE-306;PSE-577;PSE-580	IS015

MATERIAL: Impervious graphite.

Type: Standard.
Vacuum Support: Furnish for disks with bursting pressure of 15 psig or less.

FLANGES: 150 # ANSI RF or FF companion flanges (furnished by others)

MANUFACTURER: Zook, or equal.

SIZES: As listed below:

ITEM NO.	SIZE	BURSTING PRESSURE
PSE-155	1"	75 PSIG +/- 5%
PSE-156	1-1/2"	75 PSIG +/- 5%
PSE-157	2"	75 PSIG +/- 5%
PSE-170	2"	125 PSIG +/- 5%
PSE-252	3"	75 PSIG +/- 5%
PSE-301	3"	35 PSIG +/- 5%
PSE-302	3"	50 PSIG +/- 5%
PSE-303	3"	65 PSIG +/- 5%
PSE-304	3"	87 PSIG +/- 5%
PSE-305	3"	150 PSIG +/- 5%
PSE-306	3"	75 PSIG +/- 5%
PSE-307	3"	100 PSIG +/- 5%
PSE-577	3"	125 PSIG +/- 5%
PSE-580	4"	125 PSIG +/- 5%

SPECIFICATIONS: ASME UD stamp required.

NOTES: As listed below:

1 - Tag with Item No. and Service.
2 - IS015 replaces Spec. No. 7209a-CS172

SERVICE CONDITIONS:
As listed below:

Fluid Under Disks:	Water
Pressure Fluctuation:	Back Pressure:
Temperature:	40 to 150 degrees F.
Operating Pressure:	80% of bursting pressure.
Back Pressure:	Atmospheric.

GENERAL REQUIREMENTS:
As listed Below:

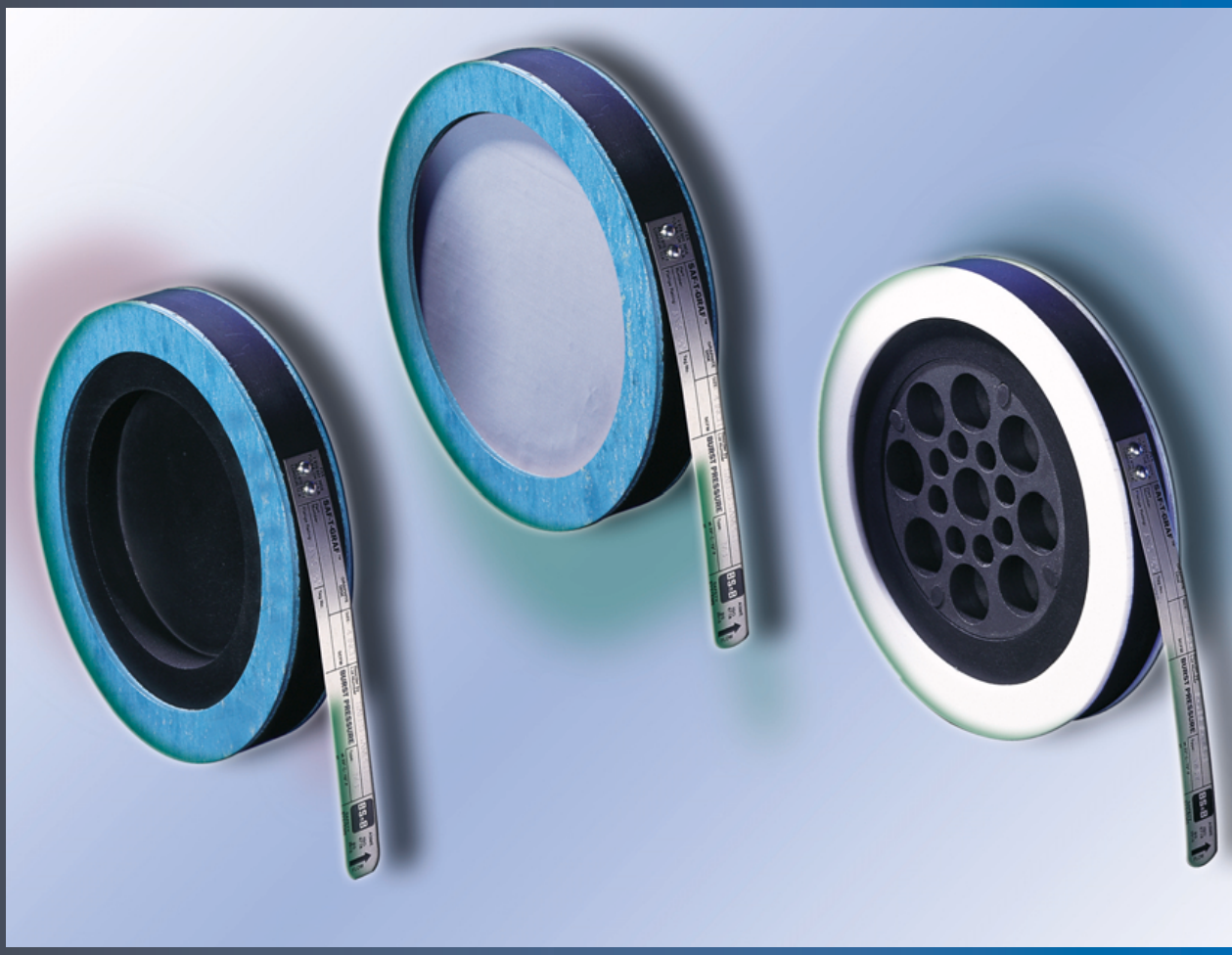
Bursting Pressure:	See table above
Coincident Temperature:	150 degrees F.

Spec. IS015 Item PSE-577

CATALOG 77-8500 SECTION C

BS&B SAFETY SYSTEMS, L.L.C.
BS&B SAFETY SYSTEMS LTD

SAF-T-GRAF



Saf-T-Graf graphite disks are impermeable to process gases and fluids

Spec. IS015 Item PSE-577

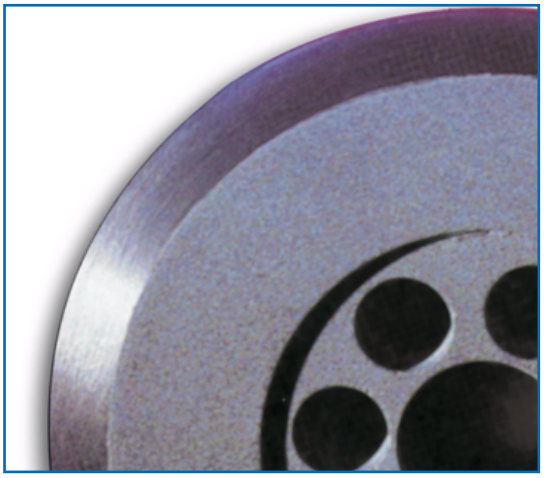
SAF-T-GRAF® System

SAF-T-GRAF® FEATURES

- Offers superior sealing characteristics to process gases and fluids
- Corrosion resistant (except free fluorine)
- Burst pressures from 0.02 bar (0.25 psig) to 69 bar (1000 psig)
- Higher operating temperature than other impregnated graphite disks up to 205°C (400°F)
- Full bore opening
- Sizes from 15 to 600 mm (0.5" to 24" and larger)
- Extended service life for operating pressures up to 80% of the disk marked pressure in a static environment - Lower operating ratios can be expected in a cyclic environment
- Suitable for gas service and liquid service
- Supplied with gaskets attached for immediate installation.
- Resists full vacuum (vacuum support required below 1.52 bar (22 psig) burst pressure)
- Optional PTFE coating to reduce product build-up
- Graphite impregnation is environmentally safe
- Patent pending
- ASME code, UD stamp above 15 psig (1.03barg) available

Armor

Armor is recommended for all graphite disks for added safety, easier installation and elimination of breakage during installation. Armor reduces the possibility of a premature burst due to uneven or excessive torqueing of the flange studs.



Armor is standard on disks with burst pressures in excess of 150 psig or to fit ANSI Class 300/600 flanges. Carbon steel armor is standard with 304/316 Stainless Steel as an option.

Saf-T-Graf monobloc impregnated graphite disks. Vacuum supports are designed utilizing the latest computer software to maximize venting capacities while maintaining structural strength. Armor ring around disk's circumference shown left.

Disks for Immediate Shipment

In order to provide the best possible service, BS&B stocks monobloc disks in the following sizes: 25, 40, 50, 80, 100, 150 and 200 mm (1", 1.5", 2", 3", 4", 6", 8").
Stocked Burst Pressures:
10-15-20-25-30-40-50-75-100-125-150 psig
All disks must be for 150 ANSI flange ratings.

Flange Ratings

Saf-T-Graf disks can be supplied to fit flange ratings ANSI, DIN, JIS, BS, AFNOR etc. Please specify flange rating when ordering

Gaskets

BS&B Safety Systems, L.L.C. stocks gaskets in the materials below:

- Garlock® or Klinger®-Sil (standard)

Optional Materials:

- GRAFOIL®
- Neoprene
- PTFE solid

Please specify your gasket material when ordering.

Sensors

A GAS™ (Graphite Alert Sensor) is available to provide warning of a burst graphite disk

Installations

The Saf-T-Graf disk is designed to permit direct installation between ANSI, DIN, JIS, BS, AFNOR pipe flanges and to locate between the flange bolts.

Operating Ratio

Up to 80% operating pressure to burst pressure ratio in a static environment. Lower operating ratios can be expected in a cyclic environment.

Klinger®-Sil is a registered trade mark of Klinger (Holdings) Ltd.
Garlock® is a registered trade mark of Coltec Industries
GRAFOIL® is a registered trade mark of UCAR Carbon Company, Inc.

Monobloc

Spec. IS015 Item PSE-577



Model MBV (with bar) and MB.

Model MB™

Monobloc disks fit most applications where a graphite disk is needed.

When using a monobloc disk in application:

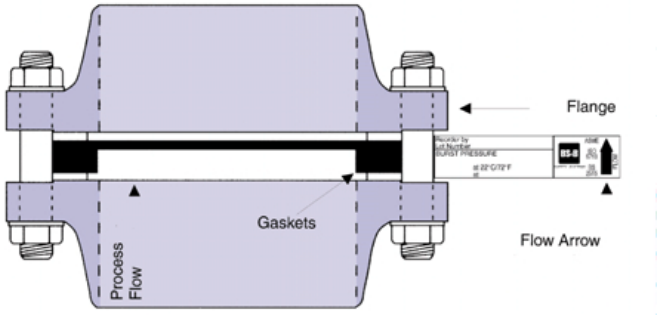
- Vacuum supports are needed for disks rated below 1.52 bar (22 psig) and where a vacuum condition exists. Model MBVTM.
- Vacuum supports are not needed for sizes 15 and 20 mm (0.5", .75").
- Temperature ranges -730 C to 205ºC (-100ºF to 400ºF).
- Armoring is recommended for all graphite disks for added safety, easier installation and elimination of breakage during installation
- Armor reduces the possibility of a premature burst due to uneven or excessive torqueing of the flange studs

MB™ Specifications

Nominal Size		Burst Ratings Barg		Burst Ratings PSIG		Internal Diameter		Disk Thickness	
mm	in	Min	Max	Min	Max	mm	in	mm	in
15	0.5	1.73	10.3	25	150	15.9	0.625	16	0.625
20	0.75	1.73	10.3	25	150	21	0.825	16	0.625
25	1	0.69	10.3	10	150	27.2	1.07	22	0.875
40	1.5	0.49	10.3	7	150	41.1	1.62	22	0.875
50	2	0.14	10.3	2	150	52.6	2.07	22	0.875
80	3	0.069	10.3	1	150	78.0	3.07	22	0.875
100	4	0.069	10.3	1	150	103.4	4.07	22	0.875
150	6	0.069	10.3	1	150	154.2	6.07	22	0.875
200	8	0.035	10.3	0.5	150	205.0	8.07	29	1.125
250	10	0.0173	8.6	0.25	125	255.8	10.07	38	1.50
300	12	0.0173	8.6	0.25	125	306.6	12.07	51	2.00
350	14	0.0173	6.89	0.25	100	336.5	13.25	57	2.25
400	16	0.0173	6.89	0.25	100	387.4	15.25	64	2.50
450	18	0.0173	6.89	0.25	100	438.2	17.25	70	2.75
500	20	0.0173	3.4	0.25	50	489.0	19.25	76	3.00
600	24	0.0173	3.4	0.25	50	590.6	23.25	76	3.00

For other disk thickness, contact BS&B Safety Systems, L.L.C. or BS&B Safety Systems LTD.

MB



MB monobloc disks are available in size from 15mm to 600 mm (0.5" to 24") with a temperature range to 205º C (400ºF).

(For Venting Capacities Chart please refer to page 5.)

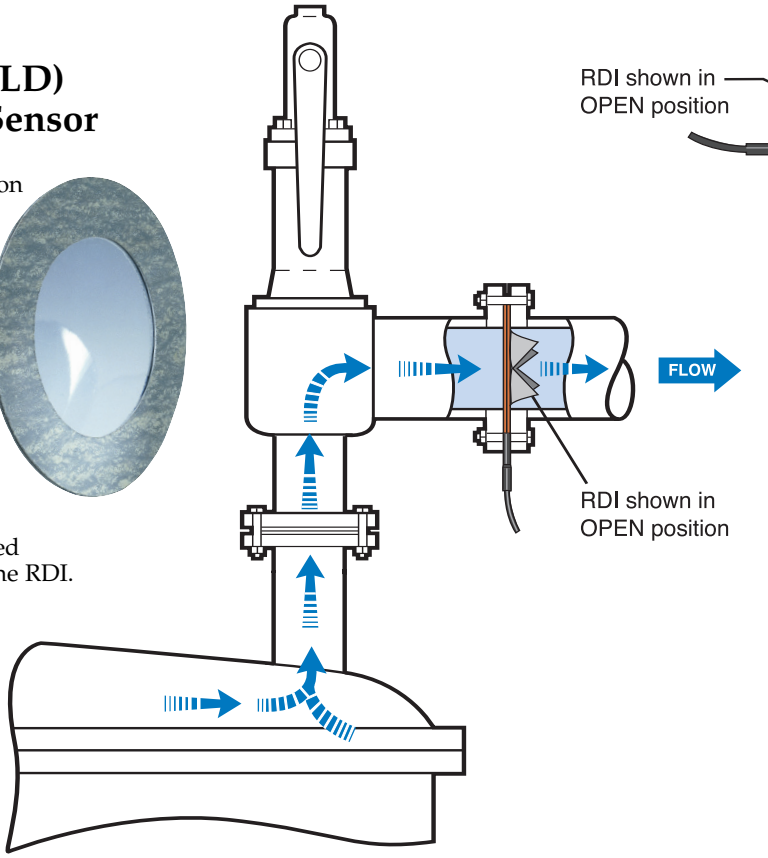
Burst Pressure - 125 psig

Optional Leak Detector (LD) for RDI Burst Sensor

For optional leak detection specify RDI-LD. The LD is a TFE seal affixed between two gaskets. When installed a build-up in pressure causes the RDI to open the electrical circuit.

Note: Max. Temperature of 500°F (260°C) *Limitation of liner material*

The LD is always installed on the pressure side of the RDI.



MONITOR

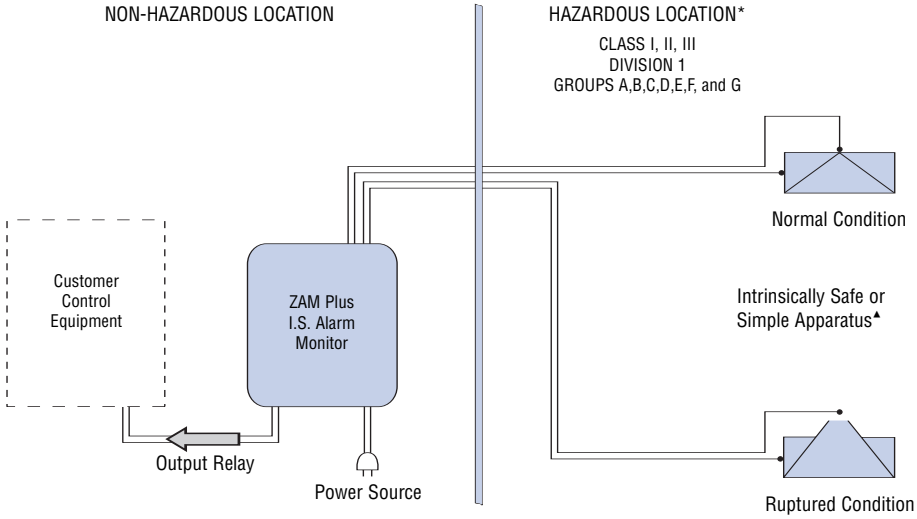
The RDI Rupture Disk Indicator works with ZOOK ZAM Plus Alarm Monitor or any other monitoring system. Contact ZOOK for additional information.

The monitor wired to the RDI will be activated providing immediate local or remote warning of a ruptured disk. The ZAM Plus monitor allows output to control pumps, valves, and other equipment which may be activated to control or shutdown a process.

CAUTION

The RDI is an electrical device suitable for use in hazardous locations (Class I, II, and III, Division 1 and 2, Group A thru G) provided that it is used with an approved intrinsically safe electrical alarm monitor.

For services involving highly electrically conductive fluids, contact ZOOK for this type of application.



*Contact ZOOK for information about mounting the ZAM Plus Alarm Monitor in hazardous locations.

▲Hazardous location equipment must be NEC compliant or simple apparatus.

UD ASME COMPLIANT
CE PED COMPLIANT

ZOOK Enterprises, LLC
16809 Park Circle Drive
Chagrin Falls, OH 44022 U.S.A.
Toll Free **800.543.1043**
Phone **440.543.1010**
Fax **440.543.4930**
E-mail **sales@zook.cc**

ZOOK Canada, Inc.
4400 South Service Road
Burlington, ON Can. L7L 5R8
Toll Free **800.370.6057**
Phone **905.681.2885**
Fax **905.681.8838**
E-mail **sales.canada@zook.cc**

ZOOK Europe, LTD.
Unit 1.14, Great House Waterside Business Park
Redwall Close, Rotherham Road
Dinnington, Sheffield UK. S25 3QA
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BS&B®

BS&B SAFETY SYSTEMS, L.L.C.
BS&B SAFETY SYSTEMS LTD.

Burst Alert® Sensors



U.S. patents 4,978,947; 5,551,471 and other international patents apply.

For Immediate Warning of a Pressure Relief Event

Visit www.bsbsystems.com or www.bsb.ie for the most complete, up-to-date information.

Burst Alert® Sensors

Coincident Rupture Disk Burst Pressure for Burst Alert® Sensors

Table 1

Size of Rupture Disk		Minimum Coincident Pressure for BAS+ Series Sensors	
in	mm	psig	barg
1	25	14	0.96
1 1/2	40	12	0.83
2	50	7	0.48
3	80	5	0.34
4	100	5	0.34
6	150	3	0.2
8	200	3	0.2
10	250	3	0.2
12	300	3	0.2

Table 2

Size of Rupture Disk		Minimum Coincident Pressure for KBA Series Sensors	
in	mm	in WC	millibar
1	25	N/A	N/A
1 1/2	40	N/A	N/A
2	50	8.5/13.5	21/34
3	80	7.5/8.5	19/21
4	100	5.5/7.5	14/19
6	150	8.5/10.5	21/26
8	200	5.5/6.5	14/16

Note: The first pressure value applies to temperatures from -40°F-90°F (-40°C-32°C). The second pressure value applies from 90°F-175°F (32°C-79°C).

Table 3

Size of Rupture Disk		Maximum pressure activation for LDAS+ Series Sensors	
in	mm	psig	barg
1	25	N/A	N/A
1 1/2	40	N/A	N/A
2	50	12	0.83
3	80	8.7	0.6
4	100	8.7	0.6
6+	150	8.7	0.6

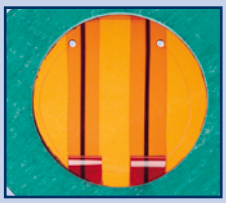
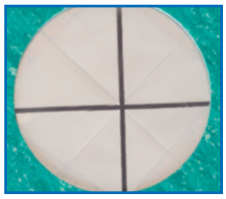
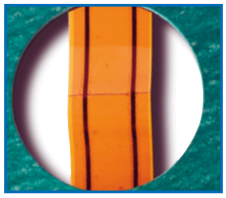
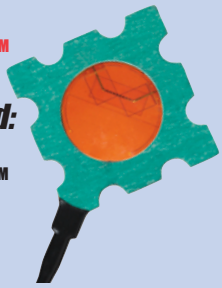
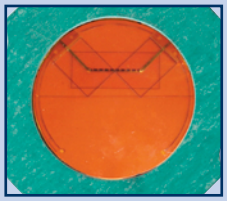
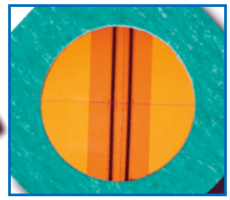
Note: These pressure values indicate the maximum pressure buildup upstream of the sensor before activation to detect leakage and/or operation of a pressure relief device.

Table 4

Size of Rupture Disk		Minimum Coincident Pressure for BAS Series Sensors	
in	mm	psig	barg
1	25	20	1.38
1 1/2	40	10	0.69
2	50	5	0.34
3	80	2.5	0.17
4	100	1.6	0.11
6+	150	1	0.069

Armored Version (ABAS+ shown)



Sensor Type		Features
BAS+™ BASS+™ **Armored: ABAS+™ ABASS+™**	  *Note: Two Reconnect Stops™ can be seen where the breaking ends of the Tantalum conductor wire run into the gasket (bottom of photo). The Stops provide electrical insulation that minimizes the risk of sensor reconnection after the pressure relief event. The wide conductor path separation further reduces the risk of electrical reconnection-there is insufficient live conductor material after perimeter opening of sensor to span the gap.*	• Superior perimeter fail • Polyimide film • Tantalum conductor wire • Dual path conductor • Reconnect Stops™ • Wide conductor separation
KBA™ KBAS™ **Armored: AKBA™ AKBAS™**	 	• Offset center fail • PTFE film • Tantalum conductor wire • Dual path conductor
KBA-S™ KBA-SS™ **Armored: Not Available**	 	• Offset center fail • PTFE film • Tantalum conductor wire • Dual path conductor
DAS™ DASS™ **Armored: ADAS™ ADASS™**	 	• Center fail • Polyimide film • Tantalum conductor wire • Dual path conductor • Domed to accommodate disk dome
LDAS+™ LDASS+™ **Armored: ALDAS™ ALDASS™**	  *The LDAS family of sensors detects both burst and leakage conditions.*	• Perimeter fail • Polyimide film • Tantalum conductor wire • Single path conductor • Dual failure point • Reconnect Stops™
BAS™ BASS™ **Armored: Not Available**	 	• Center fail • Polyimide film • Tantalum conductor wire • Dual path conductor

Note: Underlined sensor types are provided with SmartDisk™ compatible connectors. All other sensors are provided with pigtail end connections unless specified at the time of order.

Use with the following Rupture Disk type

Sure-Saf	CSI, CSR
Sta-Saf	Sigma EXL, Sigma, SK_R^+, LPS, RLS, S-90, JRS, FRS
High Pressure Eco-Saf	ECR, ECV, ECT, V/ECR (see Table 1)
Nu-Saf	XN-85, XN disks in safety head types NF-7RS and NF-7R only. Also type LCN at higher pressures (see Table 1), and XN-85S and XN disks sizes 1"~3"/25mm~80mm in safety head types NX-7R and NXV-7R.
High Pressure Graphite Disks	* MB, MBV, AMB, AMBV,IMB, AIMB, IMBL, AIMBL, RE, REV (see Table 1)
Other Disks	GFN, B, BV, D, DV, SVI, RB-90 – except for special reduced height safety heads that do not enclose the disk dome, when DAS family sensors should be used.

+ do not use BAS+ series sensor when installed in S90-7R safety head.
* when the sensor is installed on the atmospheric/ vent side of the rupture disk.

Vac-Saf	DKB, P/DKB, AVB (see Table 2)
Low Pressure Eco-Saf	(see Table 2)
Low Pressure Graphite Disks	(see Table 2)

Vac-Saf (sanitary/asceptic)	VKB, P/VKB, AVB-ST, P/AVB-ST (see Table 2)
Eco-Saf (sanitary/asceptic)	ECR-S, V/ECR-S, V/ECT-S (see Table 2)

Type GCR-S sanitary/aseptic rupture disks with integral burst alert sensors and type SAS Sanitary/Aseptic Burst Alert Sensors are detailed in catalogs 77-4014 and 77-4015.
Note: KBA-S family sensors use standard sanitary/aseptic gasket materials such as Viton, Silicone and EPDM.

Large Size Tension Loaded Disks	XN-85S and XN disks 4"/100mm and larger used in NX-7R or NXV-7R safety heads. B, BV, D, DV, XN-85 disks used in special reduced height safety heads that do not enclose the disk dome. Atmospheric vent type disks: AV, AVV, AVE, AVEL.

The response pressure capability of the DAS family of sensors matches the minimum burst pressure for the AV disk.

Sure-Saf	CSI, CSR
Sta-Saf	Sigma EXL, Sigma, SK_R^+, RLS, S-90 and high pressure LPS, JRS and FRS (see Table 3)
High Pressure Eco-Saf	ECR, ECV, ECT, V/ECR (see Table 3)
Nu-Saf	XN-85, XN disks in safety head types NF-7RS and NF-7R only. Also type LCN at higher pressures (see Table 3), and XN-85S and XN disks sizes 1"~3"/25mm~80mm in NX-7R and NXV-7R safety heads.
High Pressure Graphite Disks	* MB, MBV, AMB, AMBV,IMB, AIMB, IMBL, AIMBL, RE, REV (see Table 3)
Other Disks	GFN, B, BV, D, DV, SVI, RB-90 – except for special reduced height safety heads that do not enclose the disk dome.

+ do not use LDAS+ series sensor when installed in S90-7R safety head.
* when the sensor is installed on the atmospheric/vent side of the rupture disk.

Sure-Saf	CSI, CSR
Sta-Saf	Sigma EXL, SK_R^+, LPS, RLS, S-90, JRS, FRS
High Pressure Eco-Saf	ECR, ECV, ECT, V/ECR (see Table 4)
Nu-Saf	XN-85, XN disks in safety head types NF-7RS and NF-7R only. Also type LCN at higher pressures (see Table 1), and XN-85S and XN disks sizes 1"~3"/25mm~80mm.
High Pressure Graphite Disks	* MB, MBV, AMB, AMBV,IMB, AIMB, IMBL, AIMBL, RE, REV (see Table 4)
Other Disks	GFN, B, BV, D, DV, SVI, RB-90 – except for special reduced height safety heads that do not enclose the disk dome.

+ do not use BAS series sensor when installed in S90-7R safety head.
* when the sensor is installed on the atmospheric/ vent side of the rupture disk.

Burst Alert Sensor® Operation & Electrical Information

Each Burst Alert Sensor® is designed to operate in a "normally closed" electrical circuit. A polymer membrane is used to support an electrical conducting circuit. When the pressure event (disk rupture/valve opening) occurs, the flow of fluid places the polymer membrane in tension which leads to the break of a tantalum electrical conductor. This changes the electrical status of the sensor to "normally open." Recommended operating limits for Burst Alert Sensors are a maximum current of 500mA, maximum voltage 24 VDC; satisfactory operation can be obtained at a few milliamperes current.

Materials

Gaskets. Compressed fiber is the standard gasket material. Optional materials such as glass filled Tef, Garlock® 3000, and Tef are available upon request. The maximum service pressure for standard compressed fiber gaskets is 1450 psig (100 barg). (1000 psig/69 barg for Garlock 3000 and 800 psig/55 barg for Tef). Tef is limited to a maximum service temperature of 200ºF/93ºC.

Membrane. Each Burst Alert Sensor type uses a film of polymer material to support the electrical conductor and provide electrical insulation. Either Polyimide (yellow color in photographs) or PTFE (white color in photographs) is used for this purpose.

All Burst Alert Sensors use a flattened tantalum wire as the electrical conductor. This offers optimum corrosion resistance.

The user shall determine the compatibility of Burst Alert Sensor materials for each application.

Temperature Range

Burst Alert Sensors are suitable for a temperature range of:
-40ºF (-40ºC) to 500ºF (260ºC); 400ºF (204ºC) for the LDAS family
When supplied with standard cable, the cable temperature capability is:
-22ºF (-30ºC) to 221ºF (105ºC).
Optional high/low temperature cable permits use over the range from:
-85ºF (-65ºC) to 392ºF (200ºC).

Sensor Cable-Optional Features

Each Burst Alert Sensor is supplied with a 3 ft./1 m length of standard cable. The following options are available:
1. Standard cable, customer selected length.
2. High/low temperature, 3 ft./1 m length attached to sensor.
3. High/low temperature, customer selected length.
4. Wipe-down "clean service" two-part cable with molded water resistant connector; 3 ft. + 9 ft. (0.9 m + 2.7 m) standard package or cut smaller (purple color).
5. Extension cables available per ft./m (WSC connector required).
6. SmartDisk™ System Connector added to the normally free end of each sensor cable.

Size Availability

Standard BAS+, DAS and BAS family sensors are available up to size 12"/300 mm. Larger sizes are available upon request. The KBA and LDAS family sensors are available up to size 8"/200 mm.

Tagging and Packaging

Each Burst Alert Sensor is individually tagged and packaged. Burst Alert sensors are tagged indicating type, size, flange rating (where applicable), part number and traceable lot number.

Intrinsic Safety

Burst Alert Sensors are compatible with the requirements for operation of intrinsically safe electrical systems. All types of Burst Alert Sensor store no electrical energy; they are a "simple device" suitable for use in Classes I and II, Division I, Groups A through G provided that appropriate electrical apparatus is used (powered through a Zener Barrier).

Atex Compliance

Burst Alert Sensor types BAS+, ABAS+, LDAS+, DAS and ALDAS+ comply with the requirements of the European Union Atex directive. Special tagging is required and it is essential that the application service temperature is identified for each sensor order item. For further information, please consult the Burst Alert Sensor installation manual or BS&B Safety Systems.

Optional Armored Design

Sensor families BAS+, KBA, DAS and LDAS+ are available in optional armored configuration. The sensor is mounted to a stainless steel support concealed within the gaskets. This greatly increases the rigidity of the sensor for handling and installation. In addition, armored sensors have a perimeter extension tab to which the cable is tied. This isolates the "cable to sensor" connection avoiding damage should the cable be pulled hard or blown in the wind for an extended period.

Optional Connector

Each Burst Alert Sensor can be supplied with an optional weatherproof connector. The standard connector option is type WSC.
The characteristics of the type WSC connector are:

- Durable threaded internal pin connections (3 pin-positive/negative/shielding)
- Durable Nylon housing, threaded assembly of housing with Nitrile O-ring seals
- 10 Amps, 250 V AC
- UL listed IP 68, EN 60529:1992 conformance.
- Cable Gland suitable for cable diameters from 3.5~5 mm
- Operating Temperature range -4ºF (-20ºC) to 158ºF (70ºC)

Alternative connectors available upon request.

Cautions:

1. The user is recommended to operate Burst Alert Sensors with a latching control and alarm system.
2. Caution when using Burst Alert Sensor technology with conducting fluids. Even though the electrical conductor path is broken, conducting liquids may enable a new electrical circuit to be completed.
3. In the event of back pressure, the operation of a Burst Alert Sensor may be influenced. Seek the advice of BS&B Safety Systems, L.L.C. or BS&B Safety Systems, Ltd.
4. When using the LDAS+ family of sensors, the user must consider the impact that accumulation of pressure upstream of the sensor will have on the set pressure of differential pressure sensitive relief devices located further upstream.

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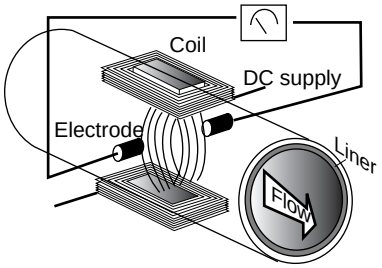
Magnetoflow® Mag Meter	Model Magnetoflow Flanged	Technical Brief

GENERAL

Badger's Magnetoflow line is the result of 35 years of research and field use in electromagnetic flow meters. Based on Faraday's law of induction, these meters can measure almost any liquid, slurry or paste that has a minimum of electrical conductivity. Designed, developed and manufactured under the strictest quality standards, the Magnetoflow meter ranks among the best in the market. Its sophisticated, processor based signal conversion represents the state of the art in the industry with accuracies of 0.25% or better. The wide selection of liner and electrode materials insures maximum compatibility and minimum maintenance over a long operating period.

OPERATION

The flow meter is basically a stainless steel tube lined with a nonconductive material. Outside the tube two DC powered electromagnetic coils are positioned diametrically opposing each other. Perpendicular to these coils, two electrodes are inserted into the flow tube. When the coils are energized, a magnetic field is created across the whole diameter of the pipe. When a conductive fluid flows through this magnetic field, a voltage is induced across the electrodes. This voltage is directly proportional to the average flow velocity of the fluid and is picked up by the two electrodes. This induced voltage is then amplified and processed digitally by the converter to produce a very accurate analog or digital signal. The signal can then be used to indicate flow rate, totalization or to communicate to remote sensors and controllers. The main advantages of this technology are that with no parts in the flow stream, there is no pressure loss, the accuracy is not affected by temperature, pressure, viscosity, density or flow profile and with no moving parts there is practically no maintenance required.



APPLICATION

Because of its inherent advantages over other more conventional technologies, this meter can be used in the majority of industrial flow applications. Whether the fluid is water or something highly corrosive, very viscous, contains a moderate amount of solids or requires special handling, this meter will be able to accurately measure it. Today Magnetoflow meters are successfully being used in most industries including food and beverage, pharmaceutical, water and wastewater, and chemical.



Magnetoflow® Flanged

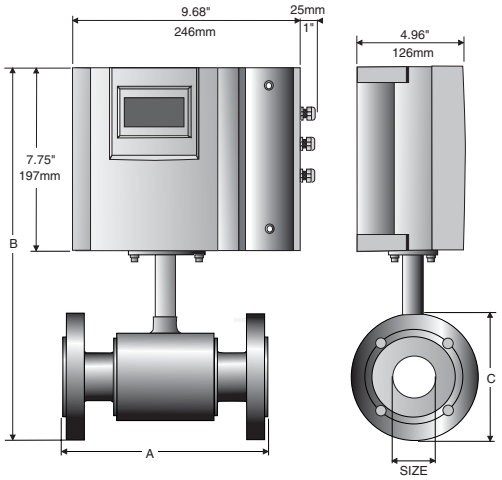
FEATURES

- 0.25% accuracy independent of fluid viscosity, density and temperature
- Unaffected by most solids contained in fluids
- Pulsed DC magnetic field for zero point stability
- No pressure loss for low operational costs
- Long life corrosion resistant liners
- Calibrated in state of the art facilities
- Integral and remote signal converter availability
- Optional grounding rings or grounding electrode
- Measurement largely independent of flow profile
- NSF listed

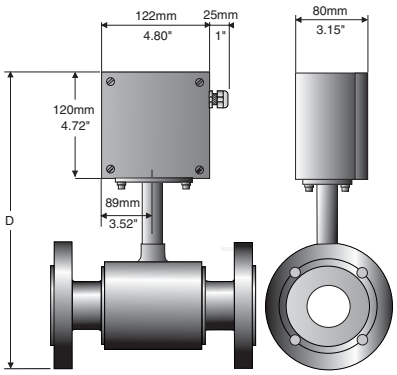
Electrodes

The two measuring electrodes, when looking from the end of the meter into the inside bore, are positioned at 3 o'clock and 9 o'clock. Badger Meter's Magnetoflow Mag meters have an "Empty Pipe Detection" feature. This is accomplished by the use of a third electrode that is positioned between 12 o'clock and 1 o'clock in the meter. At any time this electrode is not covered by fluid, (for a minimum of a five second duration), the meter will display an Empty Pipe Detection condition, send out an error message if desired, and stop measuring to maintain accuracy. When the electrode again becomes covered with fluid, the error message will disappear and the meter will continue measuring.

As an option to the use of a set of grounding rings, to assure proper grounding in a given installation a grounding electrode (4th electrode) can be installed in the meter when initially fabricated. The position of this electrode is about 5 o'clock.



Meter with Primo® Amplifier



Meter with junction box for remote Primo® Amplifier

Size		A		B		C		D		Est. Weight with Primo		Flow Range LPM		Flow Range GPM	
inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	Lbs	Kg	Min	Max	Min	Max
1/4	6	6.7	170	14.0	356	3.5	89	11.4	288	12	5.5	0.063	20	0.02	5
5/16	8	6.7	170	14.0	356	3.5	89	11.4	288	12	5.5	0.114	34	0.03	9
3/8	10	6.7	170	14.0	356	3.5	89	11.4	288	12	5.5	0.177	53	0.05	14
1/2	15	6.7	170	14.0	356	3.5	89	11.4	288	12	5.5	0.416	125	0.11	33
3/4	20	6.7	170	14.2	361	3.9	99	11.5	293	15	6.5	0.75	225	0.2	59
1	25	8.9	225	14.4	366	4.3	108	11.7	298	20	9.0	1.20	350	0.3	93
1 1/4	32	8.9	225	15.2	386	4.6	117	12.5	318	22	10.0	2.00	575	0.5	152
1 1/2	40	8.9	225	15.4	390	5.0	127	12.7	322	23	10.5	3.00	900	0.8	239
2	50	8.9	225	15.9	403	6.0	152	13.2	335	28	12.5	4.70	1400	1	373
2 1/2	65	11.0	280	17.1	434	7.0	178	14.4	366	54	24.5	8	2400	2	631
3	80	11.0	280	17.3	440	7.5	191	14.7	372	56	25.5	12	3600	3	956
4	100	11.0	280	18.4	466	9.0	229	15.7	398	58	26.5	19	5600	5	1493
5	125	15.8	400	19.6	498	10.0	254	16.9	430	60	27.0	30	8800	8	2334
6	150	15.8	400	20.6	524	11.0	279	17.9	456	62	28.0	40	12700	11	3361
8	200	15.8	400	22.5	572	13.5	343	20.4	518	88	40.0	75	22600	20	5975
10	250	19.7	500	26.8	681	16.0	406	24.1	613	180	82.0	120	35300	30	9336
12	300	19.7	500	28.9	734	19.0	483	26.2	666	209	95.0	170	50800	45	13444
14	350	23.6	590	30.8	782	21.0	533	28.2	716	260	118	230	69200	60	18299
16	400	23.6	590	33.7	856	23.5	597	31.0	788	308	140	300	90400	80	23901
18	450	23.6	590	35.0	890	25.0	635	32.4	822	402	182	380	114000	100	30250
20	500	23.6	590	38.2	969	27.5	699	35.5	901	495	225	470	140000	125	37346
22	550	23.6	590	39.6	1005	29.5	749	36.9	937	525	238	570	170000	150	45188
24	600	23.6	590	42.2	1071	32.0	813	39.5	1003	554	252	680	200000	180	53778
28	700	23.6	590	46.2	1173	36.5	927	44.0	1118	650	295	920	275000	240	73100
30	750	31.5	800	48.3	1228	39.0	984	45.7	1161	704	320	1060	315000	280	84000
32	800	31.5	800	52.2	1325	41.4	1015	49.5	1257	770	350	1200	361000	320	95600
36	900	31.5	800	55.3	1405	46.0	1168	54.1	1374	850	386	1500	457000	400	121000
40	1000	31.5	800	60.0	1525	50.2	1230	57.4	1457	924	420	1900	565000	500	149300
42	1050	36.0	914	66.0	1675	53.0	1346	63.4	1610	1100	500	2100	620000	550	164600
48	1200	39.4	1000	69.9	1775	59.4	1455	67.2	1707	1210	550	2700	814000	720	215100
54	1400	39.4	1000	78.5	1995	68.4	1675	75.9	1927	1364	620	3700	1100000	980	292700

SPECIFICATIONS - Detector

Flow Range: 0.1 - 39.4 fps (0.03-12 m/s)
Sizes: 1/4" to 54" (16 to 1400 mm)
Min. Conductivity: ≥ 5 micromhos/cm
Accuracy:
± 0.25% accuracy of rate from 1-39.4 fps.
± 0.5% accuracy of rate from 0.1-1.0 fps.
Electrode Materials: Standard: Alloy C
Optional: 316 Stainless Steel, Gold/Platinum Plated, Tantalum, Platinum/Rhodium
Liner Material: PFA up to 3/8", PTFE 1/2" thru 24", Soft and Hard Rubber from 1" to 54", Halar® from 14" to 40"
NSF Listed: Models with Hard Rubber Liner 4" size and up; PTFE Liner - All sizes.

"Only products bearing the NSF Mark are Certified."

Fluid Temperature:
With Remote Converter:
PFA, PTFE & Halar 311°F, (155°C)
Rubber 178°F, (80°C)
With Meter Mounted Converter:
PFA, PTFE & Halar 212°F, (100°C)
Rubber 178°F, (80°C)
Pressure Limits:
150 psi (10Bar) optional 300psi (20Bar)
Coil Power: Pulsed DC
Ambient Temperature: -4°F to 140°F, (-20°C to 60°C)
Pipe Spool Material: 316 Stainless Steel
Meter Housing Material: Carbon Steel welded

Flanges: Carbon Steel - Standard (ANSI B16.5 Class 150 RF) 316 Stainless Steel - Optional
Meter Enclosure Classification: Nema 4
Optional: Submersible Nema 6P (Remote Amplifier Required)
Junction Box Enclosure Protection:
(For Remote Converter Option) Powder coated die-cast aluminum, Nema 4
Cable Entries: 1/2" NPT Cord Grip
Optional Stainless Steel Grounding Rings:

Meter Size	Thickness (of one ring)
up thru 10"	.135"
12" to 20"	.187"

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Due to continuous research, product improvements and enhancements, Badger Meter reserves the right to change product or system specifications without notice, except to the extent an outstanding bid obligation exists.

Please see our website at
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Product Data Sheet
00813-0100-4360, Rev DB
October 2003

Rosemount 1151 Pressure Transmitter

- *Proven field performance and reliability*
- *Commitment to continuous improvement*
- *Application flexibility*



Content

Specifications . . . . . page 3
Product Certifications . . . . . page 7
Dimensional Drawings. . . . . page 9
Ordering Information . . . . . page 15

CE

ROSEMOUNT®

www.rosemount.com

EMERSON™
Process Management

Leading a tradition of excellence

With over five million transmitters installed worldwide, the 1151 continues to offer industry leading value. Changing customer needs have driven product improvements, while advanced manufacturing and testing processes have guaranteed product quality. Even today, the 1151 is world-renowned for proven field reliability and longevity.

Proven field performance and reliability

For over 30 years, the 1151 has provided the process control industry with unsurpassed service and reliability in even the harshest of environments. The lasting customer preference results from a combination of advanced technology, and a heritage of field proven performance.

Commitment to continuous improvement

Smart electronics increased rangeability to 40:1, reducing the number of transmitters to specify, procure and carry in inventory. In addition, ± 0.1% accuracy has been achieved through product improvements, meeting ever increasing pressure measurement requirements. A modular design allows interchangeable mechanical and electrical components, providing backward and forward compatibility.

Application flexibility

The 1151 offers a variety of configurations for differential, gage, absolute and liquid- level measurements. A high pressure models allows static line pressures up to 4500 psi (310 bar). Multiple wetted materials, as well as alternative fill fluids ensure process compatibility. Smart, analog and low-power electronics are available to meet specific application requirements.

Rosemount Pressure Solutions

Rosemount 3051S Series of Instrumentation
Scalable pressure, flow and level measurement solutions improve installation and maintenance practices.

Rosemount 3095MV Mass Flow Transmitter
Accurately measures differential pressure, static pressure and process temperature to dynamically calculate fully compensated mass flow.

Rosemount 305 and 306 Integral Manifolds
Factory-assembled, calibrated and seal-tested manifolds reduce on-site installation costs.

Rosemount 1199 Diaphragm Seals
Provides reliable, remote measurements of process pressure and protects the transmitter from hot, corrosive, or viscous fluids.

Orifice Plate Primary Element Systems: Rosemount 1495 and 1595 Orifice Plates, 1496 Flange Unions and 1497 Meter Sections
A comprehensive offering of orifice plates, flange unions and meter sections that is easy to specify and order. The 1595 Conditioning Orifice provides superior performance in tight fit applications.

Annubar Flowmeter Series: Rosemount 3051SFA, 3095MFA, and 485
The state-of-the-art, fifth generation Rosemount 485 Annubar combined with the 3051S or 3095MV MultiVariable transmitter creates an accurate, repeatable and dependable insertion-type flowmeter.

Compact Orifice Flowmeter Series: Rosemount 3051SFC, 3095MFC, and 405
Compact Orifice Flowmeters can be installed between existing flanges, up to a Class 600 (PN100) rating. In tight fit applications, a conditioning orifice plate version is available, requiring only two diameters of straight run upstream.

ProPlate Flowmeter Series: Rosemount ProPlate, Mass ProPlate, and 1195
These integral orifice flowmeters eliminate the inaccuracies that become more pronounced in small orifice line installations. The completely assembled, ready to install flowmeters reduce cost and simplify installation.

Specifications

FUNCTIONAL SPECIFICATIONS

Service

Liquid, gas, and vapor applications

Ranges

See Table 2 for ranges. Minimum span equals the upper range limit (URL) divided by rangedown. Rangedown varies with the output code See Table 1.

Outputs

Code S, Smart

4–20 mA dc, user selectable for linear or square root output. Digital process variable superimposed on 4–20 mA signal, available to any host that conforms to the HART® protocol.

Code E, Analog

4–20 mA dc, linear with process pressure

Code G, Analog

10–50 mA dc, linear with process pressure

Code J, Analog

4–20 mA dc, square root of differential input pressure between 4 and 100% of input. Linear with differential input pressure between 0 and 4% of input.

Code L, Low Power

0.8 to 3.2 V dc, linear with process pressure

Code M, Low Power

1 to 5 V dc, linear with process pressure

Current Consumption Under Normal Operating Conditions (Low Power Only)

Output Code L

1.5 mA dc

Output Code M

2.0 mA dc

Zero Elevation and Suppression

Output Codes S, E, and G

Zero elevation and suppression must be such that the lower range value is greater than or equal to the (–URL) and the upper range value is less than or equal to the (+URL). The calibrated span must be greater than or equal to the minimum span and less than or equal to the maximum span.

Output Code J

Zero is adjustable up to 10% of the calibrated flow span.

Output Code L

Zero is adjustable ±10% of URL and span is adjustable from 90 to 100% of URL.

Output Code M

Zero is adjustable ±50% of URL and span is adjustable from 50 to 100% of URL.

Span and Zero

Output Code S

Span and zero may be accessed with local adjustments or remotely through a HART-compatible Interface.

Output Codes E, G, J, L, and M

Span and zero are continuously adjustable.

Power Supply

External power supply required. Transmitter operates according to the following requirements:

Output Codes S, E, J

12 to 45 V dc with no load

Output Code G

30 to 85 V dc with no load

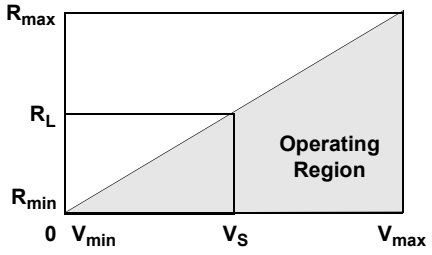
Output Code L

5 to 12 V dc

Output Code M

8 to 14 V dc

Where:



Code	V_{min}	V_{max}	R_{min}	R_{max}	R_L at Supply Voltage (V_S)
S(1)	12	45	0	1650	$R_L = 43.5 (V_S – 12)$
E(2), J	12	45	0	1650	$R_L = 50 (V_S – 12)$
G	30	85	0	1100	$R_L = 20 (V_S – 30)$
L	5	12	Low Power Minimum Load Impedance: 100 kΩ		
M	8	14			

(1) A minimum of 250 ohms is required for communication.

(2) For CSA approvals V_{max} = 42.4 V dc.

Temperature Limits

Electronics Operating

Code S: –40 to 185 °F (–40 to 85 °C)

Code E: –40 to 200 °F (–40 to 93 °C)

Code G, L, M: –20 to 200 °F (–29 to 93 °C)

Code J: –20 to 150 °F (–29 to 66 °C)

Sensing Element Operating

Silicone fill: –40 to 220 °F (–40 to 104 °C)

Inert fill: 0 to 160 °F (–18 to 71 °C)

Storage

Code S: –60 to 185 °F (–51 to 85 °C)

Codes E, G, L, M: –60 to 250 °F (–51 to 121 °C)

Code J: –60 to 180 °F (–51 to 82 °C)

TABLE 1. Rangeability

Output Code	Minimum Span	Maximum Span
S (DP and GP, SST, Range 3–8; HP SST, Range 4–7)	URL/40	2 × URL(1)
S (All Others)	URL/40(2)	2 × URL(1)
E, G, J	URL/6	URL
L	URL/1.1	URL
M	URL/2	URL

(1) Transmitter is capable of measuring from –URL to URL.

(2) Accuracy specification for calibrated spans from 1:1 to 6:1 of URL only.

TABLE 2. Transmitter Range Availability by Model (URL = Upper Range Limit)

Range Code	Model 1151 Ranges (URL)	DP	HP	GP	DP/GP/Seals	AP	LT
3	30 inH_20 (7.46 kPa)	•	NA	•	NA	NA	NA
4	150 inH_20 (31.08 kPa)	•	•	•	•	•	•
5	750 inH_20 (186.4 kPa)	•	•	•	•	•	•
6	100 psi (689.5 kPa)	•	•	•	•	•	•
7	300 psi (2,068 kPa)	•	•	•	•	•	NA
8	1,000 psi (6,895 kPa)	•	NA	•	NA	•	NA
9	3,000 psi (20,684 kPa)	NA	NA	•	NA	NA	NA
0	6,000 psi (41,369 kPa)	NA	NA	•	NA	NA	NA

TABLE 3. Upper Range Limits (URL)

Range Code	bar	mbar	kg/cm^2	psi	kPa	inH_20 @20 °C	mmH_2O @20 °C	inHg @0 °C
3	0.075	75	0.076	1.082	7.461	30	762	2.203
4	0.373	373	0.380	5.409	37.305	150	3810	11.013
5	1.865	1865	1.901	27.045	186.505	750	19050	55.065
6	6.90	6895	7.031	100	690	2773	70434	204
7	21	20685	21	300	2069	8319	211302	611
8	69	68950	70	1000	6895	27730	704340	2036
9	207	206850	211	3000	20685	83190	2113020	6108
0	413.686	413686	421.842	6000	41369	166378	4225992	12216.12

TABLE 4. Output Code Availability

Code	Model 1151 Output Options/Damping	DP	HP	GP	DP/GP/Seals	AP	LT
S	4–20 mA, Digital, Smart/Variable	•	•	•	•	•	•
E	4–20 mA, Linear, Analog/Variable	•	•	•	•	•	•
G	10–50 mA, Linear, Analog/Variable	•	•	•	•	•	•
J(1)	4–20 mA, Square Root, Analog/Variable	•	•	NA	NA	NA	NA
L	0.8 to 3.2 V, Linear, Low Power/Fixed	•	•	•	•	•	NA
M	1 to 5 V, Linear, Low Power/Fixed	•	•	•	•	•	NA

(1) Available with Ranges 3–5.

TABLE 5. Fill Fluid Specifications

Fill Fluid	Temperature Limits(1)	Specific Gravity	Coeff. of Therm. Exp. cc/cc/°F (cc/cc/°C)	Viscosity at 25 °C centistokes
D.C.® 200 Silicone	–40 to 400 °F (–40 to 205 °C)	0.934	0.00060 (0.00108)	9.5
D.C. 704 Silicone	60 to 400 °F (15 to 204 °C)	1.07	0.00053 (0.00095)	44
Inert Fill	–50 to 350 °F (–45 to 177 °C)	1.85	0.0004 (0.000864)	6.5
Syltherm®XLT, Silicone	–100 to 300 °F (–73 to 149 °C)	0.85	0.000666 (0.001199)	1.6
Glycerin and Water(2)	0 to 200 °F (–17 to 93 °C)	1.13	0.00019 (0.00034)	12.5
Propylene Glycol and Water(3)	0 to 200 °F (–17 to 93 °C)	1.02	0.00019 (0.00034)	2.85
Neobee M-20®(3)	0 to 400 °F (–17 to 205 °C)	0.900	0.00056 (0.001008)	9.8

(1) Temperature limits are reduced in vacuum service. Contact your local Rosemount representative for assistance.

(2) Glycerin and Water and Propylene Glycol and Water are not suitable for vacuum service.

(3) Not compatible with Buna-N or Ethylene-Propylene O-ring material.

Static Pressure and Overpressure Limits

Model 1151DP

0 psia to 2,000 psig (0 to 13.79 MPa) on either side without damage to transmitter. Operates within specifications from static line pressures of 0.5 psia (3.45 kPa) to 2,000 psig (13.79 MPa).

Model 1151HP

0 psia to 4,500 psig (0 to 31.02 MPa) on either side without damage to transmitter. Operates within specifications from 0.5 psia (3.45 kPa) to 4,500 psig (31.02 MPa).

Model 1151AP

0 psia to 2,000 psia (0 to 13.79 MPa) without damage to transmitter. Operates within specifications from 0 psia to the upper range limit of the transmitter.

Model 1151GP

0 psia to 2,000 psig (0 to 13.79 MPa) for ranges to 1,000 psig (6.90 MPa), 4,500 psig (31.02 MPa) for the 3,000 psig (20.68 MPa) range, and 7,500 psig (51.71 MPa) for the 6,000 psig (41.37 MPa) range, without damage to the transmitter. Operates within specifications from 0.5 psia (3.45 kPa) to the upper range limit of the transmitter.

Model 1151LT

TABLE 6. Flange Pressure Rating

Standard	Class/Rating	Carbon Steel	Stainless Steel
ANSI	150	285 psig(1)	275 psig(1)
ANSI	300	740 psig(1)	720 psig(1)
ANSI	600	1,480 psig(1)	1,440 psig(1)
DIN	PN 10–40	40 bar(2)	40 bar(2)
DIN	PN 10/16	16 bar(2)	16 bar(2)
DIN	PN 25/40	40 bar(2)	40 bar(2)

(1) At 100 °F (38 °C); the rating decreases with increasing temperature.

(2) At 248 °F (120 °C); the rating decreases with increasing temperature.

Burst Pressure All Models

10,000 psig (68.95 MPa) proof pressure on the flanges.

Humidity Limits

0 to 100% relative humidity

Volumetric Displacement

Less than 0.01 in^3 (0.16 cm^3)

Failure Mode Alarm (Output Code S)

If self-diagnosis detects a gross transmitter failure, the analog signal will be driven below 3.9 mA or above 21 mA to alert the user. High or low alarm signal is user selectable.

Level	4–20 mA Saturation Value	4–20 mA Alarm Value
Low	3.9 mA	3.8 mA
High	20.8 mA	21.75 mA

Transmitter Security (Output Code S)

Activating the transmitter security function prevents changes to the transmitter configuration, including local zero and span adjustments. Security is activated by an internal switch.

Overpressure Alarm (Output Code S)

If the sensor detects a negative overpressure value, the analog signal will be driven to 3.9 mA. If the sensor detects a positive overpressure value, the analog signal is driven to 20.8 mA.

Damping

Numbers given are for silicone fill fluid at room temperature. The minimum time constant is 0.2 seconds (0.4 seconds for Range 3). Inert-filled sensor values would be slightly higher.

Output Code S

Time constant is adjustable in 0.1 second increments from minimum to 16.0 seconds.

Output Codes E and G

Time constant continuously adjustable between minimum and 1.67 seconds.

Output Code J

Time constant continuously adjustable between minimum and 1.0 second.

Output Codes L, M

Damping is fixed at minimum time constant.

Model 1151LT

Time constant continuously adjustable between 0.4 and 2.2 seconds with silicone oil fill, or 1.1 and 2.7 seconds with inert fill for flush models and electronics codes E or G.

Turn-on Time

Maximum of 2.0 seconds with minimum damping. Low power output is within 0.2% of steady state value within 200 ms after application of power.

PERFORMANCE SPECIFICATIONS

(Zero-based calibrated ranges, reference conditions, silicone oil fill, 316 SST isolating diaphragms.)

Accuracy

Output Code S

Ranges 3 through 8, DP and GP transmitters;
Ranges 4 through 7, HP transmitters

±0.1 of calibrated span for spans from 1:1 to 10:1 of URL. Between 10:1 and 40:1 of URL.

$$\text{accuracy} = \pm\left[0.02\left(\frac{URL}{span}\right) - 0.1\right]\% \text{ of calibrated span}$$

All other ranges and transmitters

±0.25% of calibrated span(1)

Output Code S, square root mode

$$\pm\left[0.2 + 0.05x\left(\frac{URL}{span}\right)\right]\% \text{ of calibrated flow span}$$

Output Codes E, G, L, and M

±0.2% of calibrated span for Model 1151DP Ranges 3 through 5. All other ranges and transmitters, ±0.25% of calibrated span.

Output Code J

±0.25% of calibrated span

(1) Accuracy for Range 9, GP transmitter at 40:1 is ±0.7% of calibrated span.

Stability

Output Code S

±0.1% of URL for six months for DP and GP Ranges 3 through 8. (±0.25% for all other ranges and transmitters.)

Output Codes E and G

±0.2% of URL for six months for Ranges 3 through 5. (±0.25 for all other ranges.)

Output Codes J, L, and M

±0.25% of URL for six months

Temperature Effect

Output Code S [–20 to 185 °F (–29 to 85 °C)]

For DP and GP transmitter Range 4 through 8;
HP transmitter Range 4 through 7:

Zero Error = ±0.2% URL per 100 °F (56 °C)
Total Error = ±(0.2% URL + 0.18% of calibrated span) per 100 °F; For Range 3, double the stated effects. For other ranges and transmitters follow analog temperature specifications (Output Code E).

Output Code E, G, L, and M

[–20 to 200 °F (–29 to 93 °C)]
For Ranges 4 through 0

Zero Error = ±0.5% URL per 100 °F.
Total Error = ±(0.5% URL + 0.5% of calibrated span) per 100 °F; double the effect for Range 3.

Output Code J

The total output effect, whether at zero or full scale, including zero and span errors is ±1.5% of URL per 100 °F (56 °C). ±2.5% of URL per 100 °F (56 °C) for Range 3.

Static Pressure Effect – DP Transmitters

DP Transmitters

Zero Error

±0.25% of URL for 2,000 psi (13790 kPa) for Range 4 and 5 or ±0.5% for other ranges, correctable through rezeroing at line pressure.

Span Error

Correctable to ±0.25% of input reading per 1,000 psi (6895 kPa), or to ±0.5% for Range 3. For Output Code J, the span error is correctable to ±0.125% of output reading per 1,000 psi, or to ±0.25% for Range 3.

HP Transmitters

Zero Error

±2.0% of URL for 4,500 psi (31027 kPa), correctable through rezeroing at line pressure.

Span Error

Correctable to ±0.25% of input reading per 1,000 psi (6895 kPa).
For Output Code J, the span error is correctable to ±0.125% of output reading per 1,000 psi.

Vibration Effect

0.05% of URL per g to 200 Hz in any axis

Power Supply Effect

Output Codes S, E, G, and J

Less than 0.005% of output span per volt

Output Codes L, M

Output shift of less than 0.05% of URL for a 1 V power supply shift

Load Effect

Output Codes S, E, G, and J

No load effect other than the change in power supplied to the transmitter.

Output Codes L, M

Less than 0.05% of URL effect for a change in load from 100kΩ to infinite ohms.

Short Circuit Condition (Low Power Only)

No damage to the transmitter will result when the output is shorted to common or to power supply positive (limit 12 V).

EMI/RFI Effect

Output shift of less than 0.1% of span when tested to SAMA PMC 33.1 from 20 to 1000 MHz and for field strengths up to 30 V/m. (Code J is 0.1% of flow span.)

Mounting Position Effect

Zero shift of up to 1 inH_2O (0.25 kPa). Range 3 transmitters with Output Code J should be installed with the diaphragm in the vertical plane.

With liquid level diaphragm in vertical plane, zero shift of up to 1 inH_2O (0.25 kPa). With liquid level diaphragm in horizontal plane, zero shift of up to 5 inH_2O (1.25 kPa) plus extension length on extended units. All zero shifts can be calibrated out. No effect on span.

Physical Specifications, Standard Configuration

Electrical Connections

$^1/_2$–14 NPT conduit with screw terminals and integral test jacks compatible with miniature banana plugs (Pomona 2944, 3690, or equivalent). The HART Hand-Held Interface connections are fixed to the terminal block on smart transmitters.

Wetted Materials

Isolating Diaphragms

316L SST, Hastelloy® C-276®, or Tantalum. See ordering table for availability per model type.

Drain/Vent Valves

316 SST or Hastelloy C®, see ordering table for availability per model type.

Process Flanges and Adapters

Plated carbon steel, 316 SST or Hastelloy C, see ordering table for availability per model type.

Wetted O-rings

Viton® (other materials also available)

Weight

12 lb (5.4 kg) for AP, DP, GP, and HP transmitters, excluding options. Meter option: Add 2 lb (1 kg)

Non-wetted Materials

Fill Fluid

Silicone oil or inert fill

Bolts and Bolting Flange (GP and AP only)

Plated carbon steel

Electronics Housing

Low-copper aluminum. NEMA 4X

Cover O-rings

Buna-N

Paint

Polyurethane

Process Connections

1/4–18 NPT on 2.125-in. (54-mm) centers on flanges for Ranges 3, 4, and 5.

1/4–18 NPT on 2.188-in. (56-mm) centers on flanges for Ranges 6 and 7.

1/4–18 NPT on 2.250-in. (57-mm) centers on flanges for Range 8.

1/2–14 NPT on adapters.

For Ranges 3, 4, and 5, flange adapters can be rotated to give centers of 2.0 in. (51 mm), 2.125 in. (54 mm), or 2.250 in. (57 mm).

)

TABLE 7. Flange Weights with Model 1151LT Transmitter

Flange[(1)]	Flush	2-in (50mm) Ext.	4-in. (100mm) Ext.	6-in. (150mm) Ext.
2-in., Class 150	18 (8.2)	N/A	N/A	N/A
3-in., Class 150	23 (10.4)	25 (11.3)	26 (11.8)	27 (12.3)
4-in., Class 150	29 (13.2)	32 (14.5)	34 (15.4)	36 (16.3)
2-in., Class 300	20 (9.1)	N/A	N/A	N/A
3-in., Class 300	28 (12.7)	30 (13.6)	31 (14.1)	32 (14.5)
4-in., Class 300	38 (17.2)	41 (18.6)	43 (19.5)	45 (20.4)
2-in., Class 600	22 (10.0)	N/A	N/A	N/A
3-in., Class 600	31 (14.1)	33 (15.0)	34 (15.4)	35 (15.9)
DN 50, PN10-40	20 (9.1)	N/A	N/A	N/A
DN 80, PN 25/40	25 (11.3)	27 (12.3)	28 (12.7)	29 (13.2)
DN 100, PN 10/16	25 (11.3)	28 (12.7)	30 (13.6)	32 (14.5)
DN 100, PN 25/40	29 (13.2)	32 (14.5)	34 (15.4)	36 (16.3)

(1) Stainless steel flange weights are listed.

Product Certifications

Approved Manufacturing Locations

Rosemount Inc. — Chanhassen, Minnesota, USA

Fisher-Rosemount GmbH & Co. — Wessling, Germany

Emerson Process Management Asia Pacific Private Limited — Singapore

Beijing Rosemount Far East Instrument Co., Limited – Beijing, China

European Directive Information

The EC declaration of conformity for all applicable European directives for this product can be found on the Rosemount website at www.rosemount.com. A hard copy may be obtained by contacting our local sales office.

ATEX Directive (94/9/EC)

Emerson Process Management complies with the ATEX Directive.

European Pressure Equipment Directive (PED) (97/23/EC)

1151GP9, 0; 1151HP4, 5, 6, 7, 8 Pressure Transmitters
— QS Certificate of Assessment - EC No. PED-H-20 Module H Conformity Assessment

All other 1151 Pressure Transmitters
— Sound Engineering Practice

Transmitter Attachments: Diaphragm Seal - Process Flange - Manifold
— Sound Engineering Practice

Electro Magnetic Compatibility (EMC) (89/336/EEC)

All models
— EN 50081-1: 1992; EN 50082-2:1995;

Ordinary Location Certification for Factory Mutual

As standard, the transmitter has been examined and tested to determine that the design meets basic electrical, mechanical, and fire protection requirements by FM, a nationally recognized testing laboratory (NRTL) as accredited by the Federal Occupational Safety and Health Administration (OSHA).

Hazardous Locations Certifications

North American Certifications

Factory Mutual (FM) Approvals

FM Explosion Proof tag is standard. Appropriate tag will be substituted if optional certification is selected.

Explosion Proof: Class I, Division 1, Groups B, C, and D. Dust-Ignition Proof: Class II, Division 1, Groups E, F, and G; Class III, Division 1. Indoor and outdoor use. NEMA 4X. Factory Sealed.

I5 Intrinsically safe for Class I, II, and III Division 1, Groups A, B, C, D, E, F, and G hazardous locations in accordance with entity requirements and Control drawing 01151-0214 and 00268-0031. Non- incendive for Class I, Division 2, Groups A, B, C and D hazardous locations.

For entity parameters see control drawing 01151-0214.

Canadian Standards Association (CSA) Approvals

E6 Explosion proof for Class I, Division 1, Groups C and D; Class II, Division 1, Groups E, F, and G; Class III, Division 1 Hazardous Locations. Suitable for Class I, Division 2, Groups A, B, C, and D; CSA enclosure type 4X. Factory Sealed.

I6 Intrinsically safe for Class I, Division 1, Groups A, B, C, and D hazardous locations when connected per Drawing 01151-2575. For entity parameters see control drawing 01151-2575. Temperature Code T2D.

European Certifications

I1 ATEX Intrinsic Safety and Dust (1151 Smart only)
Certificate No.: BAS99ATEX1294X
ATEX Marking ⟨Ex⟩ II 1 GD
EEx ia IIC T5 (-60°C ≤ Ta ≤ 40°C)
EEx ia IIC T4 (-60°C ≤ Ta ≤ 80°C)
CE 1180
IP66

TABLE 8. IS Entity Parameters

Ui = 30 V
Ii = 125 mA
Pi = 1.0 W (T4) or 0.67 W (T5)
Ci = 0.034 μF
Li = 20 μH

Special Conditions for Safe Use (X)
The apparatus, is not capable of withstanding the 500V test as required by EN 50020: 1994. This must be taken into account when installing the apparatus.

N1 ATEX Type N and Dust Certification (1151 Smart only)
Certificate No.: BAS 99ATEX3293X
ATEX marking: ⟨Ex⟩ II 3 GD
EEx nL IIC T5 (-40°C ≤ Ta ≤ 40°C)
EEx nL IIC T4 (-40°C ≤ Ta ≤ 80°C)
Dust Rating: T90 °C (Ta = -20°C to 40°C)
U_i = 45 Vdc Max
CE
IP66

Special Conditions for Safe Use (x)
The apparatus is not capable of withstanding the 500V insulation test required by EN 50021: 1999. This must be taken into account when installing the apparatus.

E8 ATEX Flameproof
Certification Number CESI03ATEX037
ATEX Marking ⟨Ex⟩ II 1/2 G
EEx d IIC T6 (–40 ≤ Ta ≤ 40 °C)
EEx d IIC T4 (–40 ≤ Ta ≤ 80 °C)
CE 1180
V = 60 Vdc maximum

Australian Certifications

Standards Association of Australia (SAA) Certification

E7 Flameproof
Certificate Number Ex 494X
Ex d IIB + H_2 T6
DIP T6
IP65

Special Conditions for safe use (x):
For transmitters having NPT, PG or G cable entry threads, an appropriate flameproof thread adaptor shall be used to facilitate application of certified flameproof cable glands or conduit system.

I7 Intrinsically Safe
Certificate Number: Ex 122X
Ex ia IIC T5 (T_{amb} = 40 °C)
Ex ia IIC T4 (T_{amb} = 80 °C)

Special Conditions for Safe Use (x):
The equipment has been assessed to the entity concept and accordingly the following electrical parameters must be taken into account during installation.

TABLE 9. Entity Parameters

U_i = 30V
I_i = 125 mA
P_i = 1.0 W (T4) or 0.67W (T5)
C_i = 14.8 nF
L_i = 20 μH

N7 Type N
Certificate Number: Ex 887X
Ex n IIC T6 (T_{amb} = 40 °C)
Ex n IIC T5 (T_{amb} = 80 °C)
IP66

Special Conditions for safe use (x):
The equipment must be connected to a supply voltage which does not exceed the rated voltage. The enclosure end caps must be correctly fitted whilst the equipment is energized.

Combination Certifications

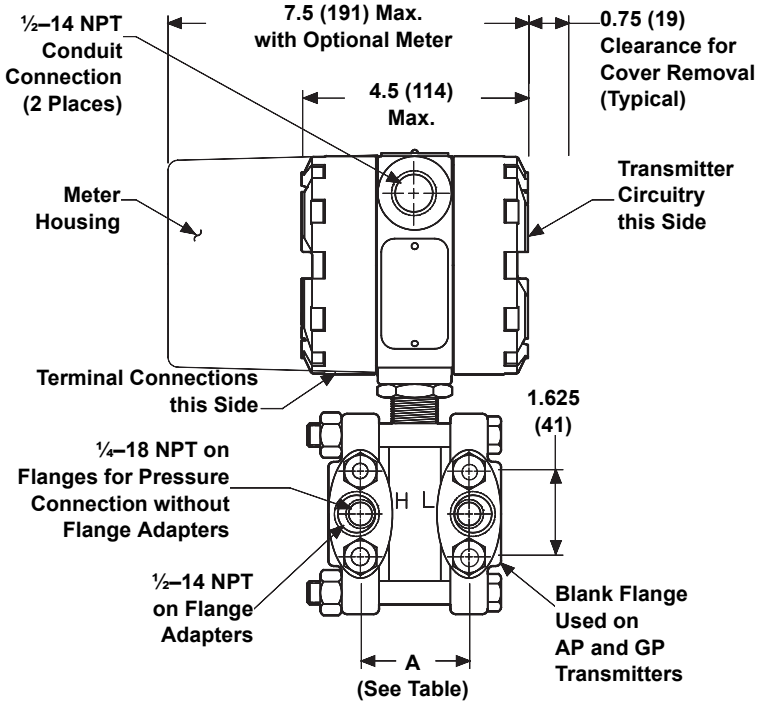
Stainless steel certification tag is provided when optional approval is specified. Once a device labeled with multiple approval types is installed, it should not be reinstalled using any other approval types. Permanently mark the approval label to distinguish it from unused approval types.

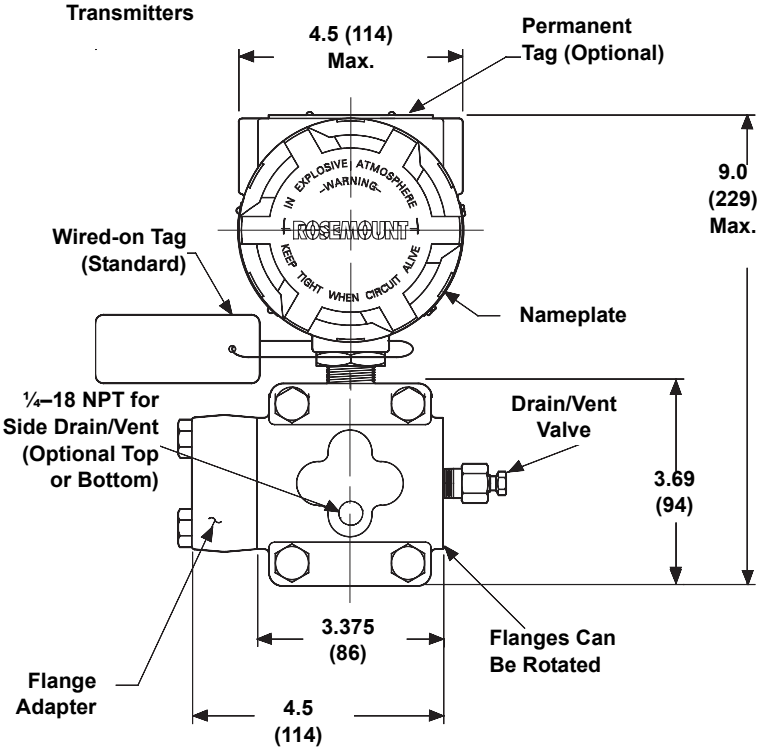
C6 Combination of I6 and E6, CSA Explosion Proof and Intrinsic Safety Approval. Factory Sealed.

K5 Combination of Explosion Proof, Intrinsic Safety, and Non-incendive Approvals.

Dimensional Drawings

Model 1151 Transmitter



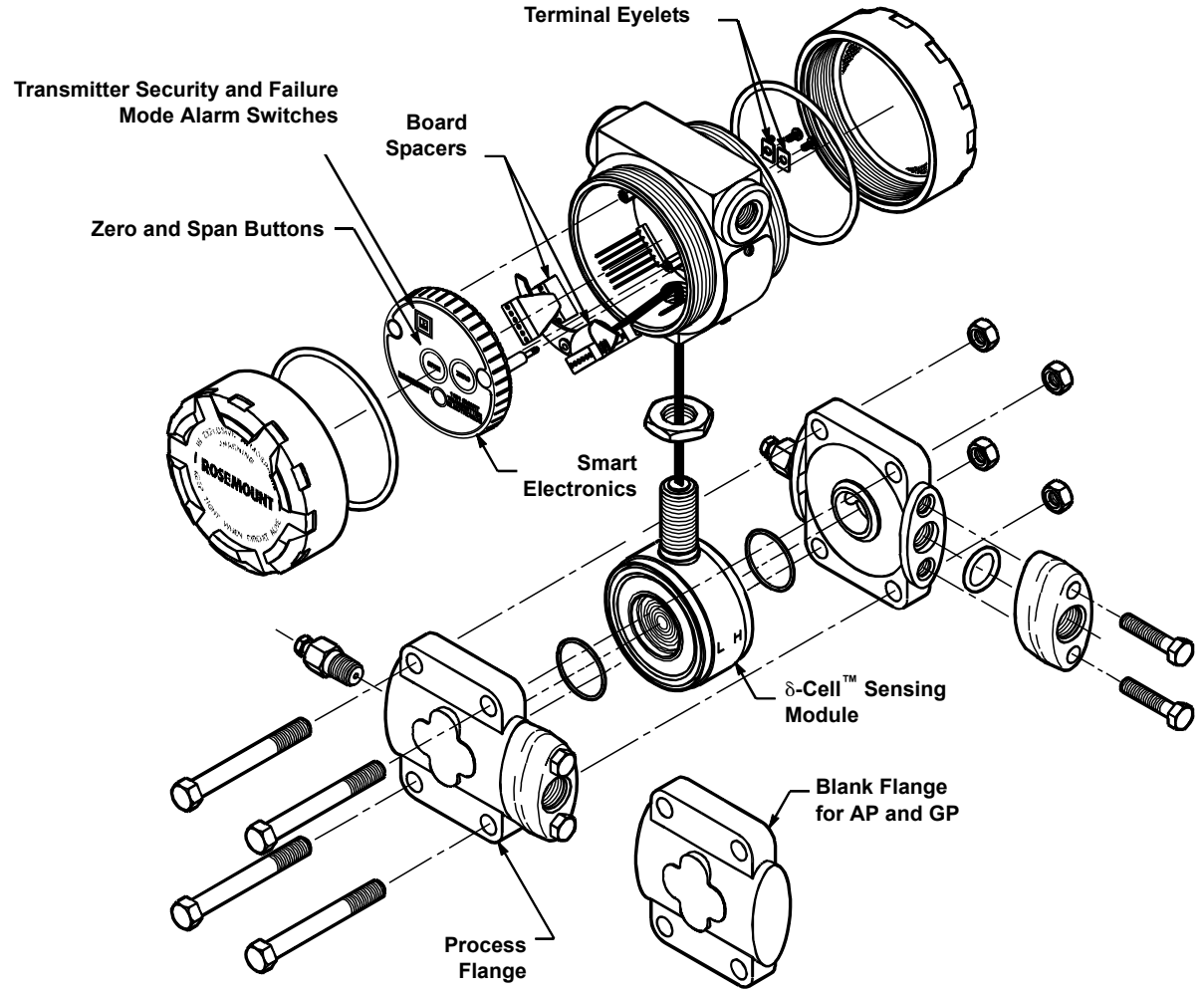


Flange Distance "A" Center to Center		
Range	inches	mm
3, 4, 5	2.125	54
6, 7	2.188	56
8	2.250	57
9	2.281	58
0	2.328	59

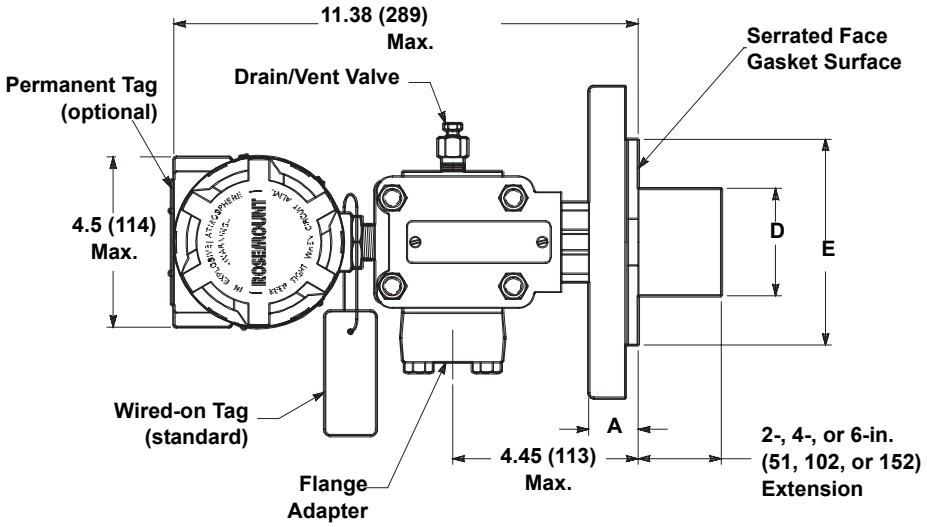
NOTE
Dimensions are in inches (millimeters).

1151-1151A, B05A

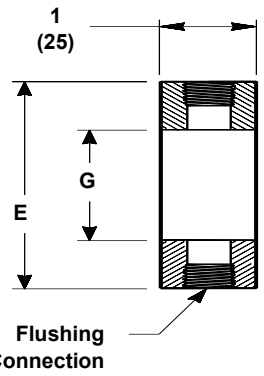
Typical Transmitter Exploded View with Smart Electronics

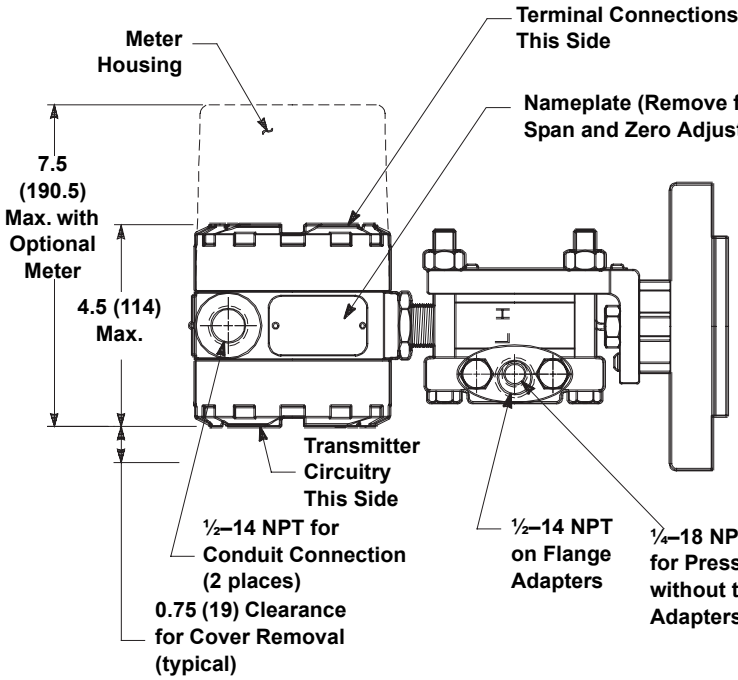


Model 1151LT

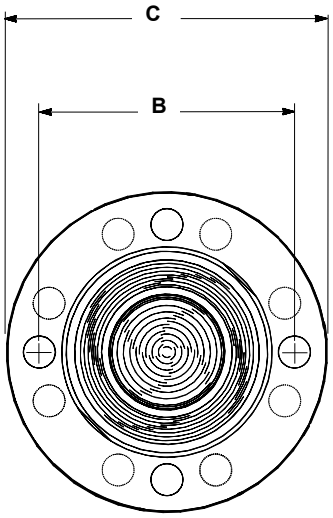


OPTIONAL FLUSHING CONNECTION RING (LOWER HOUSING)





DIAPHRAGM ASSEMBLY AND MOUNTING FLANGE



1151-51LTB05A 1151-1151B30B 1151-51LTA05A 3051-3051B27B

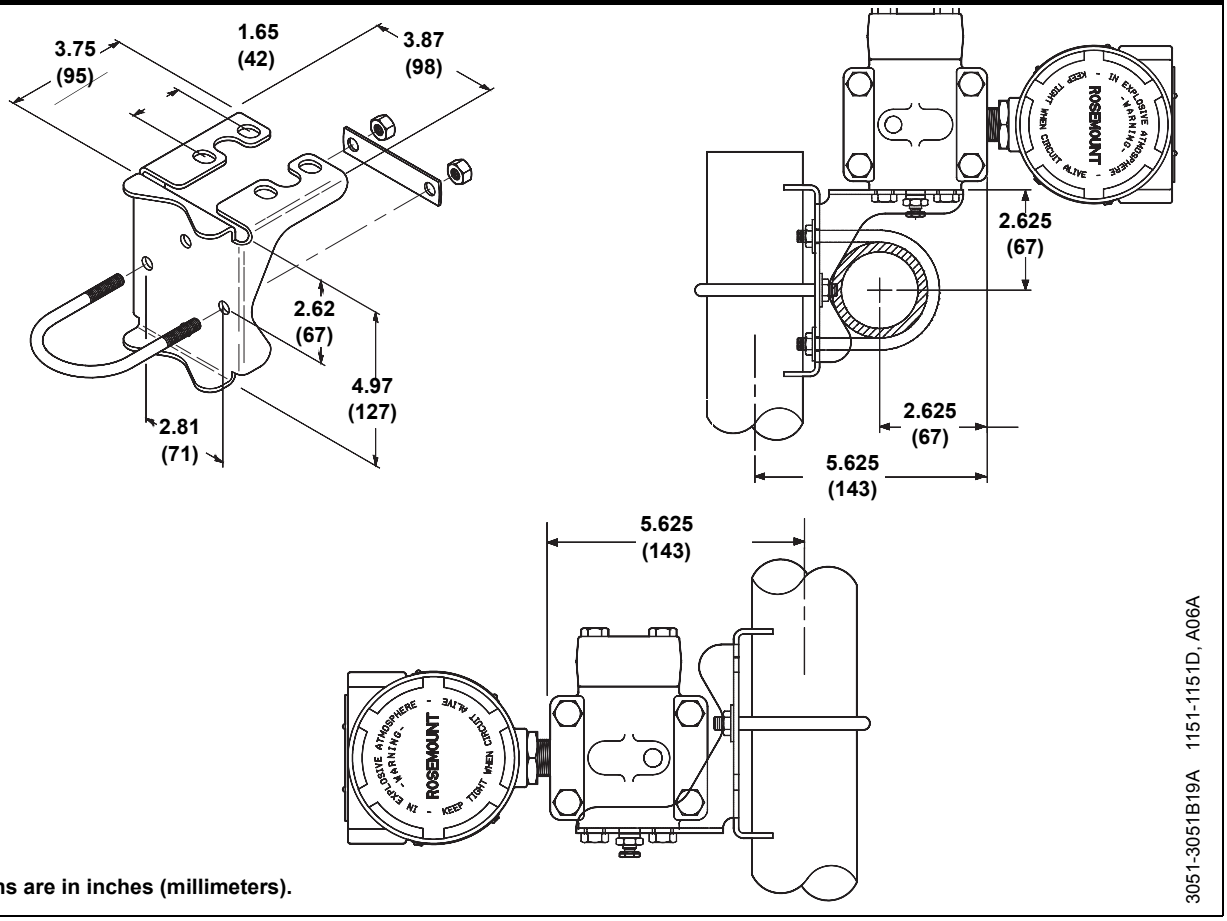
NOTE
Dimensions are in inches (millimeters).

TABLE 10. Model 1151LT Dimensional Specifications

Class	Pipe Size	Flange Thickness A	Bolt Circle Diameter B	Outside Diameter C	No. of Bolts	Bolt Hole Diameter	Exten. Diam. D (1)	O.D. Gask. Surf. E	Proc. Side G
ANSI 150	2 (51)	1.12 (28)	4.75 (121)	6.0 (152)	4	0.75 (19)	NA	3.6(92)	2.12 (54)
	3 (76)	1.31 (33)	6.0 (152)	7.5 (191)	4	0.75 (19)	2.58 (66)	5.0 (127)	3.5 (89)
	4 (102)	1.31 (33)	7.5 (191)	9.0 (229)	8	0.75 (19)	3.5 (89)	6.2 (158)	4.5 (114)
ANSI 300	2 (51)	1.25 (32)	5.0 (127)	6.5 (165)	8	0.75 (19)	NA	3.6(92)	2.12 (54)
	3 (76)	1.50 (38)	6.62 (168)	8.25 (210)	8	0.88 (22)	2.58 (66)	5.0 (127)	3.5 (89)
	4 (102)	1.62 (41)	7.88 (200)	10.0 (254)	8	0.88 (22)	3.5 (89)	6.2 (158)	4.5 (114)
ANSI 600	2 (51)	1.12 (28)	5.0 (127)	6.5 (165)	8	0.75 (19)	NA	3.6(92)	2.12 (54)
	3 (76)	1.37 (35)	6.62 (168)	6.62 (168)	8	0.88 (22)	2.58 (66)	5.0 (127)	3.5 (89)
DIN PN10-40	DN 50	26 mm	125 mm	165 mm	4	18 mm	NA	4.0 (102)	2.5 (63)
DIN PN 25/40	DN 80	30 mm	160 mm	200 mm	8	18 mm	65 mm	5.4 (138)	3.7 (94)
	DN 100	30 mm	190 mm	235 mm	8	22 mm	89 mm	6.2 (158)	4.5 (114)
DIN PN 10/16	DN 100	26 mm	180 mm	220 mm	8	18 mm	89 mm	6.2 (158)	4.5 (114)

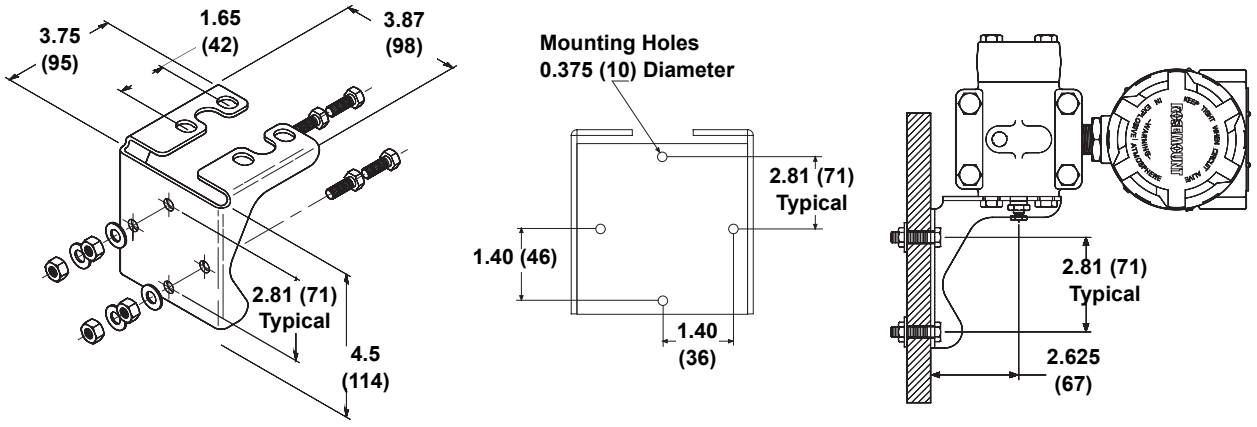
(1) Tolerances are 0.040 (1.02), –0.020 (0.51).

Mounting Bracket Option Codes B1, B4, and B7



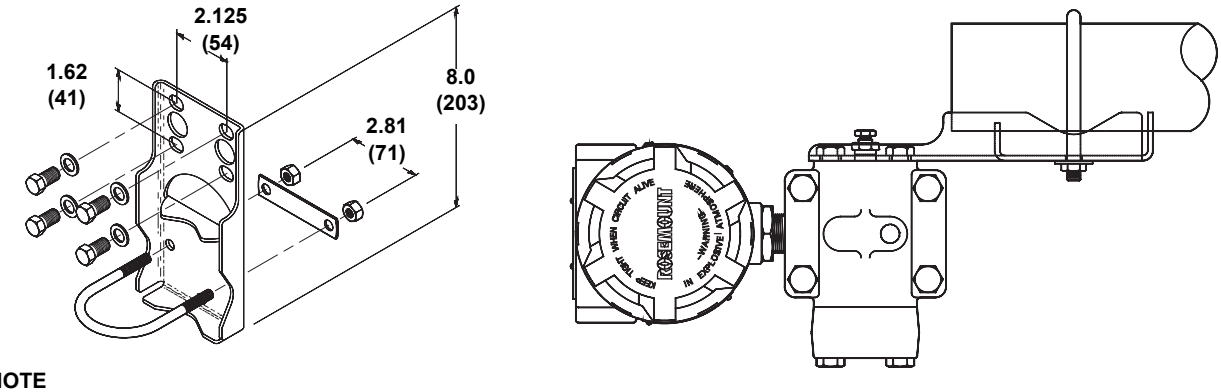
NOTE
Dimensions are in inches (millimeters).

Panel Mounting Bracket Option Codes B2 and B5



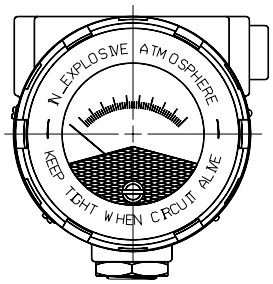
NOTE
Dimensions are in inches

Flat Mounting Bracket Option Codes B3, B6, and B9

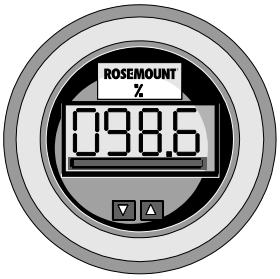


NOTE
Dimensions are in inches (millimeters).

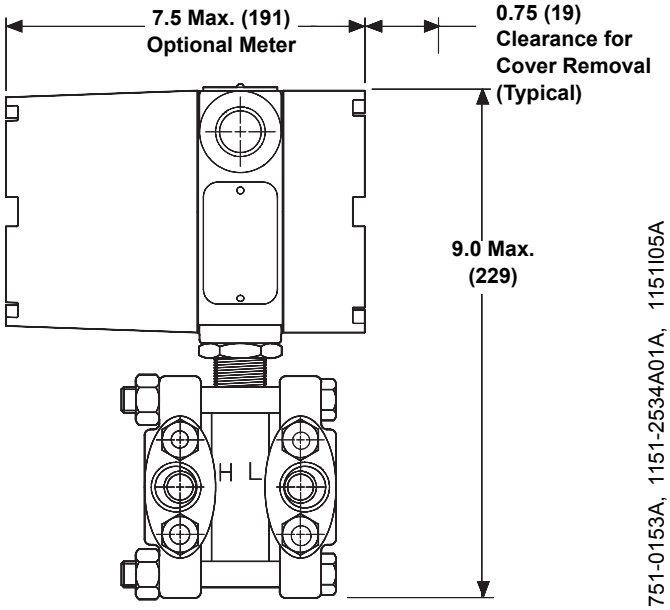
Meter Options



OPTION CODE M1
LINEAR SCALE



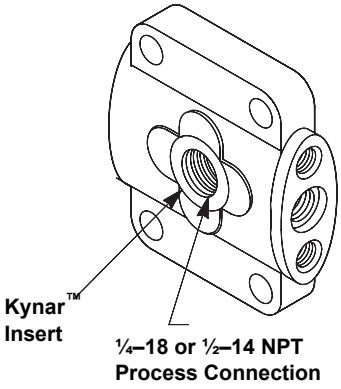
OPTION CODE M4
LINEAR SCALE



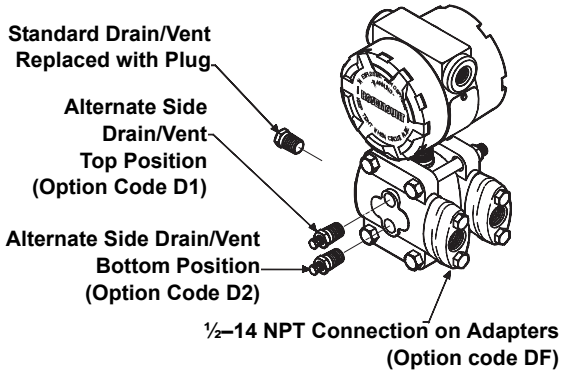
751-0153A, 1151-2534A01A, 1151I05A

NOTE
DImensions are in inches

Flange Insert



Model 1151 Process Connections



Ordering Information

TABLE 11. Model 1151 Differential, High Line, Gage and Absolute Pressure Transmitters — = Not Applicable • = Applicable

Model	Transmitter Type (select one)	DP	HP	GP	AP
1151DP	Differential Pressure Transmitter	•	—	—	—
1151HP	Differential Pressure Transmitter for High Line Pressures	—	•	—	—
1151GP	Gage Pressure Transmitter	—	—	•	—
1151AP	Absolute Pressure Transmitter	—	—	—	•
Code	**Pressure Ranges (URL) (select one)**	**DP**	**HP**	**GP**	**AP**
3	30 inH_2O (7.46 kPa)	•	—	•	—
4	150 inH_2O (37.3 kPa)	•	•	•	—
5	750 inH_2O (186.4 kPa)	•	•	•	•
6	100 psi (689.5 kPa)	•	•	•	•
7	300 psi (2068 kPa)	•	•	•	•
8	1,000 psi (6895 kPa)	•	—	•	•
9	3,000 psi (20684 kPa)	—	—	•	—
0	6,000 psi (41369 kPa)	—	—	•	—
Code	**Transmitter Output (select one)**	**DP**	**HP**	**GP**	**AP**
S	4–20 mA/Digital, Smart/Variable Damping	•	•	•	•
E	4–20 mA, Linear, Analog/Variable Damping	•	•	•	•
G	10–50 mA, Linear, Analog/Variable Damping	•	•	•	•
J	4–20 mA, Square Root, Analog/Variable Damping	•	•	—	—
L	0.8 to 3.2 V, Linear, Low Power/Fixed Damping	•	•	•	•
M	1 to 5 V, Linear, Low Power/Fixed Damping	•	•	•	•

Code	MATERIALS OF CONSTRUCTION[1] Flanges/Adapters	Drain/Vents	Diaphragms	Fill Fluid	DP	HP	GP[2]	AP[2]
52	Nickel-plated Carbon Steel	316 SST	316L SST	Silicone	•	•	•	•
53	Nickel-plated Carbon Steel	316 SST	Hastelloy C-276	Silicone	•	•	•	•
55	Nickel-plated Carbon Steel	316 SST	Tantalum	Silicone	•	—	•	—
12	Cadmium-plated Carbon Steel	316 SST	316L SST	Silicone	•	•	•	•
22	316 SST	316 SST	316L SST	Silicone	•	•	•	•
23	316 SST	316 SST	Hastelloy C-276	Silicone	•	•	•	•
25	316 SST	316 SST	Tantalum	Silicone	•	—	•	—
33[3]	Hastelloy C	Hastelloy C-276	Hastelloy C-276	Silicone	•	•	•	•
35	Hastelloy C	Hastelloy C-276	Tantalum	Silicone	•	—	•	—
73[3]	316 SST	Hastelloy C-276	Hastelloy C-276	Silicone	•	•	•	•
83[3]	Nickel-plated Carbon Steel	Hastelloy C-276	Hastelloy C-276	Silicone	•	•	•	•
5A	Nickel-plated Carbon Steel	316 SST	316L SST	Inert	•	—	•	—
5B	Nickel-plated Carbon Steel	316 SST	Hastelloy C-276	Inert	•	—	•	—
5D	Nickel-plated Carbon Steel	316 SST	Tantalum	Inert	•	•	•	—
1A	Cadmium-plated Carbon Steel	316 SST	316L SST	Inert	•	—	•	—
2A	316 SST	316 SST	316L SST	Inert	•	—	•	—
2B	316 SST	316 SST	Hastelloy C-276	Inert	•	—	•	—
2D	316 SST	316 SST	Tantalum	Inert	•	—	•	—
3B[3]	Hastelloy C	Hastelloy C-276	Hastelloy C-276	Inert	•	—	•	—
3D	Hastelloy C	Hastelloy C-276	Tantalum	Inert	•	—	•	—
7B[3]	316 SST	Hastelloy C-276	Hastelloy C-276	Inert	•	—	•	—
8B[3]	Nickel-plated Carbon Steel	Hastelloy C-276	Hastelloy C-276	Inert	•	—	•	—

Continued on Next Page

TABLE 11. Model 1151 Differential, High Line, Gage and Absolute Pressure Transmitters — = Not Applicable • = Applicable

Code	Mounting Brackets (Optional – Select One)	DP	HP	GP	AP
B1	Bracket, 2-in. Pipe Mount	•	•	•	•
B2	Bracket, Panel Mount	•	•	•	•
B3	Bracket, Flat, 2-in. Pipe Mount	•	•	•	•
B4	B1 Bracket w/Series 316 SST Bolts	•	•	•	•
B5	B2 Bracket w/Series 316 SST Bolts	•	•	•	•
B6	B3 Bracket w/Series 316 SST Bolts	•	•	•	•
B7	316 SST B1 Bracket with 316 SST Bolts	•	•	•	•
B9	316 SST B3 Bracket with 316 SST Bolts	•	•	•	•
Code	**Meters (optional - select one)(4)**	**DP**	**HP**	**GP**	**AP**
M1	Analog Scale, Linear Meter, 0–100%	•	•	•	•
M2	Analog Scale, Square Root Meter, 0–100% Flow Note: Not available with Output Code J.	•	•	—	—
M3	Analog Scale, Linear Meter, Special Scale	•	•	•	•
M4	LCD Meter, Linear Meter, 0–100%, User Selectable Note: Not available with Output Code G.	•	•	•	•
M6	Analog Scale, Square Root Meter, 1–10√ Note: Not available with Output Code J.	•	•	—	—
M7	LCD Meter, Linear Meter, Special Configuration Note: Not available with Output Code G.	•	•	•	•
M8	LCD Meter Square Root Meter, 0–100% Flow Note: Not available with Output Codes G or J.	•	•	—	—
M9	LCD Meter, Square Root Meter, 0–10√ Note: Not available with Output Codes G or J.	•	•	—	—
Code	**Certifications (optional - select one) Note: FM explosion-proof approval is standard.**	**DP**	**HP**	**GP**	**AP**
I5(5)	Factory Mutual (FM) Approvals Non-incendive and Intrinsic Safety Approval	•	•	•	•
K5	Factory Mutual (FM) Approvals Explosion-Proof and Intrinsic Safety Combination	•	•	•	•
C5(6)	Measurement Canada Accuracy Approval	•	•	•	•
C6(5)	CSA Explosion-Proof and Intrinsic Safety Approval (Requires 42.4 V dc max. power supply)	•	•	•	•
K6(7)	CSA/CENELEC Explosion-Proof and Intrinsic Safety Approval	•	•	•	•
E6	Canadian Standards Association (CSA) Explosion-Proof Approval				
E7	Standards Association of Australia (SAA) Flameproof Certification	•	•	•	•
E8	ATEX Flameproof Certification	•	•	•	•
I1(7)	ATEX Intrinsic Safety and Dust Certification	•	•	•	•
I7(5)	Standards Association of Australia (SAA) Intrinsic Safety Certification	•	•	•	•
N1(7)	ATEX Type N and Dust Certification	•	•	•	•
N7	Standards Association of Australia (SAA) Non-incendive Safety Approval	•	•	•	•
Q4	Calibration Data Sheet	•	•	•	•
Q8(8)	Material Traceability per EN 10204 3.1.B	•	•	•	•
Code	**Housing**	**DP**	**HP**	**GP**	**AP**
H1(9)	SST Non-wetted Parts on Transmitter without Meter	•	•	•	•
H2(9)	SST Non-wetted Parts on Transmitter with Meter	•	•	•	•
H3	SST Housing, Covers, Conduit Plug, Lock-nut, Without Meter	•	•	•	•
H4	SST Housing, Covers, Conduit Plug, Lock-nut, With Meter	•	•	•	•
C1	PG 13.5 Conduit Threads (Available in Germany Only)	•	•	•	•
C2	M20 Conduit Threads (Available in Germany Only)	•	•	•	•
J1	G½ Conduit Threads	•	•	•	•
Code	**Terminal Blocks**	**DP**	**HP**	**GP**	**AP**
R1	Integral Transient Protection (Only available with Option Code S and E electronics)	•	•	•	•
Code	**Bolts for Flanges and Adapters (optional - select one)**	**DP**	**HP**	**GP**	**AP**
L3	ASTM A193-B7 Flange and Adapter Bolts	•	•	•	•
L4	316 SST Flange and Adapter Bolts	•	•	•	•
L5	ASTM A193-B7M Flange and Adapter Bolts	•	•	•	•

Continued on Next Page

TABLE 11. Model 1151 Differential, High Line, Gage and Absolute Pressure Transmitters — = Not Applicable • = Applicable

Code	Process Connections (optional[10])		DP	HP	GP	AP
D1	Side Drain/Vent, Top	316 SST	•	•	•	•
		Hastelloy C-276	•	•	•	•
D2	Side Drain/Vent, Bottom	316 SST	•	•	•	•
		Hastelloy C-276	•	•	•	•
DF	½–14 NPT Flange adapter(s)- Material determined by flange material		•	•	•	•
D4	Conformance to DIN 19213 and DIN 50049 3.1.B Ranges 3, 4, 5 (Available in Germany Only)		•	•	•	•
D5	Conformance to DIN 19213 and DIN 50049 3.1.B Ranges 6, 7, 8, without ¼ NPT Threads or Drain/Vent Valve Connections (Available in Germany Only)		—	—	•	•
D6	316 SST Low Side Blank Flange		•	•	•	•
D9	JIS Process Connection–RC ¼ Flange	Carbon Steel	•	•	•	•
	with RC ½ Flange Adapter	316 SST	•	•	•	•
		Hastelloy C	•	•	•	•
G1	DIN Spacing (Single Entry Port, No Side V/D Hole Flange)		•	•	•	•
G2	DIN Spacing (Single Entry Port, Two Side V/D Hole Flange)		•	•	•	•
G3	DIN Spacing (Dual Entry Port, No Side V/D Hole Flange)		•	•	•	•
G4	DIN Spacing (Dual Entry Port, One Top Side V/D Hole Flange)		•	•	•	•
G5	DIN Spacing (Dual Entry Port, One Bottom Side V/D Hole Flange)		•	•	•	•
G6	DIN Spacing (Dual Entry Port, Two Side V/D Hole Flange)		•	—	•	•
K1[11]	*Kynar* insert, ¼–18 NPT		•	—	•	•
K2[11]	*Kynar* insert, ½–14 NPT		•	—	•	—
S1[12]	Attachment of One Remote Seal		•	—	•	—
S2[12]	Attachment of Two Remote Seals		•	•	—	—
S4[13]	Attachment of Integral Orifice Assembly		•	—	—	—

Continued on Next Page

(1) Bolts and conduit plugs are plated carbon steel.

(2) On GP and AP transmitters, the low-side flange is plated carbon steel. For a stainless-steel low-side flange, order process connection Option Code D6.

(3) Materials of Construction meet NACE material recommendation per MR 01-75. Environmental limits apply to certain materials. Consult latest standard for details.

(4) Not available with Output Codes L or M, or Option Codes V2 or V3.

(5) Not available with Output Code G.

(6) Limited availability depending on transmitter type and range. Contact your Rosemount representative.

(7) Not available with Output Codes E, G, J, L, or M.

(8) This option is available for the transmitter flange and adapters.

(9) Option includes SST housing, covers, conduit plug, locknut, L4 bolting, and D6 low side blank flange for GP and AP transmitters. Option Codes L4 and D6 parts are included with housing Option Codes H1 and H2.

(10) Allowable combinations are: D1, D6; D2, D6; and D6, S1.

(11) The maximum working pressure on this option is 300 psig. Available only with materials of construction Option Codes 1x or 2x.

(12) This option may only be used on Ranges 4–8.

(13) This option has a maximum static pressure rating of 3,000 psi, and is available for factory assembly only without associated piping and is available only for Ranges 2, 3, 4, and 5.

Code	Wetted O-ring Material	DP	HP	GP	AP
W2	Buna-N	•	•	•	•
W3	Ethylene-Propylene	•	•	•	•
W4	Aflas	•	•	•	•
W6(1)	Spring-loaded *Teflon*®	•	—	•	•
W7(2)	Teflon	•	—	•	•
Code	**Procedures**	**DP**	**HP**	**GP**	**AP**
C9(3)	Software Configuration	•	•	•	•
P1(4)	Hydrostatic Testing, 150% Maximum Working Pressure	•	•	•	•
P2(5)	Cleaning for Special Service	•	•	•	•
P3	Cleaning for <1 PPM Chlorine/Fluorine	•	•	•	•
P4	Calibrate at Line Pressure NOTE: Specify Q48 on order for corresponding certificate.	•	•	—	—
P5	Calibrate at Specific Temperature	•	•	•	•
P7(6)	Improved Temperature Coefficient	•	•	•	•
P8(7)	Calibrate to 0.1% Accuracy	•	•	•	—
Code	**Outputs**	**DP**	**HP**	**GP**	**AP**
V1(8)	Reverse Output	—	—	•	—
V2(9)	4–20 mV Test Signal	•	•	•	•
V3(9)	20–100 mV Test Signal	•	•	•	•

Typical Model Number: 1151DP 4 S 52 B3 M1

(1) Contains a Hastelloy spring that is wetted by the process; consult factory for Teflon *O-ring without a spring.*

(2) Teflon O-ring has seal property limitations; Consult your Rosemount representative for more information.

(3) Available with Output Code S only.

(4) Hydrostatic testing for Range 0, 125% maximum working pressure.

(5) Fluorolube® grease on wetted O-rings.

(6) Not available on Range 10: limited to 1,500 psi on Range 9; not applicable with Output Code S.

(7) Available only with stainless steel isolators and for span of 10 inH_2O and greater; not available with Output Code S ranges 3 - 8, or Output Code J; not available on AP.

(8) Reverse output option is not needed with smart electronics; configured via HART-based communicator.

(9) Not available with Output Codes L or M.

TABLE 12. Rosemount 1151 LT Flange-Mounted Liquid Level Transmitter

Model	Product Description		
1151LT	Alphaline Flange-Mounted Liquid Level Transmitter		
Code	**Range**		
4	150 inH_2O (3,810 mmH_2O)		
5	750 inH_2O (9,050 mmH_2O)		
6	2,770 inH_2O (70,36 mmH_2O)		
Code	**Output**		
S	4–20 mA dc HART Protocol, Smart/Variable Damping		
E	4–20 mA dc, with Adjustable Damping		
G	10–50 mA dc, with Adjustable Damping		
Code	**Size**	**Material**	**Extension Length(1)**
G0	2 in./DN 50	316L SST	Flush Mount Only
H0	2 in./DN 50	Hastelloy C-276	Flush Mount Only
J0	2 in./DN 50	Tantalum	Flush Mount Only
A0	3 in./DN 80	316L SST	Flush Mount
A2	3 in./DN 80	316L SST	2 in./50 mm
A4	3 in./DN 80	316L SST	4 in./100 mm
A6	3 in./DN 80	316L SST	6 in./150 mm
B0	4 in./DN 100	316L SST	Flush Mount
B2	4 in./DN 100	316L SST	2 in./50 mm
B4	4 in./DN 100	316L SST	4 in./100 mm
B6	4 in./DN 100	316L SST	6 in./150 mm
C0	3 in./DN 80	Hastelloy C-276	Flush Mount
C2	3 in./DN 80	Hastelloy C-276	2 in./50 mm
C4	3 in./DN 80	Hastelloy C-276	4 in./100 mm
C6	3 in./DN 80	Hastelloy C-276	6 in./150 mm
D0	4 in./DN 100	Hastelloy C-276	Flush Mount
D2	4 in./DN 100	Hastelloy C-276	2 in./50 mm
D4	4 in./DN 100	Hastelloy C-276	4 in./100 mm
D6	4 in./DN 100	Hastelloy C-276	6 in./150 mm
E0	3 in./DN 80	Tantalum	Flush Mount Only
F0	4 in./DN 100	Tantalum	Flush Mount Only

Continued on Next Page

(1) Extension diameters are sized to fit schedule 80 pipe. Consult factory for Schedule 40 pipe.

	MOUNTING FLANGE			
Code	**Size**	**Rating**		**Material**
M	2 in.	Class 150	ANSI	CS
A	3 in.	Class 150	ANSI	CS
B	4 in.	Class 150	ANSI	CS
N	2 in.	Class 300	ANSI	CS
C	3 in.	Class 300	ANSI	CS
D	4 in.	Class 300	ANSI	CS
P	2 in.	Class 600	ANSI	CS
E	3 in.	Class 600	ANSI	CS
X	2 in.	Class 150	ANSI	SST
F	3 in.	Class 150	ANSI	SST
G	4 in.	Class 150	ANSI	SST
Y	2 in.	Class 300	ANSI	SST
H	3 in.	Class 300	ANSI	SST
J	4 in.	Class 300	ANSI	SST
Z	2 in.	Class 600	ANSI	SST
L	3 in.	Class 600	ANSI	SST
Q	DN 50	PN 10-40	DIN	CS
R	DN 80	PN 40	DIN	CS
S	DN 100	PN 40	DIN	CS
V	DN 100	PN 10/16	DIN	CS
K	DN 50	PN 10-40	DIN	SST
T	DN 80	PN 40	DIN	SST
U	DN 100	PN 40	DIN	SST
W	DN 100	PN 10/16	DIN	SST

	SENSOR MODULE AND LOW-SIDE MATERIALS OF CONSTRUCTION			
Code	**Low-Side Flange and Adapter**	**Drain/Vent Valves**	**Low-Side Isolator Diaphragm**	**Low-Side Fluid Fill**
52	Nickel-plated CS	316 SST	316L SST	Silicone
12	Cadmium-plated CS	316 SST	316L SST	Silicone
55	Ni Plated CS	316 SST	Tantalum	Silicone
22	316 SST	316 SST	316L SST	Silicone
23	316 SST	316 SST	Hastelloy C-276	Silicone
25	316 SST	316 SST	Tantalum	Silicone
33	Hastelloy C	Hastelloy C-276	Hastelloy C-276	Silicone
35	Hastelloy C	Hastelloy C-276	Tantalum	Silicone
1A	Cadmium-plated CS	316 SST	316L SST	Inert
5D	Nickel-plated CS	316 SST	Tantalum	Inert
2A	316 SST	316 SST	316L SST	Inert
2B	316 SST	316 SST	Hastelloy C-276	Inert
2D	316 SST	316 SST	Tantalum	Inert
3B	Hastelloy C	Hastelloy C-276	Hastelloy C-276	Inert
3D	Hastelloy C	Hastelloy C-276	Tantalum	Inert

Code	**Process Fill—High Pressure Side**	**Temperature Limits**
A	Syltherm XLT	–100 to 300 °F (–73 to 135 °C)
C	D. C. Silicone 704	60 to 400 °F (15 to 205 °C)
D	D. C. Silicone 200	–40 to 400 °F (–40 to 205 °C)
H	Inert	–50 to 350 °F (–45 to 177 °C)
G	Glycerin and Water	0 to 200 °F (–17 to 93 °C)
N	Neobee M-20	0 to 400 °F (–17 to 205 °C)
P	Propylene Glycol and Water	0 to 200 °F (–17 to 93 °C)

Continued on Next Page

Code	Options (see complete approvals descriptions)
S1[1]	Assembly of one Remote Seal
	Meters
M1[2]	Linear Meter, 0–100% Scale
M3[2]	Special Scale Meter, Specify Range
M4[2]	LCD Meter, 0–100%
M7[2][3]	LCD Meter, Linear, Special Configuration
	Harzardous Locations Certifications NOTE: FM explosion-proof approval is standard.
E6	Canadian Standards Association (CSA) Explosion-Proof Approval
I5[3]	Factory Mutual (FM) Approvals Non-incendive and Intrinsic Safety Approval
K5	Factory Mutual (FM) Approvals Explosion-Proof and Intrinsic Safety Combination
C5[4]	Measurement Canada Accuracy Approval
C6[3]	CSA Explosion-Proof and Intrinsic Safety Approval (Requires 42.4 V dc max. power supply)
K6[3]	ATEX Explosion-Proof and Intrinsic Safety Approval
E7	Standards Association of Australia (SAA) Flameproof Certification
E8	ATEX Flameproof Certification
I1[3]	ATEX Intrinsic Safety and Dust Certification
I7[3]	Standards Association of Australia (SAA) Intrinsic Safety Certification
N1[3]	ATEX Type N and Dust Certification
N7	Standards Association of Australia (SAA) Non-incendive Safety Approval
	Other Options
W5	Copper O-ring for Vacuum Service (Nonwetted)
Q4	Calibration Data Sheet
Q8[5]	Material Traceability per EN 10204 3.1.B
V1	Reverse Output
V2	4–20 mV Test Signal
V3	20–100 mV Test Signal
F_	Select One Code from Flushing Connections Lower Housing Option

Code	Flushing Connection Ring Material (Lower Housing)	Flushing Connections	Size	Diaphragm Size 2-in.	3-in.	4-in.
F1	SST	1	1/4-18 NPT	•	•	•
F2	SST	2	1/4-18 NPT	•	•	•
F3[6]	Hastelloy C-276	1	1/4-18 NPT	•	•	•
F4[6]	Hastelloy C-276	2	1/4-18 NPT	•	•	•
F7	SST	1	1/4-18 NPT	•	•	•
F8	SST	2	1/4-18 NPT	•	•	•
F9	Hastelloy C-276	1	1/4-18 NPT	•	•	•
F0	Hastelloy C-276	2	1/4-18 NPT	•	•	•

Typical Model Number: 1151LT 4 S A0 A 52 D F1

(1) For welded capillary assemblies, order sensor module and low-side materials of construction Option Code 22.

(2) Not available with Option Codes V2, or V3.

(3) Not available with Output Code G.

(4) Limited availability depending on transmitter type and range. Contact your Rosemount representative.

(5) Available for the diaphragm, upper housing, flange, adapter, extension, and lower housing.

(6) Not available with high pressure side Option Codes A0, B0, and G0.

Standard Accessories

All models are shipped with flange adapters, drain/vent valves, and one instruction manual per shipment.

Tagging

The Alphaline Pressure Transmitter will be tagged, at no charge, in accordance with customer requirements. All tags are stainless steel. The standard tag is wired to the transmitter.
Tag character height is 0.125 in. (0.318 cm). A permanently attached tag is available upon request.

Calibration

Transmitters are factory calibrated to the customer's specified range. If calibration is not specified, the transmitters are calibrated at maximum range. Calibration is performed at ambient temperature and pressure.

Optional Three-Valve Manifolds

Part No. 01151-0150-0001:

- 3-valve manifold, carbon steel

Part No. 01151-0150-0002:

- 3-valve manifold, 316 SST

Optional Diaphragm and Sanitary Seals

Refer to Product Data Sheet 00813-0100-4016 or 00813-0201-4016.

Options

The following sections describe a variety of available options for the 1151 Transmitter. These options permit greater application flexibility.

Mounting Brackets

B1 Bracket for 2-in. Pipe Mounting

- Bracket for mounting transmitter on 2-in. pipe
- Constructed of carbon steel with carbon steel U-bolt
- Coated with polyurethane paint

B4 Bracket for 2-in. Pipe with 316 SST Bolts

- Same bracket as Option Code B1 with 316 SST bolts

B7 304 SST Bracket and 316 SST Bolts for 2-in. Pipe Mounting

- Same bracket as Option Code B1 with all SST materials

B2 Bracket for Panel Mounting

- Bracket for mounting transmitter on panel or wall
- Constructed of carbon steel with carbon steel bolts
- Coated with polyurethane paint

B5 Bracket for Panel with 316 SST Bolts

- Same bracket as Option Code B2 with 316 SST bolts

B3 Flat Bracket for 2-in. Pipe Mounting

- Bracket for vertical mounting of transmitter on 2-in. pipe
- Constructed of carbon steel with carbon steel U-bolt
- Coated with polyurethane paint

B6 Flat Bracket for 2-in. Pipe with 316 SST Bolts

- Same bracket as Option Code B3 with 316 SST bolts

B9 304 SST Flat Bracket and 316 SST Bolts for 2-in. Pipe Mounting

- Same bracket as Option Code B3 with all 316 SST materials

Bolts and Nuts for Flanges and Adapters

Options permit bolts and nuts for flanges and adapters in the specified material.

- L3 ANSI/ASTM A - 193-B7
- L4 Austenitic 316 SST
- L5 ANSI/ASTM A193-B7M

Meters

Analog

- Meters have 2-in. (50.8 mm) scale
- Plug-in mounting configuration
- Indication accuracy ±2%
- Operating temperature limit: –40 to 150 °F (–40 to 65 °C)
- Meters are enclosed in a housing certified by Factory Mutual as explosion proof for Class I, Division 1, Groups B, C, and D; Class II, Division 1, Groups E, F, and G and Class III, Division 1
- For optional CSA explosion-proof approval, see certification Option Code E6
- M1 Linear Analog Meter, 0–100% Scale
- M2 Square Root Analog Meter, 0–100% Flow Scale
- M3 Special Scaling Analog Meter (Specify Range)
- M6 Square Root Analog Meter, 0– 10$\sqrt{}$ Scale

LCD

- 4-digit display
- Indication accuracy ±0.25% of calibrated span ±1 digit
- Display resolution at ±0.5% of calibrated span ±1 digit
- Operating temperature limit: –4 to 158 °F (–20 to 70 °C)
- Plug-in mounting configuration
- Meters are enclosed in a housing certified by Factory Mutual as explosion proof for Class I, Division 1, Groups B, C, and D; Class II, Division 1, Groups E, F, and G and Class III, Division 1
- For Optional CSA explosion-proof approval, see certification Option Code E6
- M4 Linear LCD Meter, 0 to 100%
- M7 Special Scale LCD Meter (Specify Range, Mode, and Engineering Units)
- M8 Square Root LCD Meter, 0 to 100%
- M9 Square Root LCD Meter, 0–10$\sqrt{}$ Scale

NOTES
Meter Options are not available with Output Codes L or M, or Option Codes V2 or V3. Meter Options M2, M6, M8, and M9 are not available with Output Code J. Meter Options M4, M7, M8, and M9 are not available with Output Code G.

Process Connections

D1 Side Drain/Vent-Top

- Drain/vent valve mounted in side of flange.
- Top position used to vent gas buildup in liquid process applications with transmitter mounted vertically.
- Plug of same material as requested flange inserted in end of flange opposite adapter.

D2 Side Drain/Vent-Bottom
- Drain/vent valve mounted in side of flange.
- Bottom position used to drain liquid buildup in gas process applications with transmitter mounted vertically.
- Plug of same material as requested flange inserted in end of flange opposite adapter.

D6 316 SST Low Side Flange (Rosemount 1151GP and 1151AP Only)

DF 1/2–14 NPT flange adapters
- Options provide 1/2–14 NPT process connection on flanges rather than 1/4–18 NPT

K1 1/4–18 NPT Kynar™ Process Flange Insert

K2 1/2–14 NPT Kynar Process Flange Insert
- Options provide Kynar plastic process flange insert that prevents process from coming in contact with the metal of the flange. One process insert for Rosemount 1151AP, GP and LT; two inserts for Rosemount1151DP.
- Process connections are from the side.
- Available with carbon steel and stainless steel process flanges only.
- Pressure Maximum: 200 psi at 200 °F with Kynar impulse piping; 300 psi at 200 °F with metal impulse piping.

S1 Assembled with One Remote Diaphragm Seal

S2 Assembled with Two Remote Diaphragm Seals
- Options provide for the assembly of one or two remote diaphragm seals.

S4 Assembled with 1195 Integral Orifice
- Designed for highly accurate, small-bore flow measurement of any clean gas, liquid, or vapor.
- Reduce the costs associated with traditional orifice plate installations.
- Several configurations are available factory assembled to Rosemount differential pressure transmitters.(1)
- Wide orifice bore/flow range capability.
- Wide choice of process connections, including threaded, socket weld, and ANSI flanges.
- Static pressure maximum limit is 3,000 psig.
- Wetted materials are available that comply with NACE MR 01-75(90).
- Available only with Ranges 2, 3, 4, and 5.

Wetted O-rings
- Standard: Viton® (2)
- W2 Buna N
- W3 Ethylene-Propylene
- W4 Aflas®
- W5 Copper O-ring for Vacuum Service (Nonwetted - Rosemount 1151LT only)
- W6 Spring-Loaded Teflon
- Contains a Hastelloy spring that is in contact with the process fluid. Consult factory if Hastelloy is unacceptable.
- W7 Teflon

Procedures

Standard Configuration

Unless otherwise specified, transmitter will be shipped as follows:

Engineering Units:	inH_2O
4 mA:	0
20 mA:	Upper Range Limit
Output:	Linear
Software Tag:	Blank

Customer may specify the above items at no charge. Software tag (8 characters) is left blank unless specified.

C9 Custom Configuration (Option Code C9)

If Option Code C9 is ordered, the customer may specify the following data in addition to the standard configuration parameters.

Descriptor:	16 characters
Message:	32 characters
Date:	Day, Month, Year
Damping:	Seconds
Burst Mode:	Select Output Choice
Flange Material:	Model Code Information
O-Ring Material:	Model Code Information
Isolator Material:	Model Code Information
Sensor Fluid:	Model Code Information
Drain/Vent:	Model Code Information
Integral Meter:	installed or None
Remote Seal:	Specified Information
Failure Mode:	High or Low
Transmitter Security:	Off or On

TABLE 13. Hydrostatic Test Pressure

Model	Test Pressure
1151DP	3,000 psi
1151HP	6,750 psi
1151AP	2,000 psi
1151GP	
Ranges 3–8	2,000 psi
Range 9	4,500 psi
Range 0	7,500 psi
1151LT	
Class 150 Flange	450 psi
Class 300 Flange	1,100 psi

P1 Hydrostatic Testing
- Each transmitter is hydrostatic tested according to Table 13.
- Test medium is water.
- This option provided for transmitters with remote diaphragm seal on application only.
- Rosemount Procedure 1746 outlines the testing procedure.

P2 Cleaning for Special Service
- This option minimizes contaminants to the process system by cleaning wetted surfaces with a suitable detergent.
- Rosemount Procedure 97412 outlines the cleaning procedure.

P3 Cleaning for <1 PPM Chlorine/Fluorine

(1) Applicable only to orifice assemblies without piping.
(2) For enhanced sealing performance below 0°F (-18 °C), consult factory.

P4 Calibration at Line Pressure

- This option allows transmitters to be calibrated at an elevated line pressure rather than atmospheric pressure.
- Customer must specify line pressure at which transmitter is to be calibrated.
- Customer is provided with calibration data at line pressure by ordering Q48 certificate.
- Available with Rosemount 151DP and 1151HP only. (Not available with Remote Seals.)
- Elevated line pressure and differential span desired for calibration must not exceed the rated pressure for transmitter model.
- Minimum differential span that can be calibrated at elevated line pressure is 30 inH_2O; maximum is 300 psi.
- Rosemount Procedure 3787 outlines the calibration procedure.

P5 Calibration at Temperature

- This option allows transmitters to be calibrated at temperatures other than room temperature in the range of 0 to 200 °F (–18 to 93 °C).
- Customer must specify temperature at which transmitter is to be calibrated and calibration range.
- Calibration temperature will be printed on instrument tag specified by customer, or on a tag wired to the transmitter if no tag is specified.
- Rosemount Procedure 27823B outlines the calibration procedure.

P8 0.1% Accuracy

- Available on Rosemount 1151DP (Ranges 3–8), GP (Ranges 3–8), HP, and LT transmitters with 316 SST diaphragms and Output Codes E, G, L, and M. Also available on 1151DP (Range 9–0) and 1151GP (Range 9–0) with Output Code S (Min. Span = URL/10).

P7 Enhanced Temperature Performance for Analog Electronics

- Transmitter is specifically compensated as a complete assembly and will exhibit $^1/_2$ of the standard temperature coefficient over the ambient temperature range of 20 to 140 °F (–7 to 60 °C). Outside this range, the unit will meet the standard temperature effect specification published for transmitter model.
- Not available on Range 10, limited to 1,500 psi on Range 9.
- The transmitter is compensated as an assembly; therefore, units in which the sensor module or electronics are changed after the P7 procedure has been performed will meet the standard published temperature specification for that particular model.
- Available on DP, GP, and HP models, Ranges 3–8, with SST diaphragms and Output Codes E, G, L, and M.

Outputs

V1 Reverse Output

- This option permits reversing of pressure input so that electrical output will increase as pressure input decreases.
- This option applies only to Rosemount 1151GP and 1151LT. When this option is selected, the process flange, adapter, drain/vent valve, appropriate O-rings, and bolting are installed on low side of transmitter. Not available for Ranges 9 and 0.
- Not available with 1151AP. Reverse output on Rosemount 1151DP and 1151HP can be obtained by connecting high-pressure input to low side of transmitter and vice versa.
- This option should not be ordered with smart transmitters (Output Code S). The 1151 Smart transmitter can be configured for reverse output through a HART-Compatible Interface.

V2 1 Ω Test Resistor

- A 1 Ω precision resistor is mounted across the test terminals to provide 4–20 mV output or a 10–50 mV output if 10–50 mA output is used.
- This option cannot be used with any meter options or Option Codes I5 or I6.

V3 5 Ω Test Resistor

- A 5 Ω precision resistor is mounted across test terminals to provide 20–100 mV output or a 50–250 mV output if 10–50 mA output is used.
- This option cannot be used with any meter options or Option Codes I5 or I6.

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Process Management

Reference Manual
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Rosemount 1151 Pressure Transmitter



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Rosemount 1151
Pressure Transmitter

NOTICE

Read this manual before working with the product. For personal and system safety, and for optimum product performance, make sure you thoroughly understand the contents before installing, using, or maintaining this product.

For technical assistance, contacts are listed below:

Customer Central
Technical support, quoting, and order-related questions.

United States - 1-800-999-9307 (7:00 am to 7:00 pm CST)

Asia Pacific- 65 777 8211

Europe/ Middle East/ Africa - 49 (8153) 9390

North American Response Center
Equipment service needs.

1-800-654-7768 (24 hours—includes Canada)

Outside of these areas, contact your local Emerson Process Management representative.

⚠CAUTION

The products described in this document are NOT designed for nuclear-qualified applications.

Using non-nuclear qualified products in applications that require nuclear-qualified hardware or products may cause inaccurate readings.

For information on Rosemount nuclear-qualified products, contact your local Emerson Process Management Sales Representative.

May be protected by one or more of the following U.S. Patent Nos. 4,804,958; 4,866,435; 4,878,012; 4,988,990; 5,083,091; 5,094,109; 5,237,285; Des. 317,266; Des. 318,432. Mexico Pats. Pend. 6057,912237. May depend on model. Other foreign patents issued and pending.

Table of Contents

SECTION 1 Introduction

Using This Manual 1-1
Models Covered 1-2

SECTION 2 Installation

Overview 2-1
Safety Messages 2-2
Warnings 2-2
General Considerations 2-4
Transmitter Access Requirements 2-4
Mechanical Considerations 2-5
Mounting Considerations 2-8
Mounting Requirements (for Steam, Liquid, Gas) 2-8
Process Connections 2-10
Mounting Brackets 2-11
Electrical Considerations 2-13
Power Supply 2-13
Conduit Installation 2-13
Wiring 2-14
Grounding 2-15
Hazardous Locations Certifications 2-17
Environmental Requirements 2-17
Liquid Level Measurement 2-17
Closed Vessels 2-17
Installation Options 2-21
Mounting Brackets 2-21
Analog Displays 2-21
LCD Displays 2-21
Terminal Blocks 2-24

SECTION 3 Configuration (Smart Only)

Overview 3-1
Safety Messages 3-1
Warnings 3-1
Commissioning the Transmitter on the Bench 3-1
Setting Hardware Switches 3-1
Commissioning with a HART-Based Communicator 3-3
Wiring Diagrams 3-3
Bench Hook-up 3-3
Field Hook-up 3-4
Hart Communicator 3-5
Testing the Equipment and the Loop 3-6
Common Functions 3-7
Configure the Analog Output Parameters 3-7
Reranging 3-7
Advanced Functions 3-12
Multidrop Communication 3-13

SECTION 4 Operation and Maintenance

Overview 4-1
Safety Messages 4-1
Warnings 4-1
Smart Calibration 4-2
Calibration Overview 4-2
Calibrate the Sensor 4-4
Digital to Analog Converter Trim 4-8
Analog Calibration 4-9
Calibration Overview 4-9
Quick Calibration Procedure (for E and G Electronics) 4-9
Quick Calibration Procedure (For L and M Electronics) 4-9
Data Flow with Calibration Options 4-11
Span Adjustment Range 4-11
Zero Adjustment Range 4-11
Zero and Span Adjustment 4-13
Elevated or Suppressed Zeros 4-14
Linearity Adjustment 4-15
Damping Adjustment 4-15
Static Pressure Span Correction Factor 4-16

SECTION 5 Troubleshooting

Overview 5-1
Safety Messages 5-1
Warnings 5-1
Smart Troubleshooting 5-3
Disassembly Procedure 5-5
Reassembly Procedure 5-7
Optional Plug-in Meters 5-9
Sensor Module Checkout 5-9
Analog Troubleshooting 5-10
Hardware Diagnostics 5-10
Transmitter Disassembly 5-12
Process Sensor Body Removal 5-13
Reassembly Procedure 5-15
Backup Ring and O-ring Installation 5-16
Optional Plug-in Meters 5-18

SECTION 6 Retrofitting the Rosemount 1151 Transmitter

Overview 6-1
Safety Messages 6-1
Warnings 6-1
Retrofitting Overview 6-2
Removing the Analog Electronics Assembly 6-2
Installing the Smart Retrofit Kit 6-10
Characterization 6-12
Before Characterizing the Transmitter 6-13
Characterizing with a HART Communicator 6-14

APPENDIX A
Reference Information

Performance Specifications A-1
Functional Specifications A-3
Physical Specifications A-8
Electrical Connections A-8
Process Connections A-8
1151 Process Wetted Parts A-8
1151LT Process Wetted Parts A-9
Non-wetted Materials A-9
Dimensional Drawings A-11
Ordering Information A-16
1151 Parts List A-22
1151LT Parts List A-30
Display Specifications A-34

APPENDIX B
Product Certifications

Approved Manufacturing Locations B-1
European Directive Information B-1
Hazardous Locations Certifications B-2
North American Certifications B-2
European Certifications B-2
Australian Certifications B-3
Combination Certifications B-4
Approval Drawings B-4

APPENDIX C

Glossary . . . . . C-1 to C-2

Index

Index . . . . . Index-1 to Index-2

Section 1 Introduction

Using This Manual . . . . . page 1-1
Models Covered . . . . . page 1-2

USING THIS MANUAL

This manual provides information on installation, operation, and maintenance of Rosemount 1151 Pressure Transmitters. This manual is organized into the following sections:

Section 2–Installation

This section provides mechanical and electrical installation instructions.

Section 3–Configuration

This section contains commissioning, output check, basic setup, LCD Display configuration, detailed setup, diagnostic and services, and advanced functions.

Section 4–Operation and Maintenance

This section contains calibration and trim procedures.

Section 5–Troubleshooting

This section provides troubleshooting techniques for the most common operating problems.

Section 6–Retrofitting the Rosemount 1151 Transmitter

This section describes how the Rosemount Smart Retrofit Kit can be used to retrofit a Rosemount 1151AP, DP, GP, HP, or LT transmitter with 4-20 mA linear or square root output.

Appendix A–Reference Information

This appendix supplies reference and specification data, as well as ordering information and spare parts tables.

Appendix B–Product Certifications

This appendix contains European directive information, Hazardous Location Certifications, and approval drawings.

Appendix C–Glossary

This section provides brief definitions of the terms used in this manual.

Index

This section provides a comprehensive index.

MODELS COVERED

This manual provides basic installation, commissioning, and troubleshooting information for the following Rosemount 1151 Pressure Transmitters:

Rosemount 1151DP—Differential Pressure Transmitter

Measures differential pressure up to 1,000 psi (6895 kPa).

Rosemount 1151HP—Differential Pressure Transmitter for High Line Pressures

Provides high line pressure up to 300 psi (2068 kPa).

Rosemount 1151GP—Gage Pressure Transmitter

Measures gage pressure up to 6,000 psi (41369 kPa).

Rosemount 1151AP—Absolute Pressure Transmitter

Measures absolute pressure up to 1,000 psi (6895 kPa).

Rosemount 1151LT—Flange-Mounted Liquid Level Transmitter

Provides precise level and specific gravity measurements up to 2,770 inH2O (690 kPa) for a wide variety of tank configurations.

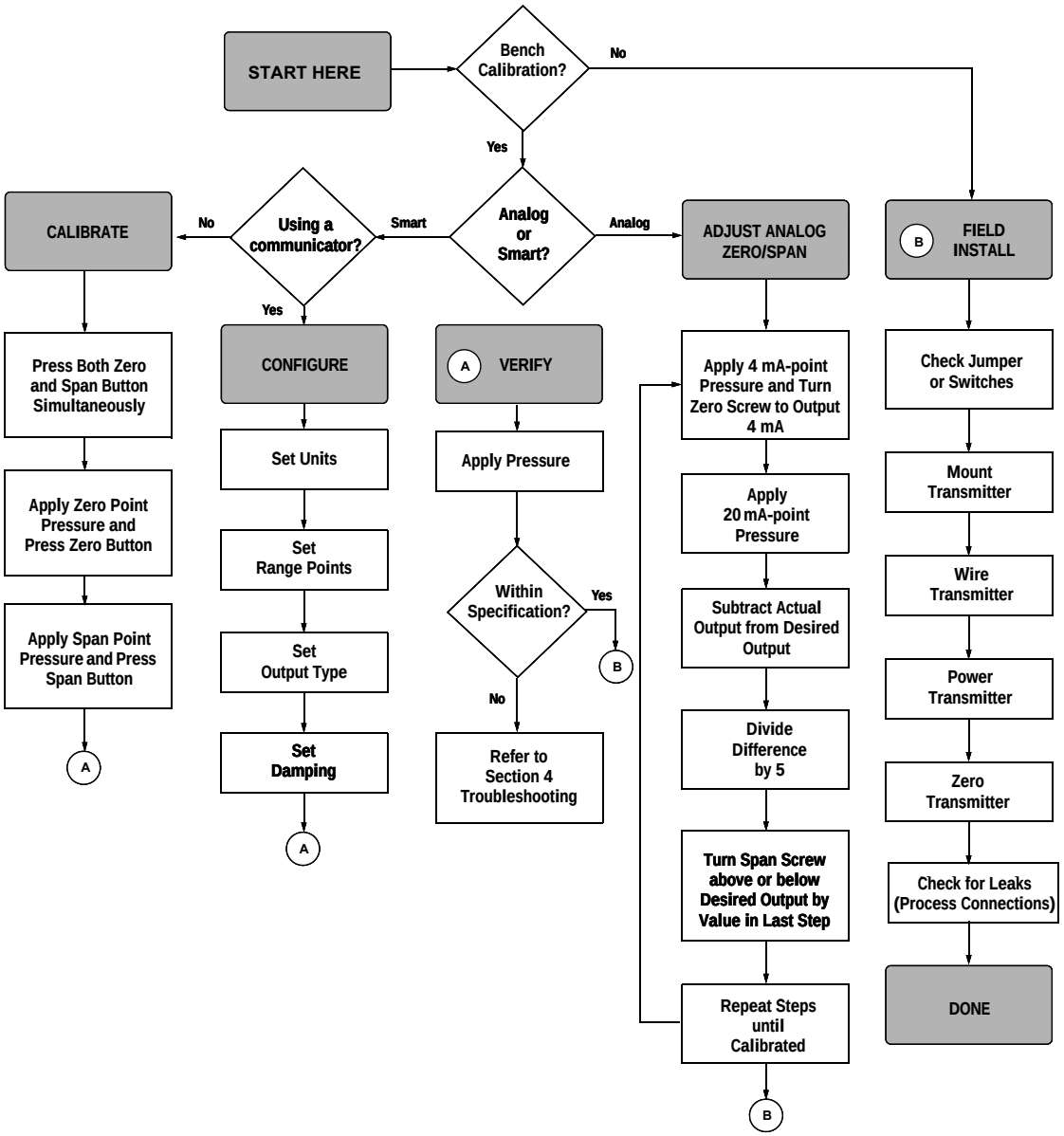
Section 2 Installation

Overview . . . . . **page 2-1**
Safety Messages . . . . . **page 2-2**
General Considerations . . . . . **page 2-4**
Mechanical Considerations . . . . . **page 2-6**
Mounting Considerations . . . . . **page 2-8**
Electrical Considerations . . . . . **page 2-14**
Liquid Level Measurement . . . . . **page 2-18**
Installation Options . . . . . **page 2-21**

OVERVIEW

This section is designed to guide you through a successful Rosemount 1151 installation. This section contains an installation flow chart; safety messages; general, mechanical, mounting, and electrical installation information; as well as installation guidance for optional parts. Dimensional drawings for each Rosemount 1151 variation and mounting configuration are included.

Figure 2-1. Rosemount 1151 Installation Flowchart.



SAFETY MESSAGES

Warnings (⚠)

Procedures and instructions in this section that raise potential safety issues are indicated by a warning symbol (⚠). Refer to the following warning messages before performing an operation preceded by this symbol.

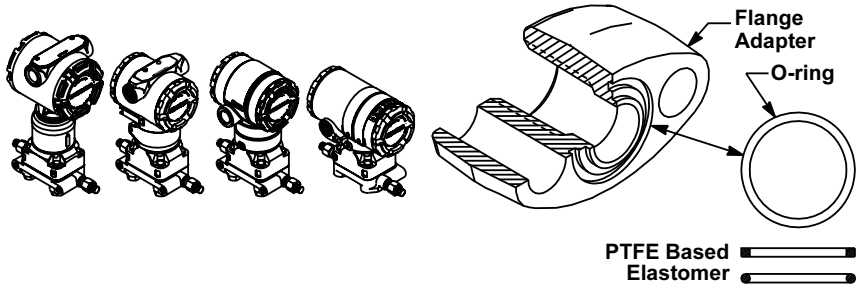
⚠WARNING

- Explosions can result in death or serious injury. Before connecting a communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or nonincendive field wiring practice.
- Process leaks can cause death or serious injury. Install and tighten all four flange bolts before applying pressure, or process leakage may result. Attempting to remove the flange bolts while the transmitter is in service may cause process fluid leaks.
- All explosion-proof, flameproof, and dust-ignition-proof installations require insertion of conduit plugs in all unused openings with a minimum of 40 ft-lb (54 N-m) of torque. This will maintain five full threads of engagement.
- When adding a meter option to a Rosemount 1151 with an Option Code R1 terminal block, make sure to change to cemented meter covers with a glass window. Make sure a sticker is located inside the cover that indicates a “cemented cover.” This cover is required to maintain explosion-proof approval.
- Explosions can cause death or serious injury. Do not remove the instrument cover in explosive atmospheres when the circuit is alive.
- Explosions can cause death or serious injury. To meet hazardous location requirements, any transmitter with a tag specifying Option Codes I5, I1, N1, I8, I7, or N7 requires an intrinsically safe analog display (Part Nos. 01151-2614-0004 through 0009) or an LCD Display (Part Nos. 01151-1300-1000,01151-1300-1001).

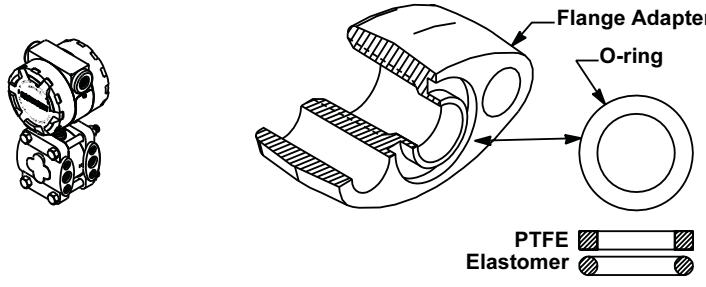
⚠WARNING

Failure to install proper flange adapter O-rings may cause process leaks, which can result in death or serious injury. The two flange adapters are distinguished by unique O-ring grooves. Only use the O-ring that is designed for its specific flange adapter, as shown below.

ROSEMOUNT 3051S / 3051 / 2051 / 3001 / 3095 / 2024



ROSEMOUNT 1151



GENERAL CONSIDERATIONS

The accuracy of a flow, pressure, or level measurement depends on proper installation of the transmitter and impulse piping. The piping between the process and transmitter must accurately transmit process pressure to the transmitter. Mount the transmitter close to the process and use a minimum of piping to achieve best accuracy. However, keep in mind the need for easy access, safety of personnel, practical field calibration, and a suitable transmitter environment.

In general, install the transmitter so as to minimize vibration, shock, and temperature fluctuations.

Installations in food, beverage, and pharmaceutical processes may require sanitary seals and fittings. Regulations may dictate special installation requirements to maintain sanitation and cleanability. See www.emersonprocess.com for more information about sanitary pressure instruments.

Transmitter Access Requirements

When choosing an installation location and position, take into account the need for access to the transmitter.

Process Flange Orientation

Orient the process flanges to enable process connections to be made. For safety reasons, orient the drain/vent valves so that process fluid is directed down and away from technicians when the valves are used. This can be accomplished by pointing the hole in the outside valve body downward and away.

Housing Rotation

⚠CAUTION

Do not rotate the transmitter housing more than 90 degrees without disconnecting the header board. Exceeding 90 degrees rotation will damage the internal sensor module wiring.

The electronics housing is designed to be rotated up to 90 degrees in order to provide field access to the two housing compartments. (If rotating the housing more than 90 degrees is necessary, follow the transmitter disassembly procedures in Section 5: Troubleshooting.) To rotate the housing up to 90 degrees, loosen the housing lock nut and turn the housing not more than 90 degrees.

NOTE
Seal module threads with Loctite® 222 before retightening housing lock nut (see **Connecting the Electrical Housing to the Sensor on page 5-7**.)

Terminal Side of Electronics Housing

The terminal side is marked on the nameplate located on the side of the transmitter. Mount the transmitter so that the terminal side of the housing is accessible by providing:

- A ¾-inch clearance for cover removal with no meter
- A 3-inch clearance for cover removal with a meter installed

If practical, provide approximately 6 inches clearance so that a meter may be installed later.

Circuit Side of Electronics Housing

The circuit compartment should not routinely need to be opened when the unit is in service. However, provide 6 inches clearance, if possible, to allow access to the integral zero and span buttons or for on-site maintenance. The circuit side of the housing is marked on the nameplate located on the side of the transmitter.

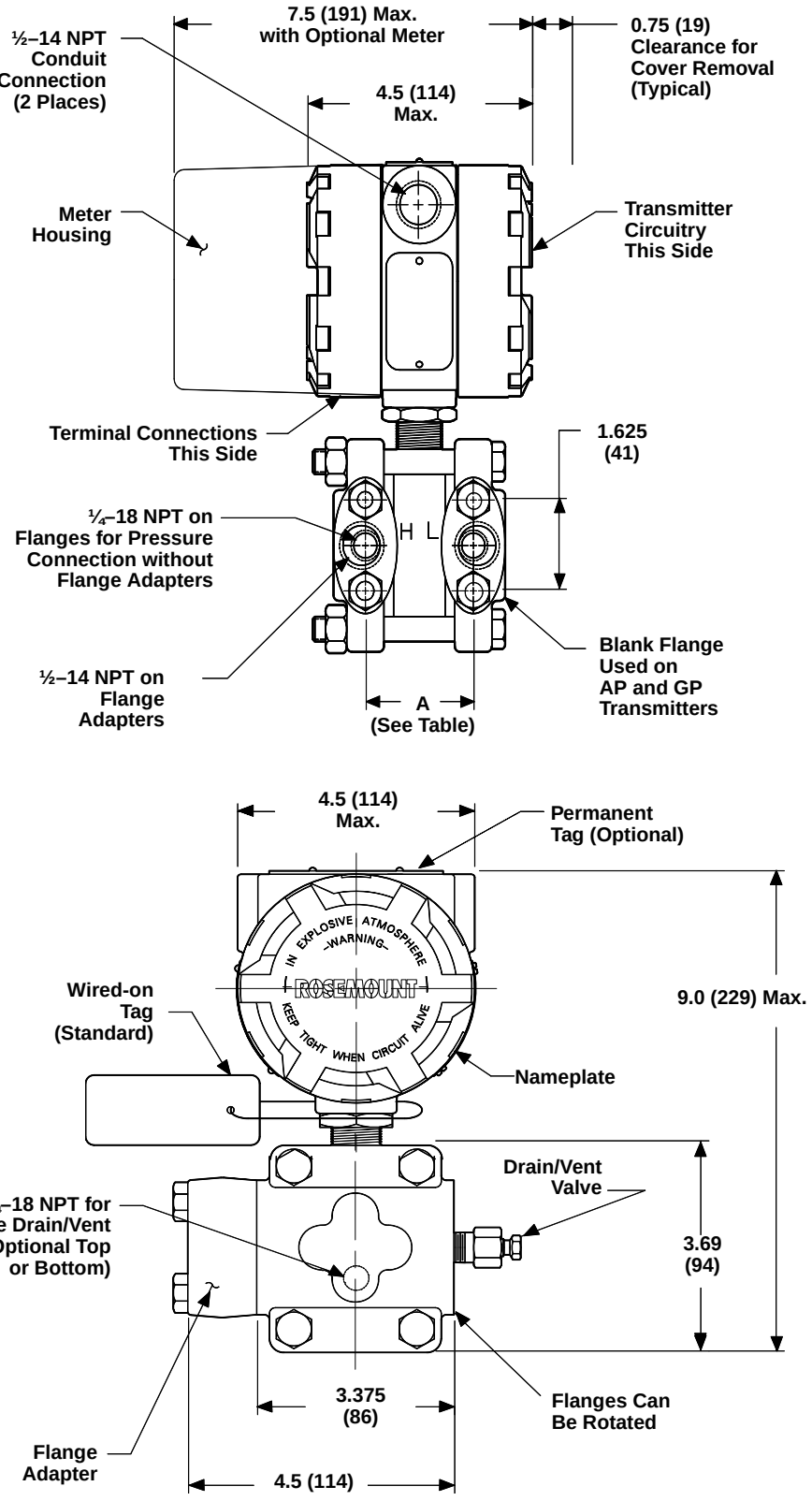
Exterior of Electronics Housing

The Rosemount 1151 Smart Pressure Transmitter uses the same housing as the Rosemount 1151 Analog. For this reason, integral span and zero screws—non-functional on the Rosemount 1151 Smart Pressure Transmitter—are located under the nameplate on the side of the transmitter.

MECHANICAL CONSIDERATIONS

Dimensional Drawings

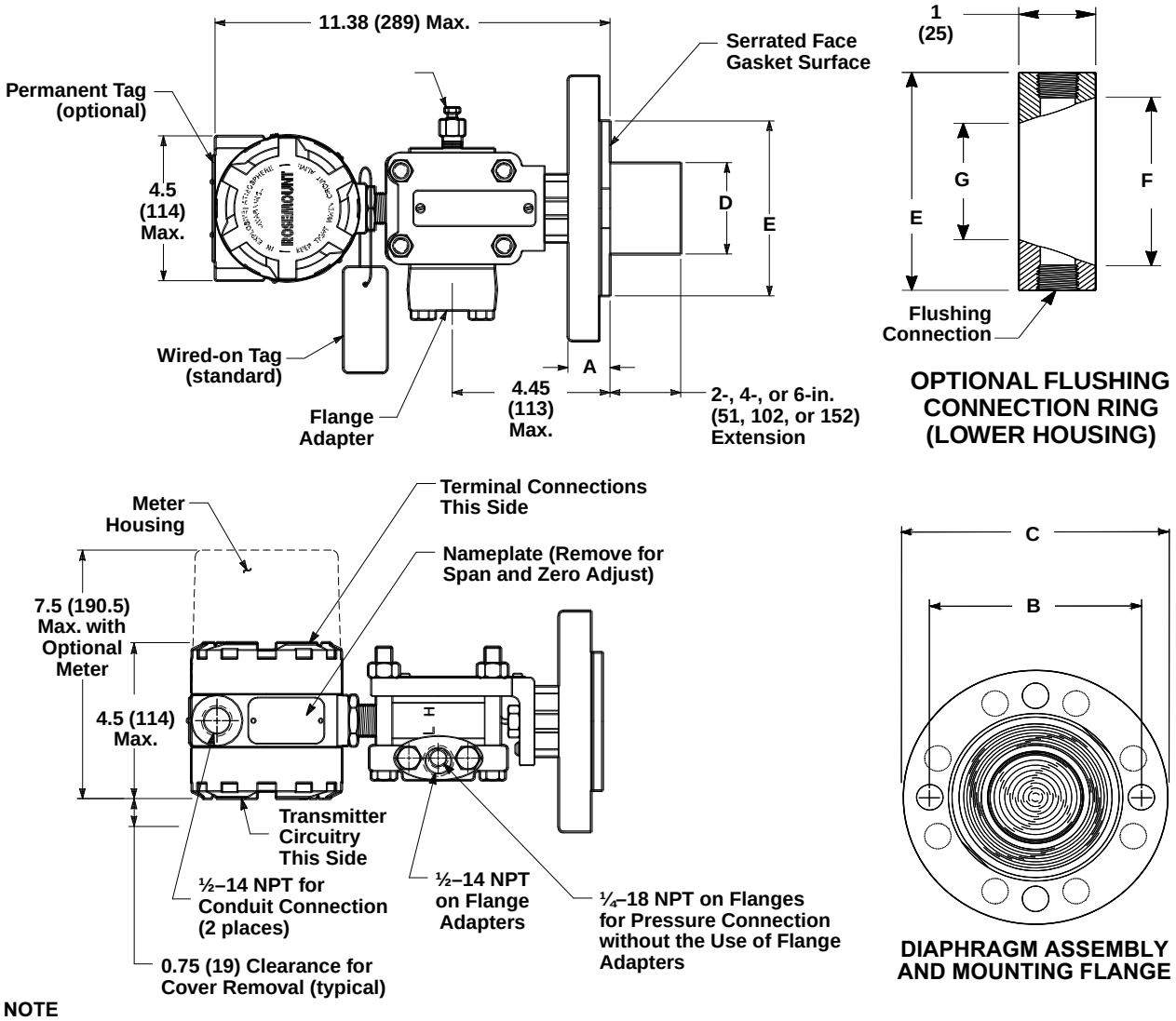
Figure 2-2. Rosemount 1151AP, DP, GP, and HP Dimensional Drawings.



Range	Flange Distance "A" Center to Center	
	inches	mm
3, 4, 5	2.125	54
6, 7	2.188	56
8	2.250	57
9	2.281	58
0	2.328	59

NOTE
Dimensions are in inches (millimeters).

Figure 2-3. Rosemount 1151LT Dimensional Drawing.



NOTE
Dimensions are in inches (millimeters).

Table 2-1. Rosemount 1151LT Dimensional Specifications

Class	Pipe Size	Flange Thickness A	Bolt Circle Diameter B	Outside Diameter C	No. of Bolts	Bolt Hole Diameter	Exten. Diam. D (1)	O.D. Gask. Surf. E	Lower Housing	
									Xmtr Side F	Proc. Side G
ANSI 150	2 (51) 3 (76) 4 (102)	1.12 (28) 1.31 (33) 1.31 (33)	4.75 (121) 6.0 (152) 7.5 (190)	6.0 (152) 7.5 (190) 9.0 (228)	4 4 8	0.75 (19) 0.75 (19) 0.75 (19)	NA 2.58 (65) 3.5 (89)	3.75 (95) 5.0 (127) 6.81 (173)	2.9 (74) 3.11 (79) 4.06 (103)	2.16 (55) 3.11 (79) 4.06 (103)
ANSI 300	2 (51) 3 (76) 4 (102)	1.25 (32) 1.50 (38) 1.62 (41)	5.0 (127) 6.62 (168) 7.88 (200)	6.5 (165) 8.25 (209) 10.0 (254)	8 8 8	0.75 (19) 0.88 (22) 0.88 (22)	NA 2.58 (65) 3.5 (89)	3.75 (95) 5.0 (127) 6.81 (173)	2.9 (74) 3.11 (79) 4.06 (103)	2.16 (55) 3.11 (79) 4.06 (103)
ANSI 600	2 (51) 3 (76)	1.12 (28) 1.37 (35)	5.0 (127) 6.62 (168)	6.5 (165) 6.62 (168)	8 8	0.75 (19) 0.88 (22)	NA 2.58 (65)	3.75 (95) 5.0 (127)	2.9 (74) 3.11 (79)	2.16 (55) 3.11 (79)
DIN PN10-40	DN 50	26 mm	125 mm	165 mm	4	18 mm	NA	95 mm	74 mm	55 mm
DIN PN 25/40	DN 80 DN 100	30 mm 30 mm	160 mm 190 mm	200 mm 235 mm	8 8	18 mm 22 mm	65 mm 89 mm	127 mm 173 mm	79 mm 103 mm	79 mm 103 mm
DIN PN 10/16	DN 100	26 mm	180 mm	220 mm	8	18 mm	89 mm	173 mm	103 mm	103 mm

(1) Tolerances are 0.040 (1.02), –0.020 (0.51).

MOUNTING CONSIDERATIONS

The Rosemount 1151 Pressure Transmitter weighs 12 lb. (5.4 kg) without a meter and 15 lb. (6.8 kg) with a meter. This weight must be securely supported. The transmitter is calibrated in an upright position at the factory. If this orientation is changed during mounting, the zero point will shift by an amount equivalent to the liquid head caused by the mounting position. For Smart Transmitters, follow “Because a zero trim must be zero-based, it generally should not be used with Rosemount 1151 Smart Absolute Pressure Transmitters. Absolute pressure transmitters reference absolute zero. To correct mounting position effects on a Rosemount 1151 Smart Absolute Pressure Transmitter, perform a low trim within the full sensor trim function. The low trim function provides a “zero” correction similar to the zero trim function but it does not require the input to be zero based.” on page 4-5 to correct this shift. For Analog Transmitters, follow “Zero and Span Adjustment” on page 4-15 to correct this shift.

NOTE
Do not plug the low side with a solid plug. Plugging the low side will cause an output shift.

Mounting Requirements (for Steam, Liquid, Gas)

The following information applies to steam, liquid, and gas installations.

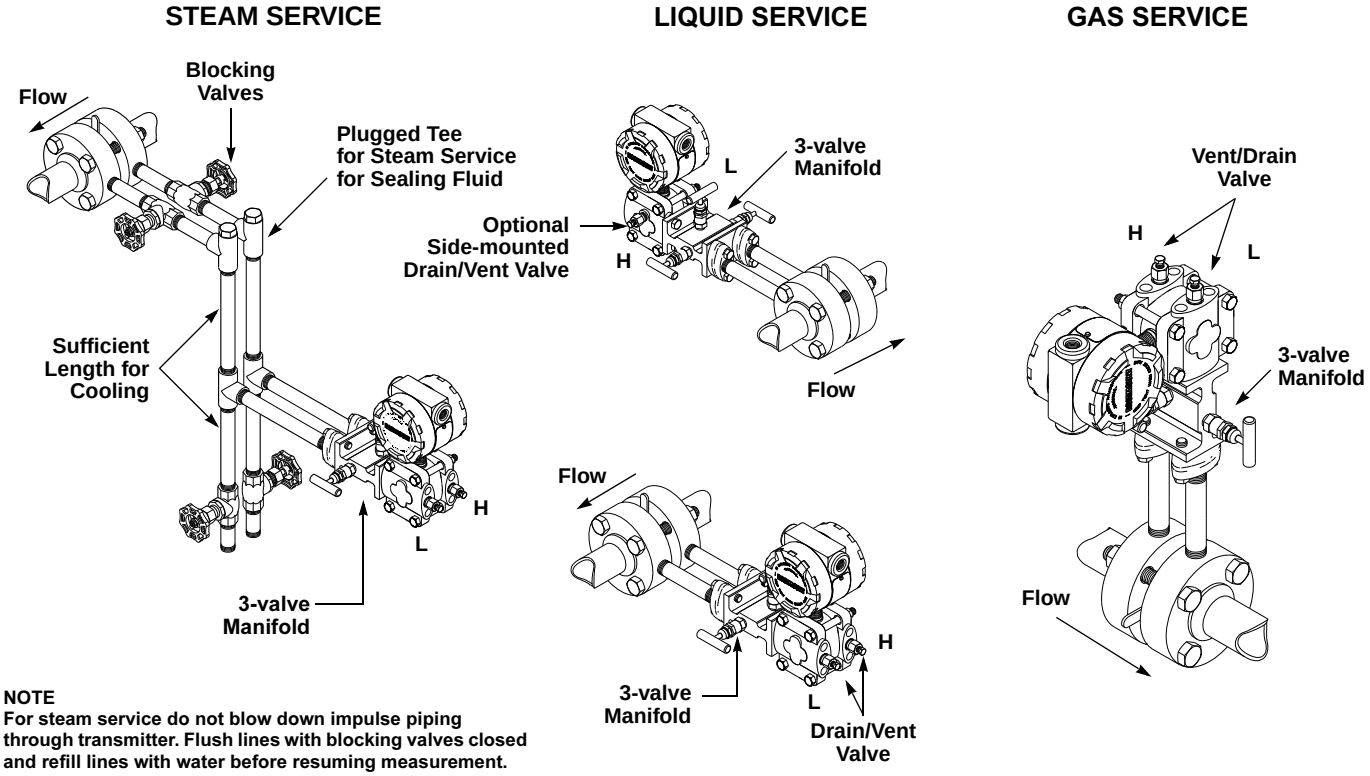
Taps

Tap placement is dependent on the type of process being measured, and on whether the transmitter has side drain/vent valves:

- For liquid flow measurement, place taps to the side of the line to prevent sediment deposits, and mount the transmitter beside or below these taps so gases can vent into the process line and away from the transmitter.
- For gas flow measurement, place taps in the top or side of the line and mount the transmitter beside or above the taps so liquid will drain away from the transmitter.
- For steam flow measurement, place taps to the side of the line with the transmitter mounted below them to ensure that the impulse piping stays filled with condensate.
- For transmitters with side drain/vent valves, place taps to the side of the line.

See Figure 2-4 for a diagram of these arrangements.

Figure 2-4. Steam, Liquid, and Gas Service Installation Diagrams.



NOTE
For steam service do not blow down impulse piping through transmitter. Flush lines with blocking valves closed and refill lines with water before resuming measurement.

Drain/Vent Valves

Drain/vent valve orientation is also dependent on the process being measured:

- For liquid service, mount the side drain/vent valve upward to allow the gases to vent.
- For gas service, mount the drain/vent valve down to allow any accumulated liquid to drain.

To change the drain/vent valve orientation from top to bottom, rotate the process flange 180 degrees.

Impulse Piping

The piping between the process and the transmitter must accurately transfer the pressure in order to obtain accurate measurements. In this pressure transfer, there are five possible sources of error:

- Leaks
- Friction loss (particularly if purging is used)
- Trapped gas in a liquid line
- Liquid in a gas line
- Temperature-induced or other density variation between the legs

The best location for the transmitter in relation to the process pipe depends on the process itself. Consider the following general guidelines in determining transmitter location and placement of impulse piping:

- Keep impulse piping as short as possible.
- Slope the impulse piping at least 1 inch per foot (8 centimeters per meter) upward from the transmitter toward the process connection for liquid.
- Slope the impulse piping at least 1 inch per foot (8 centimeters per meter) downward from the transmitter toward the process connection for gas.
- Avoid high points in liquid lines and low points in gas lines.
- Make sure both impulse legs are the same temperature.
- Use impulse piping large enough to avoid friction effects and prevent blockage.
- Vent all gas from liquid piping legs.
- For steam service, fill impulse piping with water to prevent contact of live steam with the transmitter.

⚠CAUTION

Steam or other elevated temperature processes can cause damage to the sensor. Do not allow the temperature inside the process flanges to exceed the transmitter limit of 220 °F (104 °C).

- When using a sealing fluid, fill both piping legs to the same level.
- When purging is necessary, make the purge connection close to the process taps and purge through equal lengths of the same size pipe. Avoid purging through the transmitter.
- Keep corrosive or hot process material out of direct contact with the sensor module and flanges.
- Prevent sediment deposits in the impulse piping.
- Keep the liquid head balanced on both legs of the impulse piping.

Process Connections

⚠ **Flange Adaptors:**

Rosemount 1151AP, DP, GP, and HP process connections on the transmitter flanges are 1/4–18 NPT. Flange adapters are available with standard 1/2–14 NPT Class 2 connections. The flange adapters allow users to disconnect from the process by removing the flange adapter bolts. Use plant-approved lubricant or sealant when making the process connections. Figure 2-2 shows the distance between pressure connections. This distance may be varied ±1/8 in. (3.2 mm) by rotating one or both of the flange adapters.

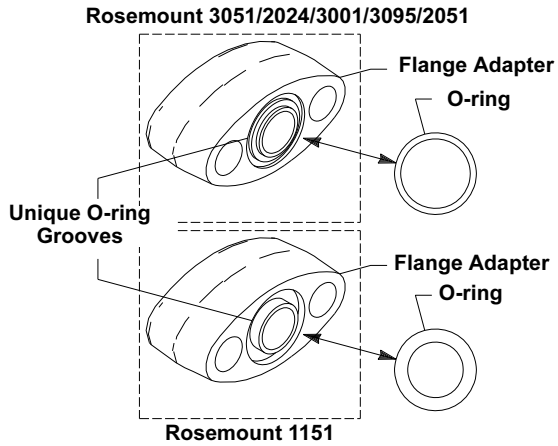
On open vessels, the low-side process flange is open to atmosphere and should be mounted with the threaded hole pointed down. On closed vessels, this connection is used for the dry or wet leg.

High-pressure-side process connections for the Rosemount 1151LT Transmitter are offered with 2-, 3-, or 4-in., Class 150, 300, or 600 flanges; DN 50 (PN 10-40), DN 80 (PN 25/40), or DN 100 (PN 10/16, 25/40). Low-pressure-side process connections for the Rosemount 1151LT Transmitter are offered with ¼–18 NPT on the flange, and ½–14 NPT on the adapter.

O-rings:

The two styles of Rosemount flange adapters (Rosemount 1151 and Rosemount 3051/2024/3001/3095/2051) each require a unique O-ring (see Figure 2-5). Use only the O-ring designed for the corresponding flange adaptor.

Figure 2-5. O-Rings.



⚠ When compressed, PTFE O-rings tend to “cold flow,” which aids in their sealing capabilities.

NOTE
PTFE O-rings should be replaced if the flange adapter is removed.

Tightening the Seal:

To ensure a tight seal on the flange adapters or a three-valve manifold, first finger-tighten both bolts, then wrench-tighten the first bolt to approximately 29 ft.-lbs (39 N-m). Wrench-tighten the second bolt to approximately 29 ft.-lbs (39 N-m).

Mounting Brackets

Optional mounting brackets permit mounting the transmitter to a wall, a panel, or a 2-inch horizontal or vertical pipe. Figure 2-6 illustrates some typical configurations these mounting brackets.

Table 2-2. Mounting Brackets

	Mounting		Material			
Option Code	Pipe Mount	Panel Mount	CS Bracket	SST Bracket	CS Bolts	SST Bolts
B1	X		X		X	
B3		X	X		X	
B4	X		X			X
B6		X	X			X
B7	X			X		X
B9		X		X		X

Figure 2-6. Mounting Bracket Option Codes B1, B4, and B7.

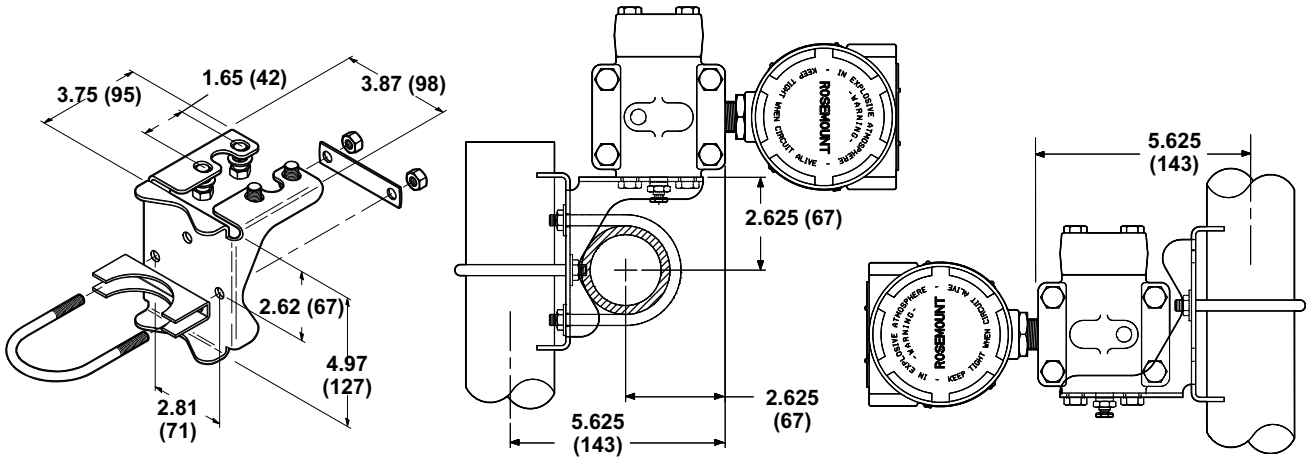


Figure 2-7. Panel Mounting Bracket Option Codes B2, and B5

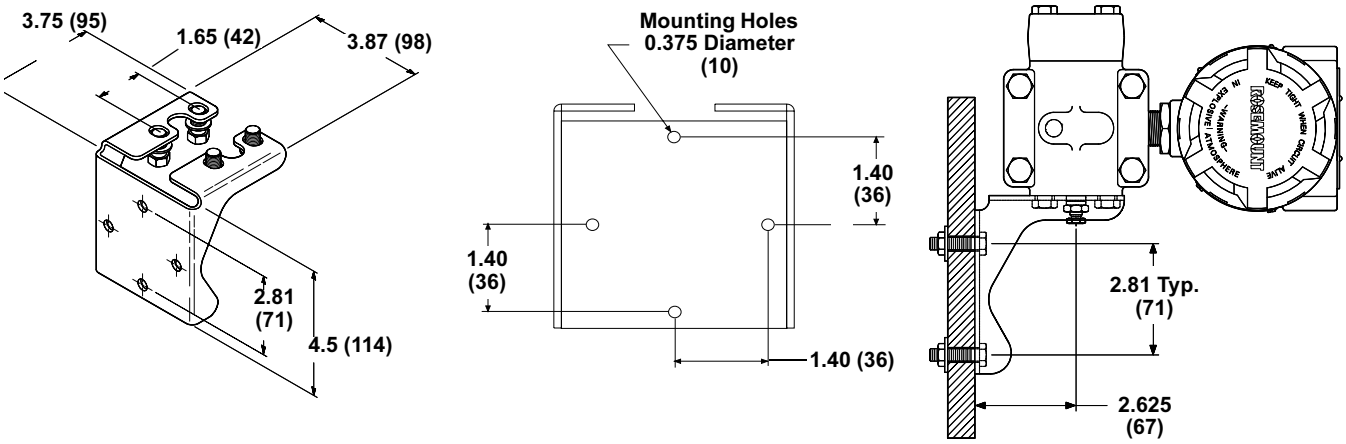
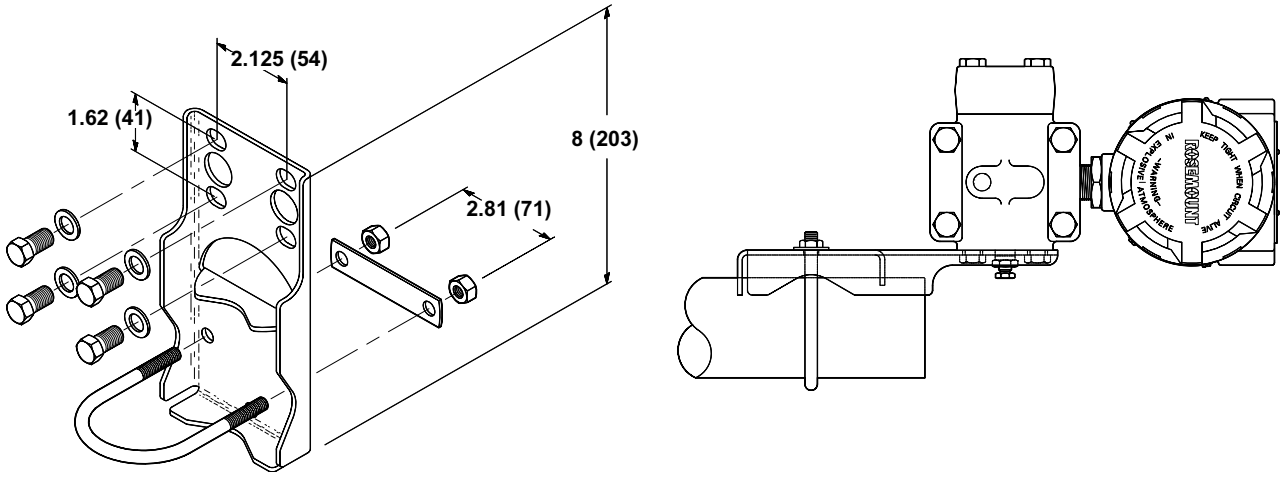


Figure 2-8. Flat Mounting Bracket Option Codes B3, B6, and B9



NOTE
Dimensions are in inches (millimeters).

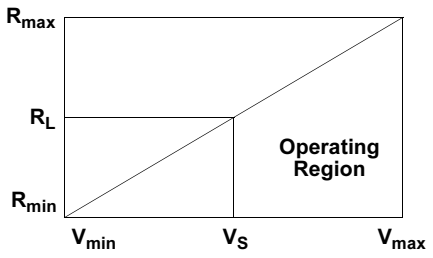
ELECTRICAL CONSIDERATIONS

NOTE
Make sure all electrical installation is in accordance with national and local code requirements.

Power Supply

The DC power supply should provide power with less than 2% ripple. The total load is the sum of the resistance of the signal leads and the load resistance of the controller, indicator, and related pieces. The resistance of intrinsic safety barriers, if used, must be included. Figure 2-7 illustrates power supply load limitations for the transmitter.

Figure 2-7. Power Supply Load Limitations.



Code	V_{min}	V_{max}	R_{min}	R_{max}	R_L at Supply Voltage (V_s)
S(1)	12	45	0	1650	$R_L = 43.5 (V_S – 12)$
E(2)	12	45	0	1650	$R_L = 50 (V_S – 12)$
G	30	85	0	1100	$R_L = 20 (V_S – 30)$
L	5	12	Low Power Minimum Load Impedance: 100 kΩ		
M	8	14			

(1) A minimum of 250 ohms is required for communication.
(2) For CSA Approvals (code E), V_{max} = 42.4 V dc.

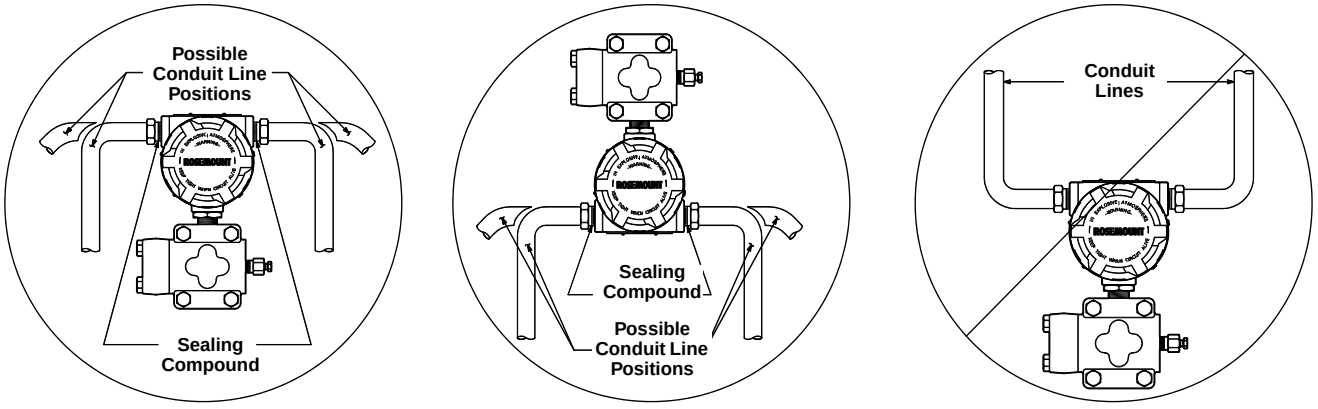
Conduit Installation

⚠CAUTION

If all connections are not sealed, excess moisture accumulation can damage the transmitter. Make sure to mount the transmitter with the electrical housing positioned downward for drainage. To avoid moisture accumulation in the housing, install wiring with a drip loop, and ensure the bottom of the drip loop is mounted lower than the conduit connections or the transmitter housing.

Recommended conduit connections are shown in Figure 2-8.

Figure 2-8. Conduit Installation Diagrams.



Wiring

⚠CAUTION

Do not connect the power signal wiring to the test terminals. Voltage may burn out the reverse-polarity protection diode in the test connection. If the test diode is destroyed, then the transmitter can still be operated without local indication by jumping the test terminals.

High voltage (greater than 50 V and greater than 0.005 amperes) can cause damage to the transmitter. Do not apply high voltage to the test terminals.

The signal terminals and test terminals are located in a compartment of the electronics housing that is separate from the transmitter electronics. The nameplate on the side of the transmitter indicates the locations of both of these compartments. The upper pair of terminals are the signal terminals and the lower pair are the test terminals. The test terminals have the same 4–20 mA output as the signal terminals and are only for use with the optional integral meter or for testing.

NOTE
An alternate location to connect an ammeter is on the set of terminals labeled “TEST.” Connect the positive lead of the ammeter to the positive test terminal, and the negative lead of the ammeter to the negative test terminal.

⚠ To make connections, remove the cover on the side marked “Terminal” on the nameplate. All power to the transmitter is supplied over the signal wiring. Connect the lead that originates at the positive side of the power supply to the terminal marked “+” and the lead that originates at the negative side of the power supply to the terminal marked “–”. No additional wiring is required.

Do not run signal wiring in conduit or open trays with power wiring or near heavy electrical equipment.

For improved performance against EMI/RFI effects, refer to “Terminal Blocks” on page 2-24 for information on transient protection terminal blocks.

Shielded cable should be used for best results in electrically noisy environments. Refer to “Grounding” on page 2-16 for more details.

NOTE
When conduit lines are used, signal wiring need not be shielded, but twisted pairs should be used for best results. Wiring must be 24 AWG or larger and not exceed 5,000 feet (1500 meters).

NOTE
A minimum loop resistance of 250 Ω is required to communicate with a hand-held HART-based communicator. With 250 Ω of loop resistance, the transmitter requires a minimum of 17 volts to output 20 mA. If a single power supply is used to power more than one Rosemount 1151 Smart transmitter, the power supply used, and circuitry common to the transmitters should not have more than 20 Ω of impedance at 1200 Hz.

Grounding

⚠ Use the following techniques to properly ground the transmitter signal wiring and case:

Signal Wiring

Do not run signal wiring in conduit or open trays with power wiring or near heavy electrical equipment. It is important that the instrument cable shield be:

- Trimmed close and insulated from touching the transmitter housing
- Connected to the next shield if cable is routed through a junction box
- Connected to a good earth ground at the power supply end

Signal wiring may be grounded at any one point on the signal loop or may be left ungrounded. The negative terminal of the power supply is a recommended grounding point.

Transmitter Case

The transmitter case must be grounded in accordance with national and local electrical codes. The most effective transmitter case grounding method is a direct internal connection to earth ground with minimal impedance. The transmitter case may also be grounded through the process or conduit connections.

Internal Ground Connection: Inside the field terminals side of the electronics housing is the internal ground connection screw. This screw is identified by a ground symbol:  .

NOTE
Grounding the transmitter case via threaded conduit connection may not provide sufficient ground continuity.

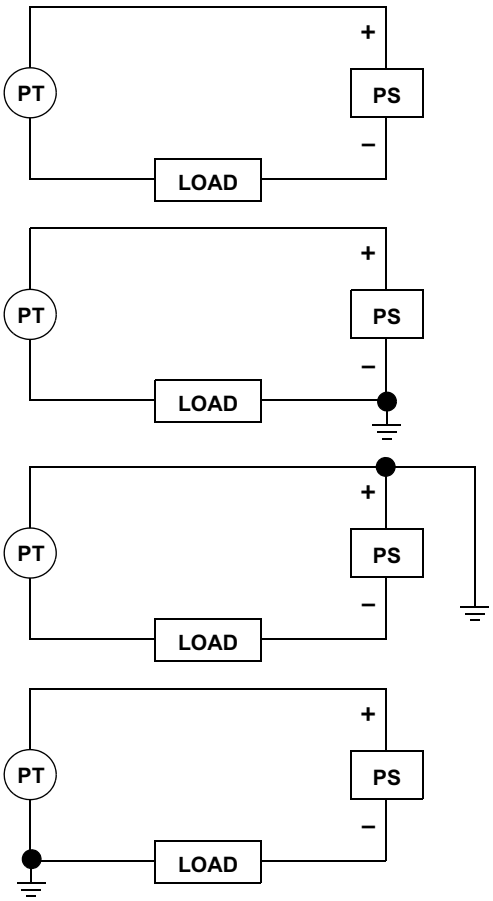
NOTE
The transient protection terminal block (page 2-25) does not provide transient protection unless the transmitter case is properly grounded. Use the preceding guidelines to ground the transmitter case.
Do not run the transient protection ground wire with signal wiring as the ground wire may carry excessive current if a lightning strike occurs.

Grounding Effects

The capacitance sensing module requires alternating current to generate a capacitance signal. This alternating current is developed in an oscillator circuit with a frequency of approximately 32 kHz. This signal is capacitor-coupled to transmitter-case ground through the sensing module. Because of this coupling, a voltage may be imposed across the load, depending on the choice of grounding. See Figure 2-9.

Impressed voltage, which is seen as high frequency noise, will have no effect on most instruments. Computers with short sampling times in circuits will detect a significant noise signal, which should be filtered out by using a large capacitor (1 μF) or by using a 32 kHz LC filter across the load. Computers that are wired and grounded, as shown in Figure 2-9, are negligibly affected by this noise and do not need filtering.

Figure 2-9. Effects of Grounding on Accuracy for Fast Sample Computers.



Ungrounded System

Impressed Voltage: 12 to 22 mV_{p-p}
32 kHz

Effect: 0.01% of span, max.

Ground Between Negative Side of Power Supply and Load

Impressed Voltage: 35 to 60 mVp-p
32 kHz

Effect: 0.03% of span, max.

Ground Between Positive Side of Transmitter and Power Supply

Impressed Voltage: 35 to 60 mVp-p
32 kHz

Effect: 0.03% of span, max.

Ground Between Negative Terminal of Transmitter and Load

Impressed Voltage: 500 to 600 mVp-p
32 kHz

Effect: 0.27% of span, max.

*The effect caused by the impressed voltage on a computer with a sampling time of 100 microseconds using a 2 to 10 volt signal.

Hazardous Locations Certifications

⚠ The Rosemount 1151 was designed with an explosion-proof housing and circuitry suitable for intrinsically safe and nonincendive operation. Factory Mutual explosion-proof certification is standard for the Rosemount 1151 Transmitter. Individual transmitters are clearly marked with a tag indicating the approvals they carry. Transmitters must be installed in accordance with all applicable codes and standards to maintain these certified ratings. Refer to “Hazardous Locations Certifications” on page B-2 for information on these approvals.

Environmental Requirements

Mount the transmitter in an environment that has minimal ambient temperature change. The transmitter electronics temperature operating limits are –40 to 185 °F (–40 to 85 °C). Refer to Section A: Reference Information that lists the sensing element operating limits. Mount the transmitter so that it is not susceptible to vibration and mechanical shock and does not have external contact with corrosive materials.

LIQUID LEVEL MEASUREMENT

Differential pressure transmitters used for liquid level applications measure hydrostatic pressure head. Liquid level and specific gravity of a liquid are factors in determining pressure head. This pressure is equal to the liquid height above the tap multiplied by the specific gravity of the liquid. Pressure head is independent of volume or vessel shape.

Open Vessels

A pressure transmitter mounted near a tank bottom measures the pressure of the liquid above.

Make a connection to the high pressure side of the transmitter, and vent the low pressure side to the atmosphere. Pressure head equals the liquid’s specific gravity multiplied by the liquid height above the tap.

Zero range suppression is required if the transmitter lies below the zero point of the desired level range. Figure 2-10 shows a liquid level measurement example.

Closed Vessels

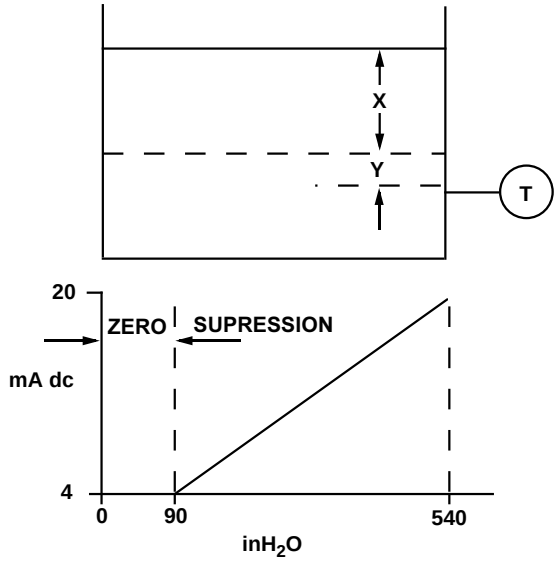
Pressure above a liquid affects the pressure measured at the bottom of a closed vessel. The liquid specific gravity multiplied by the liquid height plus the vessel pressure equals the pressure at the bottom of the vessel.

To measure true level, the vessel pressure must be subtracted from the vessel bottom pressure. To do this, make a pressure tap at the top of the vessel and connect this to the low side of the transmitter. Vessel pressure is then equally applied to both the high and low sides of the transmitter. The resulting differential pressure is proportional to liquid height multiplied by the liquid specific gravity.

Dry Leg Condition

Low-side transmitter piping will remain empty if gas above the liquid does not condense. This is a dry leg condition. Range determination calculations are the same as those described for bottom-mounted transmitters in open vessels, as shown in Figure 2-10.

Figure 2-10. Liquid Level Measurement Example.



Let **X** equal the vertical distance between the minimum and maximum measurable levels (500 in.).
Let **Y** equal the vertical distance between the transmitter datum line and the minimum measurable level (100 in.).
Let **SG** equal the specific gravity of the fluid (0.9).
Let **h** equal the maximum head pressure to be measured in inches of water.
Let **e** equal head pressure produced by **Y** expressed in inches of water.
Let **Range** equal **e** to **e** + **h**.

Then h = (**X**)(**SG**)
= 500 x 0.9
= 450 inH_2O
e = (**Y**)(**SG**)
= 100 x 0.9
= 90 inH_2O
Range = 90 to 540 inH_2O

Wet Leg Condition

Condensation of the gas above the liquid slowly causes the low side of the transmitter piping to fill with liquid. The pipe is purposely filled with a convenient reference fluid to eliminate this potential error. This is a wet leg condition.

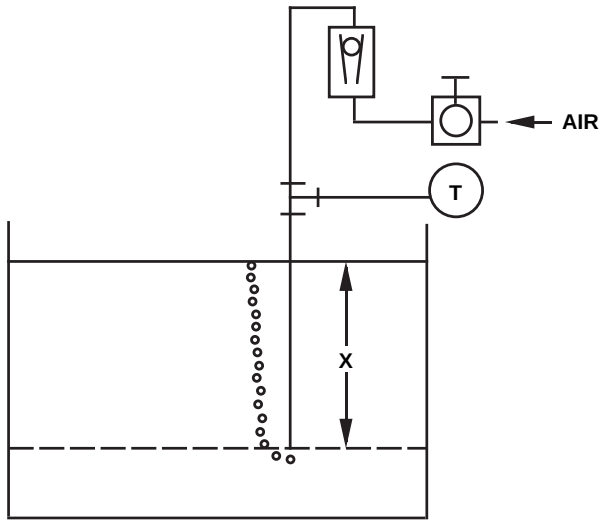
The reference fluid will exert a head pressure on the low side of the transmitter. Zero elevation of the range must then be made. See Figure 2-11.

Bubbler System in Open Vessel

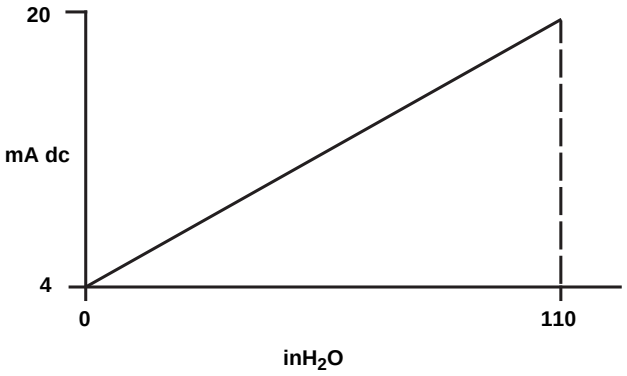
A bubbler system that has a top-mounted pressure transmitter can be used in open vessels. This system consists of an air supply, pressure regulator, constant flow meter, pressure transmitter, and a tube that extends down into the vessel.

Bubble air through the tube at a constant flow rate. The pressure required to maintain flow equals the liquid's specific gravity multiplied by the vertical height of the liquid above the tube opening. Figure 2-11 shows a bubbler liquid level measurement example.

Figure 2-11. Bubbler Liquid Level Measurement Example.



Let **X** equal the vertical distance between the minimum and maximum measurable levels (100 in.).
Let **SG** equal the specific gravity of the fluid (1.1).
Let **h** equal the maximum head pressure to be measured in inches of water.
Let **Range** equal **zero** to **h**.
Then **h** = **(X)(SG)**
= 100 x 1.1
= 110 inH_2O
Range = 0 to 110 inH_2O



INSTALLATION OPTIONS

Analog Displays

⚠ Option Codes M1, M2, and M6 provide local indication of the transmitter output in a variety of scaling configurations with an indicator accuracy of ±2 percent. The plug-in mounting configuration allows for simple installation and removal of the analog displays. The meter scaling options are shown below.

- M1 Linear analog display, 0–100% scale
- M2 Square-root analog display, 0–100% flow scale
- M6 Square-root analog display, 0– 10√ scale

LCD Displays

The LCD Display Option Codes, M4 and M7–M9, provide a highly accurate local display of the process variable. A variety of scaling configurations are available and listed as follows:

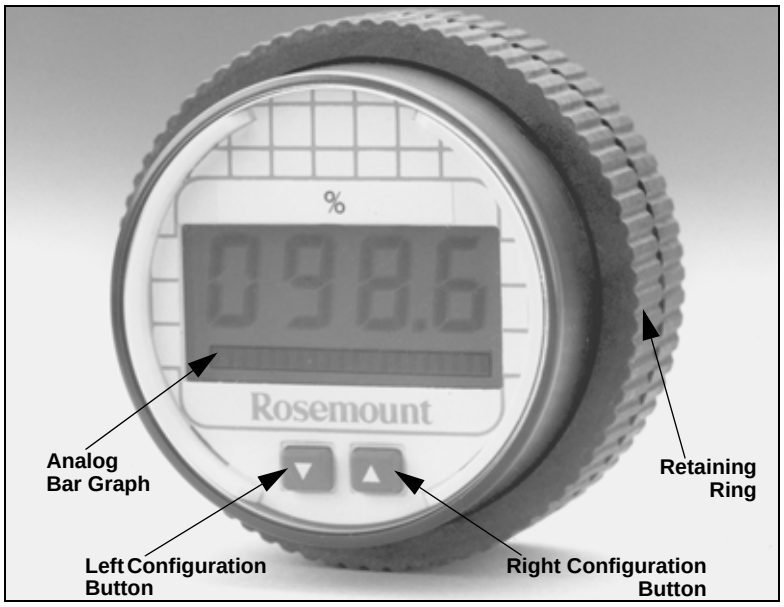
- M4 Linear LCD Display, 0 to 100%
- M7 Special scale LCD Display (specify range, mode, and engineering units)
- M8 Square-root LCD Display, 0 to 100%
- M9 Square-root LCD Display, 0 to 10%

LCD Display Configuration

The Rosemount LCD Display has four digits and plugs directly into the Rosemount 1151 Smart Pressure Transmitter to provide a highly accurate digital display of the process variable. This manual explains the configuration and assembly of the LCD Display and includes the applicable functional, performance, and physical specifications. This meter adds no voltage drop in the 4–20 mA current loop when connected directly across the transmitter test terminals.

The LCD Display may be configured to meet specific requirements by using the left and right calibration buttons located on the meter face as shown in Figure 2-12. The LCD Display cannot be configured for reverse flow because the 20 mA value must always be greater than the 4 mA value. The analog bar graph is also shown in Figure 2-12. The 20-segment bar graph is factory calibrated and represents 4–20 mA directly.

Figure 2-12. LCD Display.



No calibration equipment is required to configure the LCD Display, but between 4 and 20 mA must be flowing through the loop. The actual value of the current is not significant. In addition, meter configuration does not affect the transmitter/loop current. Use the following meter configuration procedure to properly configure the LCD Display:

Remove the Cover

1. Unscrew the retaining ring shown in Figure 2-12 and lift the transparent cover off of the housing.

NOTE
The LCD Display time-out is approximately 16 seconds. If keys are not pressed within this period, the indicator reverts to reading the current signal.

Position the Decimal Point and Select the Meter Function

2. Press the left and right configuration buttons simultaneously and release them immediately.
3. To move the decimal point to the desired location, press the left configuration button.
4. To scroll through the mode options, press the right configuration button repeatedly until the desired mode is displayed.
   See Table 2-3.

Table 2-3. LCD Display Modes.

Options	Relationship between Input Signal and Digital Display
L in	Linear
L inF	Linear with five-second filter
Srt	Square root
SrtF	Square root with five-second filter

Square root function only relates to the digital display.
The bar graph output remains linear with the current signal.
Square root response
The digital display will be proportional to the square root of the input current where 4 mA=0 and 20 mA=1.0, scaled per the calibration procedure. The transition point from linear to square root is at 25% of full scale flow.
Filter response operates upon "present input" and "input received in the previous five second interval" in the following manner:
Display = (0.75 × previous input) + (0.25 × present input)
This relationship is maintained provided that the previous reading minus the present reading is less than 25% of full scale.

Store the Information

5. Press both configuration buttons simultaneously for two seconds. The meter displays "----" for approximately 7.5 seconds while the information is being stored.

Set the Display Equivalent to a 4 mA Signal

6. Press the left button for two seconds.
7. To set the display numbers to a lower value, press the left configuration button, and to set the display numbers to a higher value, press the right configuration button. Set the numbers between –999 and 1000.
8. To store the information, press both configuration buttons simultaneously for two seconds.

Set the Display Equivalent to a 20 mA Signal

9. Press the right button for two seconds.
10. To set the display numbers to a lower value, press the left configuration button, and to set the display numbers to a higher value, press the right configuration button. Set the numbers between –999 and 9999. The sum of the 4 mA point and the span must not exceed 9999. The 20 mA value must be greater than the 4 mA value.
11. To store the information, press both configuration buttons simultaneously for two seconds. The LCD Display is now configured.

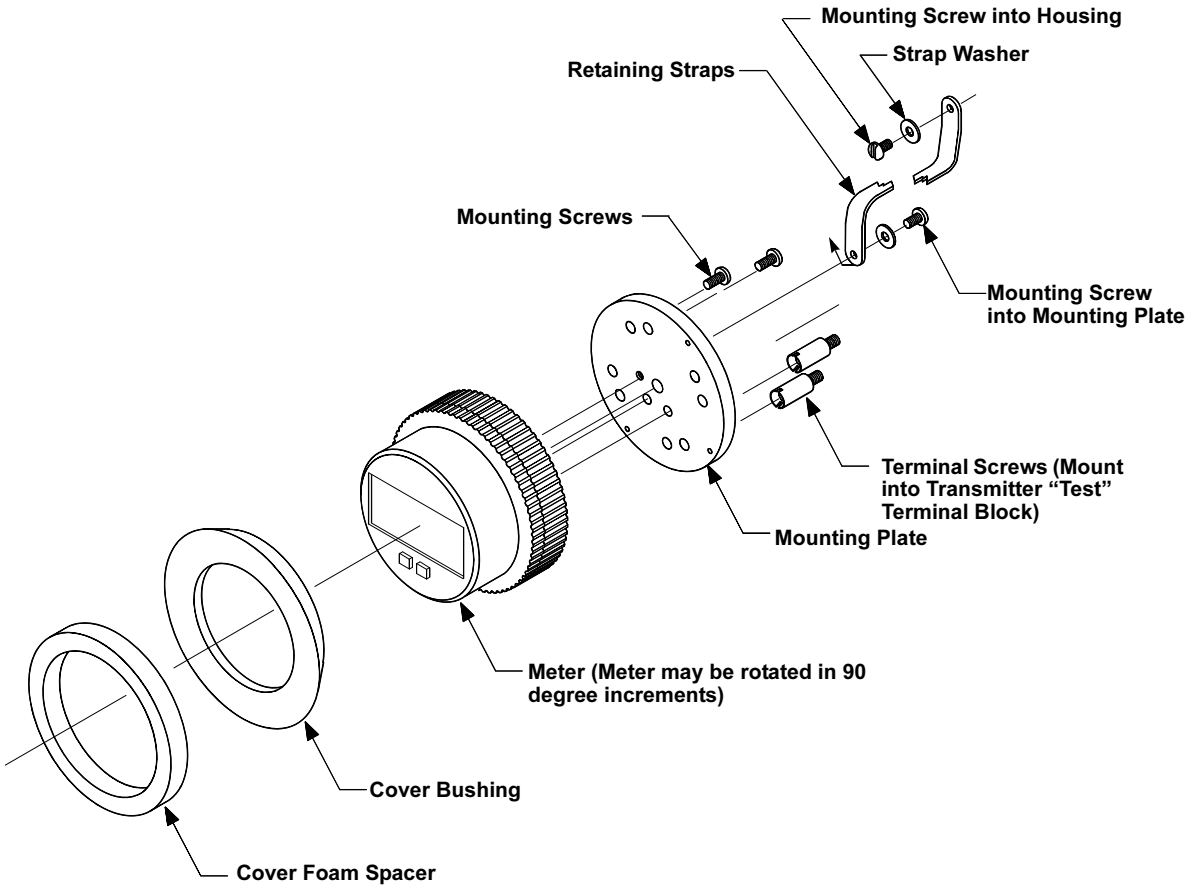
Replace the Cover

12. Make sure the rubber gasket is seated properly, replace the transparent cover, and replace the retaining ring.

LCD Display Assembly

Figure 2-13 shows the mounting hardware required to properly install the LCD Display on a transmitter or in the field signal indicator.

Figure 2-13. LCD Display
Exploded View.



Terminal Blocks

The terminal block options can increase the Rosemount 1151 Pressure Transmitter's ability to withstand electrical transients induced by lightning, welding, heavy electrical equipment, or switch gears. The Rosemount 1151 Pressure Transmitter, with the integral transient protection option, meets the standard performance specifications as outlined in this product manual. In addition, the transient protection circuitry meets IEEE Std 587, Category B, and IEEE Std 472, Surge Withstand Capability.

Figure 2-14. Transient Protection and Filter Terminal Block (Code R1).



Transient Protection and Filter Terminal Block (Option Code R1)

Option Code R1 provides EMI/RFI protection and the benefit of integral transient protection. This terminal block can be ordered as a spare part to retrofit existing Rosemount 1151 Transmitters with Option Code R2.

Terminal Block Installation

Use a Phillips screwdriver, a flat-blade screwdriver and the following steps to install a retrofitable transient protection terminal block:

1. Turn off all power to the Rosemount 1151 on which the terminal block is being installed.
2. ⚠ Unscrew the transmitter terminal-side (indicated on the housing nameplate) cover (on the high side of the transmitter) exposing the standard terminal block.
3. Disconnect wiring to the terminal block.
4. Remove the single grounding screw and the two signal terminal screws, with terminal eyelet washers, from the standard terminal block.
5. Set the retrofitable transient protection terminal block into the housing, making sure the ground and signal terminals are properly aligned.
6. Insert the short mounting screws with washers in the mounting holes and tighten the terminal block to the transmitter.
7. Turn the transient protector grounding sleeve, located in the grounding hole, just enough to stabilize the unit on the transmitter. Overtightening the grounding sleeve will shift the terminal block out of alignment.
8. Insert the long grounding screw with the square washer into the grounding hole and tighten.
9. Connect the positive power supply wire to the transient protector terminal screw labeled “+ SIGNAL”, and the negative power supply wire to the terminal screw labeled “- SIGNAL.”
10. Attach the supplied label to the terminal side transmitter cover.
11. ⚠ Replace the terminal side cover on the transmitter.

Section 3 Configuration (Smart Only)

Overview . . . . . page 3-1
Safety Messages . . . . . page 3-1
Wiring Diagrams . . . . . page 3-3
Hart Communicator . . . . . page 3-5
Testing the Equipment and the Loop . . . . . page 3-6

OVERVIEW

This section contains information on commissioning and operating Rosemount 1151 Smart Pressure Transmitters. Instructions for setting transmitter switches (prior to installation) and explanations of software functions are provided in this section. Also, fast key sequences are listed for each software function.

SAFETY MESSAGES

Warnings (⚠)

Procedures and instructions in this section that raise potential safety issues are indicated by a warning symbol (⚠). Refer to the following warning messages before performing an operation preceded by this symbol.

⚠WARNING

Explosions can result in death or serious injury. Before connecting a communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or nonincendive field wiring practices.

Commissioning the Transmitter on the Bench

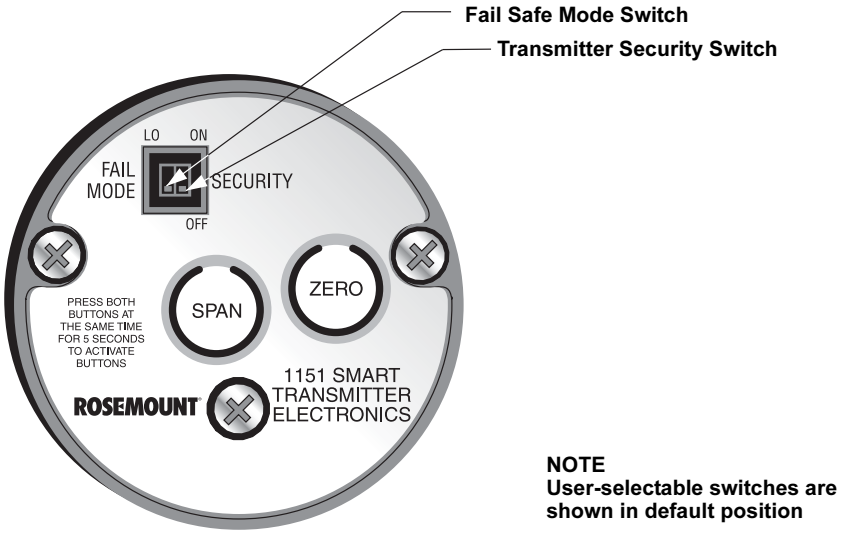
Commissioning consists of testing the transmitter, testing the loop, and verifying transmitter configuration data. Rosemount 1151 Smart Pressure Transmitters may be commissioned either before or after installation. The recommendation is to commission the transmitter on the bench before installation. This ensures that all transmitter components are in good working order and heightens familiarity with the device.

To avoid exposing the transmitter electronics to the plant environment after installation, set the failure mode and transmitter security switches during the commissioning stage on the bench.

Setting Hardware Switches

The Rosemount 1151 Smart Pressure Transmitter contains hardware switches that provide user-selectable operation of the failure mode and transmitter security. The switches are located on the electronics assembly just inside the electronics housing cover, as shown in Figure 3-1.

Figure 3-1.
Transmitter Switch Locations.



NOTE
User-selectable switches are shown in default position

Failure Mode Alarm Switch

As part of its normal operation, the Rosemount 1151 Smart continuously monitors its own operation. This automatic diagnostic routine is a timed series of checks repeated continuously.

The electronics faceplate has HI and LO user-selectable failure mode settings, refer to Figure 3-1. If the diagnostic routine detects a failure in the transmitter in analog output, the transmitter either drives its output below 3.8 mA or above 21.0 mA, depending on the position of the failure mode alarm switch.

NOTE
With multidrop (digital) output, the analog output remains at 4 mA, even when a diagnostic failure is detected. This is true for both the HI and LO fail mode switch settings. A bit is enabled in the digital word to indicate a diagnostic failure.

Transmitter Security (Write-Protection Switch)

Once the transmitter has been configured, it may be desirable to protect the configuration data from changes. The electronics assembly is equipped with a switch labeled SECURITY. Figure 3-1 shows the switch location on the circuit side of the electronics housing. In the ON position, the switch prevents the accidental or deliberate change of configuration data. To enable the sending of configuration data, simply return the transmitter security switch to the OFF position.

NOTE
The transmitter security switch must be in the OFF position before configuration changes can be made to the transmitter configuration.

Commissioning with a HART-Based Communicator

Before putting the Rosemount 1151 Smart Pressure Transmitter into operation, commission the instrument using a HART-based communicator.

⚠ To commission on the bench, connect a 17 to 45 V dc power supply and a current meter. Make connections as shown in Figure 3-2. The power supplied to the transmitter should not drop below the transmitter lift-off voltage. If the transmitter is being configured when the power drops below the lift-off voltage, the configuration information may not be interpreted correctly by the transmitter.

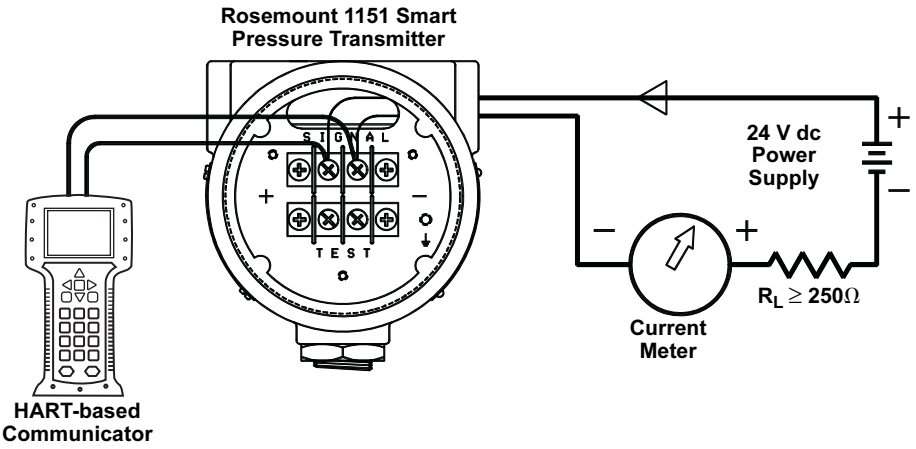
NOTE
To enable communication, a resistance of at least 250 Ω must be present between the communicator loop connection and the power supply.

WIRING DIAGRAMS

Bench Hook-up

After the bench equipment is connected as shown in Figure 3-2, turn on the HART-based communicator. The communicator will search for a HART-compatible device and will indicate when the connection is made. If the connection is not made, the communicator will indicate that no device was found. If this occurs, refer to Section 5 Troubleshooting.

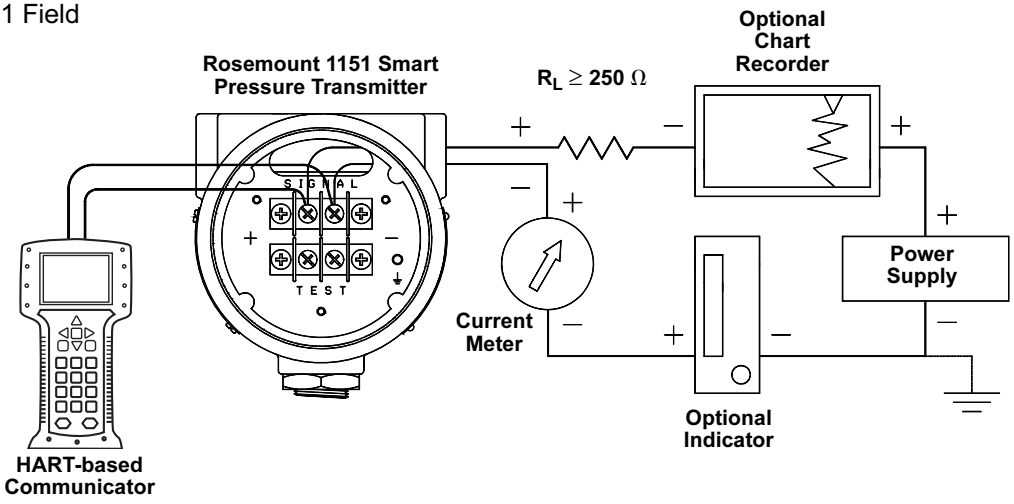
Figure 3-2. Bench Hook-up.



NOTE
An alternate location to connect an ammeter is on the set of terminals labeled “TEST.” Connect the positive lead of the ammeter to the positive test terminal, and the negative lead of the ammeter to the negative test terminal.

Field Hook-up

Figure 3-3. Rosemount 1151 Field Wiring Diagram.

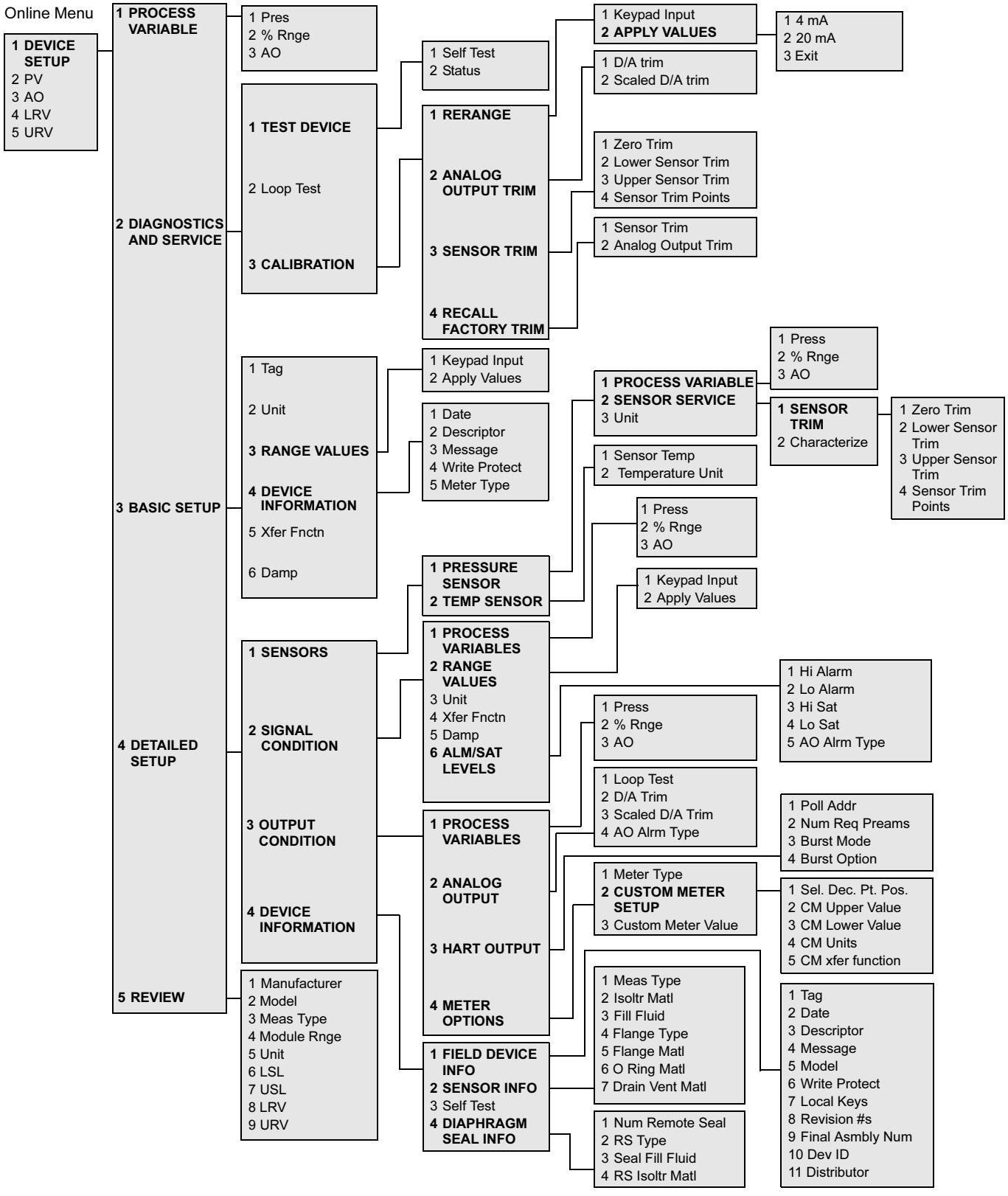


NOTE
Signal Loop may be grounded at any point or left ungrounded.

NOTE
A HART Interface may be connected at any termination point in the loop. Signal loop must have 250 ohms minimum load for communications.

HART COMMUNICATOR

Figure 3-4. HART Communicator Menu Tree



TESTING THE EQUIPMENT AND THE LOOP

Test functions verify that the transmitter, the communicator, and the loop are in good working order. Testing is recommended whenever component failure or a problem with loop performance is suspected.

Communicator Test

A communicator test is performed to ensure the communicator is working properly. The HART Communicator performs a self-test after being turned on. If a problem is detected, the communicator will list a diagnostic message.

Transmitter Test

HART Comm. Fast Key Sequence	1, 2, 1, 1

Although the Rosemount 1151 Smart Pressure Transmitter performs continuous self-diagnostics, a more extensive diagnostic routine can be initiated with the transmitter test function. The transmitter test routine can identify an electronics failure.

If the transmitter test detects a problem, messages to indicate the source of the problem are displayed.

Loop Test

HART Comm. Fast Key Sequence	1, 2, 2

The loop test allows verification of the output of the transmitter, the integrity of the loop, and the operation of any recorders or similar devices. If commissioning the transmitter on the bench, repeat this test after the transmitter has been installed in the field.

A reminder appears to set the loop to manual. Do so and proceed. The next display selects a discrete milliampere transmitter output level. To command the transmitter to output 4 mA, for example, select 4 mA. Check the current meter installed in the test loop to verify that it reads 4 mA. If so, end the loop test. If the output is not 4 mA, then the receiving meter is malfunctioning or the transmitter requires a digital trim as described on page 4-4.

Review Configuration Data

HART Comm. Fast Key Sequence	1, 5

Review of the transmitter factory configuration data is recommended.

Checking the Transmitter Output

HART Comm. Fast Key Sequence	2

Process variable readings can be obtained in engineering units and milliamperes. If the milliampere display does not agree with the actual loop reading given by a multimeter, a 4–20 mA trim is required.

The last step of start-up and commissioning is to check the transmitter output. Obtain process variable readings in engineering units and milliamperes. If this display does not agree with the actual loop reading given by a multimeter, a 4–20 mA trim is required (see page 4-10).

Range Points

HART Comm. Fast Key Sequence	1, 3, 3

The Rosemount 1151 Smart 4 and 20 mA range points can be viewed and edited with these fast key sequences.

Common Functions

The following tasks are a common part of a transmitter commissioning.

Setting the Loop to Manual

When preparing to send or request data that would disrupt the loop or change the output of the transmitter, set the loop to manual. The HART Communicator will prompt for this setting when necessary. Keep in mind that simply acknowledging this prompter does not set the loop to manual. It is only a reminder; the loop must be set to manual as a separate operation.

Change Non-Output Related Information

The Rosemount 1151 Smart contains several configuration parameters that do not directly affect the transmitter output. These parameters include:

- Date
- Descriptor
- Message
- Meter type

Configure the Analog Output Parameters

Setting Units

HART Comm. Fast Key Sequence	1, 3, 2

By setting the output units, a process can be monitored using the specified units. This is important if a plant uses units which differ from the default values. Output units can be selected from among 14 output options:

• inH_20	• inHg	• ftH_20
• mmH_20	• mmHg	• psi
• bar	• mbar	• g/cm^2
• kg/cm^2	• Pa	• kPa
• torr	• atm	

Reranging

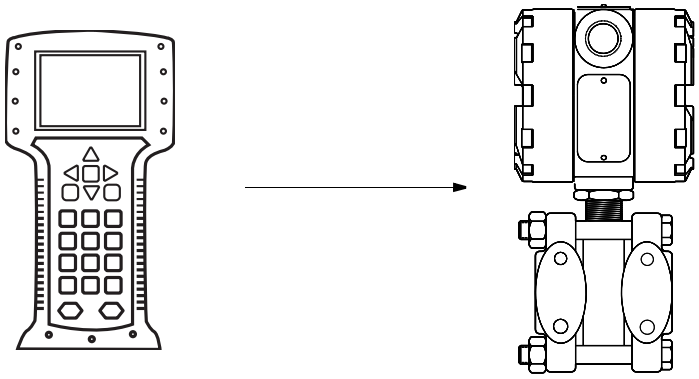
One of the most common configuration tasks involves reranging the transmitter 4 and 20 mA points.

Reranging matches the transmitter range points with the applied process pressures. It can be performed three ways:

- using the communicator only
- using the communicator and a reference pressure
- using the integral zero and span buttons and a reference pressure

Reranging with a Communicator Only

HART Comm. Fast Key Sequence	1, 2, 3, 1, 1



Reranging with only the communicator changes the analog 4 and 20 mA points independently without a pressure input.

This means that when you change either the 4 or 20 mA setting, you also change the span. For instance:

If the transmitter is ranged so that

4 mA = 0 inH_2O, and
20 mA = 100 inH_2O,

and you change the 4 mA setting to 50 inH_2O using the communicator only, the new settings are:

4 mA = 50 inH_2O, and
20 mA = 100 inH_2O.

Note that the span was also changed from 100 inH_2O to 50 inH_2O, while the 20 mA setpoint remained at 100 inH_2O.

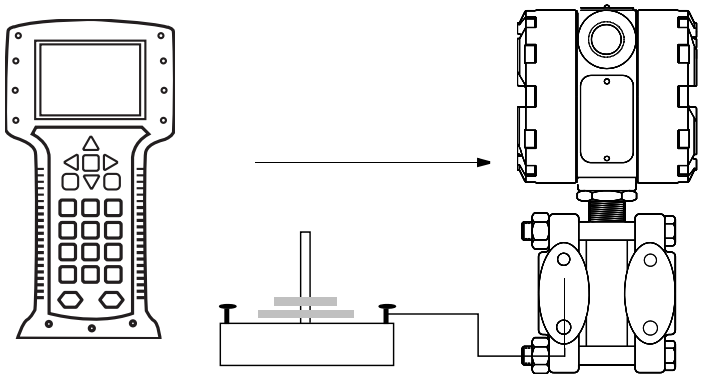
To obtain reverse output, simply set the 4 mA point at a greater numerical value than the 20 mA point. Using the above example, setting the 4 mA point at 100 inH_2O and the 20 mA point at 0 inH_2O will result in reverse output.

NOTE
The 4 and 20 mA output is based on the transmitter's existing digital calibration. Before reranging with the communicator, make sure the transmitter is correctly interpreting the process variable input. To match the transmitter's reading in engineering units to plant standard, use the sensor trim function under “Digital Trim” in this section.

Reranging with a Communicator and a Reference Pressure

HART Comm. Fast Key Sequence	1, 2, 3, 1, 2

Reranging with a pressure input source and the communicator allows you to maintain the same analog span.



For instance, if the transmitter is ranged so that:

4 mA = 0 inH_2O, and
20 mA = 100 inH_2O,

and you then change the 4 mA setting to 50 inH_2O using the communicator (or buttons) and a pressure input, the new settings are:

4 mA = 50 inH_2O
20 mA = 150 inH_2O

The 100 inH_2O span is maintained.

To rerange with a reference pressure, apply the desired pressure input to represent the 4 or 20 mA point. Allow the variable reading to stabilize for approximately ten seconds. Press either the 4 mA or 20 mA to make this pressure value either point.

It is also important to note that when using a pressure source, the 4 and 20 mA setpoints are based on the transmitter's interpretation of the pressure input provided. It is possible that when a plant standard is input, the transmitter reads it as a slightly different value. Although the 4 and 20 mA setpoints will operate properly within these applied settings, the transmitter's digital output in engineering units may indicate a slightly different value.

The sensor trim function under "Digital Trim" can be used to match the transmitter's reading in engineering units to your plant standard, thereby eliminating any discrepancy.

NOTE
Reranging only the 4 mA or the 20 mA with a pressure input will maintain the initial span width.

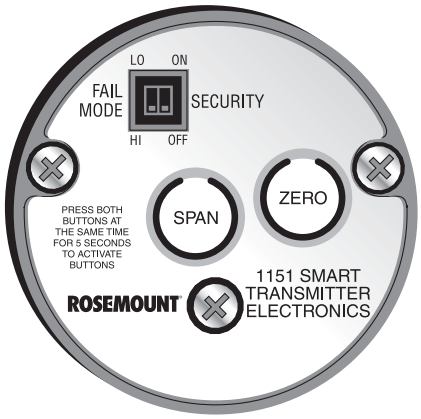
NOTE
Do not rerange the transmitter such that the 4 and 20 mA range points—upper range value (URV) and lower range value (LRV)—are outside the high and low digital sensor trim values. To optimize performance, the digital trim span should be equal to or slightly greater than the 4–20 mA span.

Reranging Using the Integral Span and Zero Buttons and a Reference Pressure

It is also possible to rerange the transmitter using the span and zero buttons located within the circuit side of the electronics housing on the electronics faceplate, as shown in Figure 3-5.

Reranging with a pressure input and the zero and span buttons maintains the same analog span.

Figure 3-5. Rosemount 1151 Electronics Faceplate.



NOTE
User-selectable switches are shown in default position.

Use the following steps to rerange using the integral span and zero buttons:

1. Using a pressure source with an accuracy three to ten times the desired calibrated accuracy, apply a pressure equivalent to the lower calibrated value to the high side of the transmitter.
2. Remove the circuit side cover to expose the span and zero buttons. Hold both the span and zero buttons down simultaneously for at least five seconds to activate the controls. The buttons remain active for 15 minutes. After 15 minutes the buttons must be reactivated by pressing simultaneously and holding again.
3. Press the zero button for five seconds to set the 4 mA point. Verify that the output is 4 mA.
4. Apply a pressure equivalent to the higher calibrated value to the high side of the transmitter.
5. Press the span button for five seconds to set the 20 mA point. Verify that the output is 20 mA.

NOTE
Both the lower and upper range values must fall within the lower and upper range limits of the sensor module, and meet the minimum and maximum span criteria allowed by the transmitter.

Setting Output Type

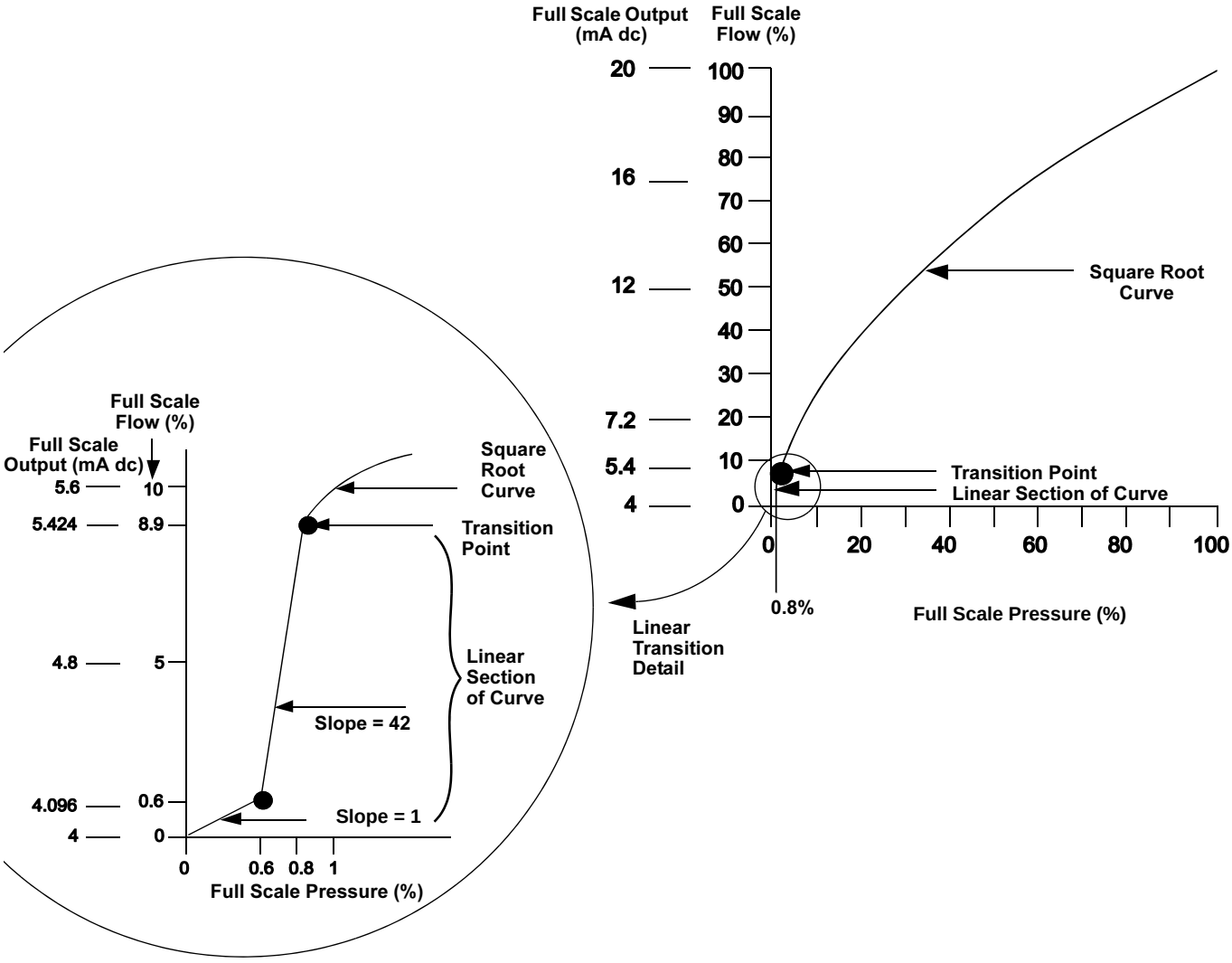
HART Comm. Fast Key Sequence	1, 3, 5

When the square root output option is active the Rosemount 1151 analog output is proportional to flow. To avoid the extremely high gain that results as the input approaches zero, the Rosemount 1151 automatically switches to a linear output in order to ensure a more stable output near zero. Figure 3-6 illustrates this transition point.

The transition from linear to square root is not adjustable. It occurs at 0.8% of ranged pressure input or 9.0% of full-scale flow output in transmitters with Revision 5.2. software. In earlier software, the transition point occurred at 4.0% of ranged pressure input, or 20% of full scale flow output.

The transition from linear to square root output is smooth, with no step change or discontinuity in output.

Figure 3-6. Square Root Output Transition Point.



From 0.0 percent to 0.6 percent of the ranged pressure input, the slope of the curve is unity (y = x). This allows accurate calibration near zero. Greater slopes would cause large changes in output for small changes at input. From 0.6 percent to 0.8 percent, the slope of the curve equals 42 (y = 42x) to achieve continuous transition from linear to square root at the transition point.

Setting Damping

HART Comm. Fast Key Sequence	1, 3, 6

The Rosemount 1151 Smart Pressure Transmitter has electronic damping that can increase the response time of the transmitter to smooth the output when there are rapid input variations. High damping values filter out process noise, but response time is decreased. Low damping values increase response time, but process noise can also be detected.

For Rosemount 1151 Smart Pressure Transmitter transmitters, damping values may be set in 0.1 second increments from 0 to 16.0 seconds. The default damping value is 0.2 seconds (0.4 seconds for Range 3). Damping values for inert-filled sensors are slightly higher.

Advanced Functions

Burst Mode

HART Comm. Fast Key Sequence	1, 4, 3, 3, 3

When the Rosemount 1151 Smart is configured for burst mode, it provides faster digital communication from the transmitter to the control system by eliminating the time required for the control system to request information from the transmitter.

Burst mode is compatible with use of the analog signal. Because HART protocol features simultaneous digital and analog data transmission, the analog value can drive other equipment in the loop while the control system is receiving the digital information. Burst mode applies only to the transmission of dynamic data (pressure and temperature in engineering units, pressure in percent of range, and/or analog output in mA or V), and does not affect the way other transmitter data is accessed.

Access to information other than dynamic transmitter data is obtained through the normal poll/response method of HART communication. A HART-based communicator or the control system may request any of the information that is normally available while the transmitter is in burst mode. Between each message sent by the transmitter, a short pause allows the HART-based communicator or a control system to initiate a request. The transmitter will receive the request, process the response message, and then continue “bursting” the data approximately three times per second.

Saving, Recalling, and Cloning Configuration Data

Data that was entered off-line can be stored in the HART-based communicator memory and downloaded to other transmitters later. Data also can be copied from a transmitter in order to be sent to other transmitters in a process known as “cloning.” This is especially useful if when working with a large number of transmitters that require the same configuration data.

NOTE
The HART Communicator requires the use of the Transfer Menu to move data between the transmitter memory and the communicator. This menu is available from the Main Menu of the HART Communicator.

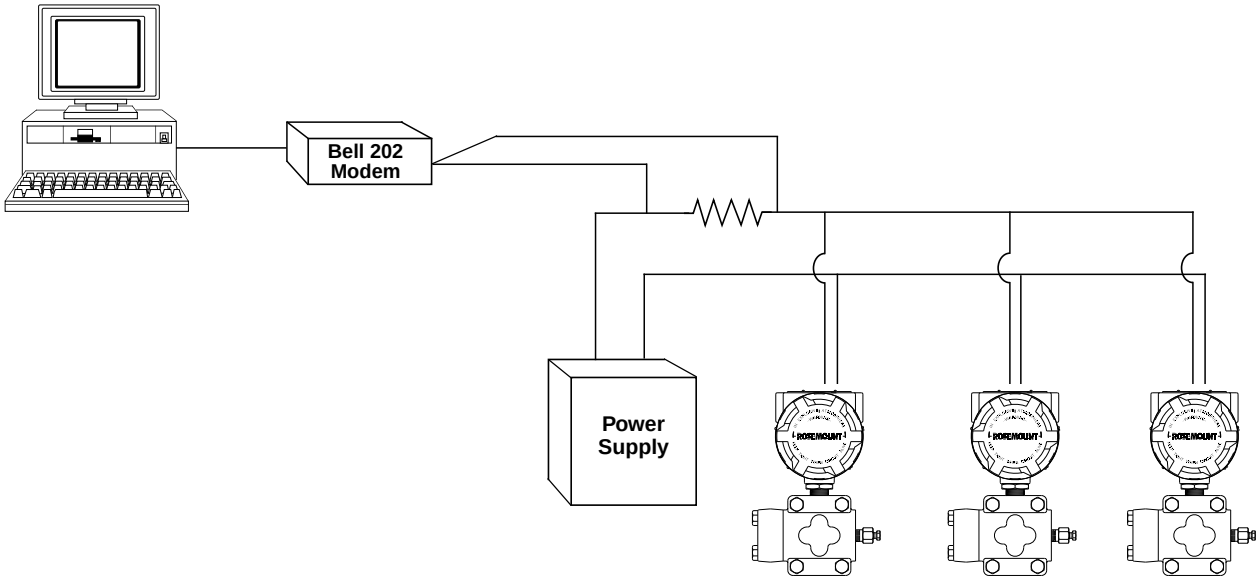
Multidrop Communication

Multidropping transmitters refers to the connection of several transmitters to a single communications transmission line. Communication between the host and the transmitters takes place digitally with the analog output of the transmitters deactivated. With the smart communications protocol, up to 15 transmitters can be connected on a single twisted pair of wires or over leased phone lines. Note that burst mode operation is not compatible with multidrop communications.

The application of a multidrop installation requires consideration of the update rate necessary from each transmitter, the combination of transmitter models, and the length of the transmission line. Multidrop installations are not recommended where intrinsic safety is a requirement. Communication with the transmitters can be accomplished with commercially available Bell 202 modems and a host implementing the HART protocol. Each transmitter is identified by a unique address (1-15) and responds to the commands defined in the HART protocol.

Figure 3-7 shows a typical multidrop network. This figure is not intended as an installation diagram. Contact Emerson Process Management product support with specific requirements for multidrop applications.

Figure 3-7. Typical Multidrop Network.



HART-based communicators can test, configure, and format a multidropped Rosemount 1151 in the same way as it can a Rosemount 1151 in a standard point-to-point installation.

NOTE
The Rosemount 1151 Smart Pressure Transmitter is set to address 0 at the factory, allowing it to operate in the standard point-to-point manner with a 4–20 mA output signal. To activate multidrop communication, the transmitter address must be changed to a number between 1 and 15 (inclusive). This change deactivates the 4–20 mA analog output, sending it to 4 mA. It also disables the failure mode alarm signal, which is controlled by the upscale/downscale switch.

Changing a Transmitter Address

HART Comm. Fast Key Sequence	1, 4, 3, 3, 1

To change the address of a multidropped transmitter, follow these fast key sequences. To activate multidrop communication, the transmitter address must be changed to a number from 1 to 15.

Polling a Multidropped Loop

HART Comm. Fast Key Sequence	1, 1, 1

Polling a multidropped loop determines the model, address, and number of transmitters on the given loop.

Section 4 Operation and Maintenance

Overview . . . . . **page 4-1**
Safety Messages . . . . . **page 4-1**
Smart Calibration . . . . . **page 4-2**
Analog Calibration . . . . . **page 4-11**

OVERVIEW

This section is separated into two parts: SMART and ANALOG. Go to the correct corresponding pages.

The Operation & Maintenance section contains information on calibration, including the trim functions for the Smart transmitters and hardware adjustments for the analog transmitters.

SAFETY MESSAGES

Warnings (⚠)

Procedures and instructions in this section that raise potential safety issues are indicated by a warning symbol (⚠). Refer to the following warning messages before performing an operation preceded by this symbol.

⚠WARNING

- Isolate a failed transmitter from its pressure source as soon as possible. Pressure that may be present could cause death or serious injury to personnel if the transmitter is disassembled or ruptures under pressure.
- Explosions can cause death or serious injury. Do not remove the instrument cover in explosive atmospheres when the circuit is alive.
- Explosions can cause death or serious injury. Do not break the housing seal in explosive environments. Breaking the housing seal invalidates the explosion-proof housing rating.
- Process leaks can cause death or serious injury. An incorrectly installed backup ring can destroy the o-ring and cause process leaks. Install the backup ring using the following procedure.
- Exposure to hazardous substances can cause death or serious injury. If a hazardous substance is identified, a Material Safety Data Sheet (MSDS), required by law to be available to people exposed to specific hazardous substances, must be included with the returned goods.
- Explosions can cause death or serious injury. Do not disassemble the glass in the meter cover in explosive atmospheres. Disassembling the glass in the meter cover invalidates the explosion-proof meter rating.

⚠WARNING

- The following performance limitations may inhibit efficient or safe operation. Critical applications should have appropriate diagnostic and backup systems in place. Pressure transmitters contain an internal fill fluid. It is used to transmit the process pressure through the isolating diaphragms to the pressure sensing element. In rare cases, oil leak paths in oil-filled pressure transmitters can be created. Possible causes include physical damage to the isolator diaphragms, process fluid freezing, isolator corrosion due to an incompatible process fluid, etc. A transmitter with an oil fill fluid leak can continue to perform normally for a period of time. Sustained oil loss will eventually cause one or more of the operating parameters to exceed published specifications while a small drift in operating point output continues. Symptoms of advanced oil loss and other unrelated problems include:
    - Sustained drift rate in true zero and span or operating point output or both
    - Sluggish response to increasing or decreasing pressure or both
    - Limited output rate or very nonlinear output or both
    - Change in output process noise
    - Noticeable drift in operating point output
    - Abrupt increase in drift rate of true zero or span or both
    - Unstable output
    - Output saturated high or low

SMART CALIBRATION

Calibration Overview

Complete calibration of the Rosemount 1151 Smart Pressure Transmitter involves the following tasks:

Configuring the Analog Output Parameters

- Setting process variable units (page 3-7)
- Reranging (page 3-7)
- Setting output type (page 3-11)
- Setting damping (page 3-12)

Calibrating the Sensor

- Sensor trim (page 4-5)
- Zero trim (page 4-5)

Calibrating the 4–20 mA Output

- 4–20 mA output trim (page 4-11) or
- 4–20 mA output trim using other scale (page 4-11)

Figure 4-1. Rosemount 1151 Smart Transmitter Data Flow with Calibration Options.

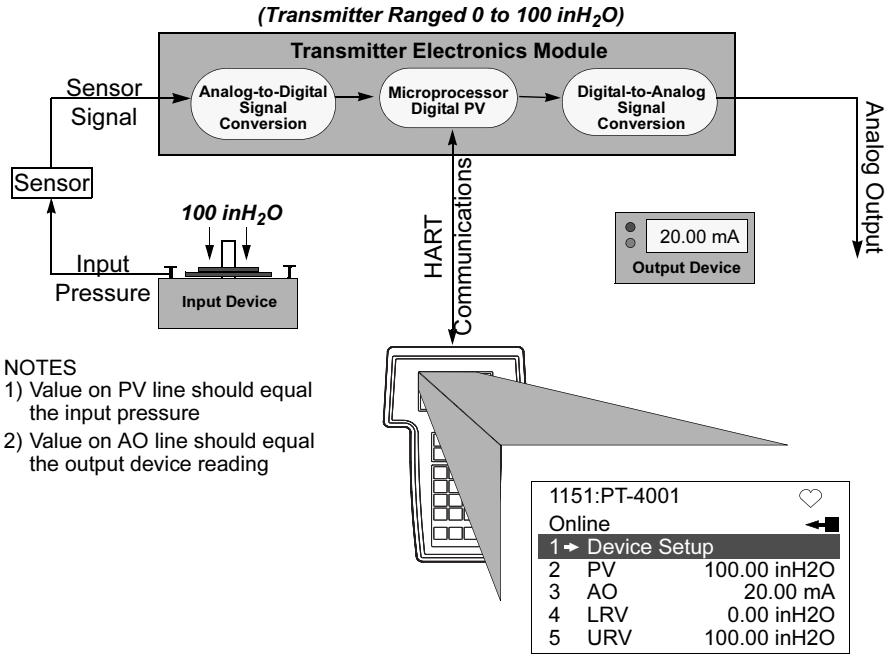


Figure 4-1 illustrates the Rosemount 1151 Smart transmitter data flow. This data flow can be summarized in four major steps:

1. A change in pressure is measured by a change in the sensor output (Sensor Signal).
2. The sensor signal is converted to a digital format that can be understood by the microprocessor (Analog-to-Digital Signal Conversion).
3. Corrections are performed in the microprocessor to obtain a digital representation of the process input (Digital PV).
4. The Digital PV is converted to an analog value (Digital-to-Analog Signal Conversion).

Figure 4-1 also identifies the approximate transmitter location for each calibration task. Note that the data flows from left to right, and a parameter change affects all values to the right of the changed parameter.

Table 4-1 identifies the recommended calibration procedures for each type of Rosemount 1151 Smart transmitter for both bench and field calibration.

Table 4-1. Recommended Calibration Tasks.

Transmitter	Bench Calibration Tasks	Field Calibration Tasks
Standard Calibration Tasks 1151DP 1151GP 1151HP 1151LT	1. Set output configuration parameters: a) Set the Transmitter Range Points. b) Set the Output Units. c) Set the Output Type (linear or square root). d) Set the Damping Value. 2. *Optional:* Perform a Full Sensor Trim —Pressure source required. 3. *Optional:* Perform an Analog Output Trim —Multimeter required.	1) Reconfigure parameters if necessary. 2) Zero trim the transmitter to compensate for mounting position effects or static pressure effects.
1151AP	Standard Bench Calibration, **except step 2**: 2. *Optional:* Perform a Full Sensor Trim if equipment is available (accurate absolute pressure source required); otherwise, perform the Low Trim Value section of Full Sensor Trim procedure.	1) Reconfigure parameters if necessary. 2) Perform Low Trim Value section of Full Sensor Trim procedure to correct for mounting position effects.

NOTE
A HART-based communicator is required for all sensor and output trim procedures.

Calibrate the Sensor

Digital Trim (Sensor Trim and Analog Output Trim)

In order to understand the digital trim function, it is necessary to understand that smart transmitters operate differently from conventional analog transmitters. Smart transmitters are characterized, which involves comparing a pressure input with the output of each transmitter's sensor module. The information obtained in the comparison is stored in the sensor module EEPROM during the characterization process. In operation, the transmitter uses this information to produce a process variable output, in engineering units, dependent on the pressure input. The digital trim function allows corrections to be made to this factory-stored curve.

The digital trim procedure is a two-step process. The first step, called sensor trim, consists of matching the digital process variable reading of the transmitter to a precision pressure input. The second step, called 4–20 mA trim, consists of adjusting the output electronics.

This procedure should not be confused with reranging. Although you can still match a pressure input to a 4 or 20 mA output through a reranging function, you have not affected the transmitter's interpretation of that input. A *sensor trim* allows you to alter the transmitter's interpretation of the input signal. *A 4-20 mA analog output trim* allows you to alter the transmitter's conversion of that interpretation into an analog 4–20 mA output.

The transmitter can only be as accurate as the equipment used to perform the digital trim. Use precise equipment under stable, ambient conditions for best results. If such equipment is not available, it may be better to return the transmitter to a local Rosemount service center for verification of the trim values. To eliminate the possibility of over-trimming the transmitter, the Rosemount 1151 Smart will accept only trim values that are within 5 percent of its original characterization.

Sensor Trim

The sensor may be trimmed in two ways: sensor trim and zero trim. They vary in complexity, and their use is application-dependent.

The low trim value should be trimmed first. This provides a stable reference for additional sensor trim adjustment. Adjustment of the low trim value provides an offset correction to the factory-established characterization curve. Adjustment of the high trim value provides a slope or gain correction to the characterization curve based on the low trim value. In neither case is the factory-established characterization curve changed by this procedure. The trim values allow optimized performance over a specified measuring range at the calibration temperature. See Figure 4-3 on page 4-6 for instrumentation set up.

Zero Trim

HART Comm. Fast Key Sequence	1, 2, 3, 3, 1

A **zero trim** is a simpler, one-point adjustment. It must be zero-based (in other words, within 3.0% of true zero) and it may be performed when an exact pressure source is not available for the second pressure needed in a sensor trim.

It is useful for compensating for mounting position effects or for zero shifts due to static pressure in differential pressure applications. However, since this correction maintains the slope of the characterization curve, it should not be used in place of a sensor trim over the full sensor range.

Zero trim is best performed with the transmitter installed in its final mounting position with static pressure applied (or no pressure for a gage transmitter).

NOTE
Because a zero trim must be zero-based, it generally should not be used with Rosemount 1151 Smart Absolute Pressure Transmitters. Absolute pressure transmitters reference absolute zero. To correct mounting position effects on a Rosemount 1151 Smart Absolute Pressure Transmitter, perform a low trim within the full sensor trim function. The low trim function provides a “zero” correction similar to the zero trim function but it does not require the input to be zero based.

Sensor Trim

HART Comm. Fast Key Sequence	1, 2, 3, 3

A **sensor trim** is a two-point sensor calibration where two end-point pressures are applied, and all output is linearized between them. To start the procedure, connect the communicator and a pressure input source of at least three times greater accuracy than the Rosemount 1151 Smart Transmitter as shown in Figure 4-3. Always let the variable stabilize for 10 seconds after application of the pressure source before taking its reading.

Figure 4-2. Sensor Trim

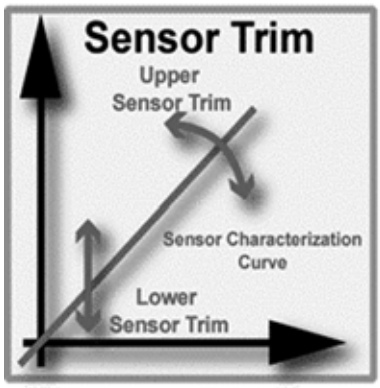
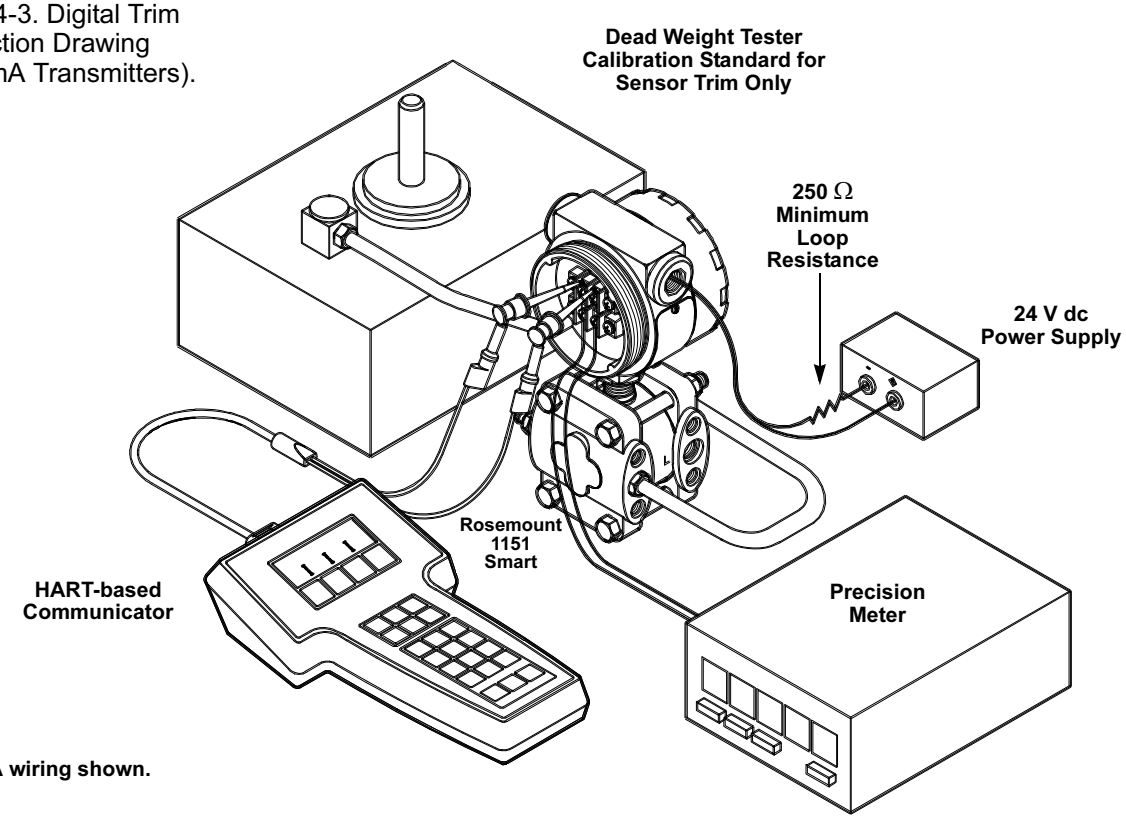


Figure 4-3. Digital Trim Connection Drawing (4–20 mA Transmitters).



NOTE
4–20 mA wiring shown.

NOTE
The Rosemount 1151 Smart Pressure Transmitter allows approximately a 5.0% URL deviation from the characterized curve established at the factory.

NOTE
A sensor trim requires a pressure source at least three times more accurate than the transmitter. For best accuracy, make sure the applied pressure is equal to or slightly less than the desired 4 mA setpoint, or equal to or slightly greater than the 20 mA setpoint.

The last trim/input values used will be displayed briefly. The engineering units shown match those selected under configuration or in transmitter characterization.

In selecting the pressure input values, the low and high values should be equal to or outside the 4 and 20 mA points. Do not attempt to obtain reverse output by reversing the high and low points.

Compensating for High Static Pressure

Systematic Error Correction

One feature of sensor trim is the ability to use it to improve the Rosemount 1151 Smart DP or HP performance by correcting for systematic error because of static pressure.

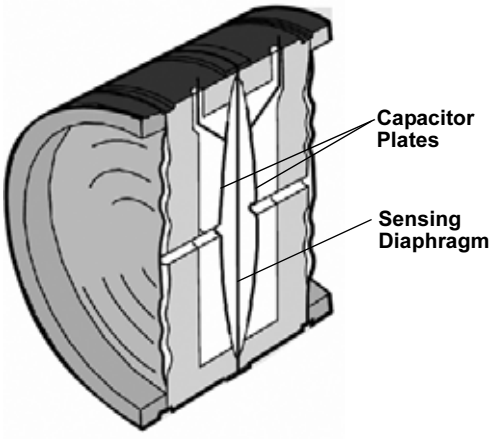
NOTE
Corrections can only be made in linear mode. Switch from square-root mode to linear mode if necessary.

To better understand the effect of static pressure on the Rosemount 1151DP/HP transmitter, below is a technical description.

Static pressure affects the δ-cell in two independent ways. First, with zero input differential, the effects on the high and low side of the cell tend to cancel each other, but this cancellation may not be complete at higher static pressures. The slight remaining difference in output is called the *Static Pressure Effect On Zero.* While the magnitude of the zero effect is predictable, its direction is not. The effect is repeatable, however, and can be eliminated by simply rezeroing the transmitter at line pressure.

Figure 4-4. δ-Cell™ Construction.

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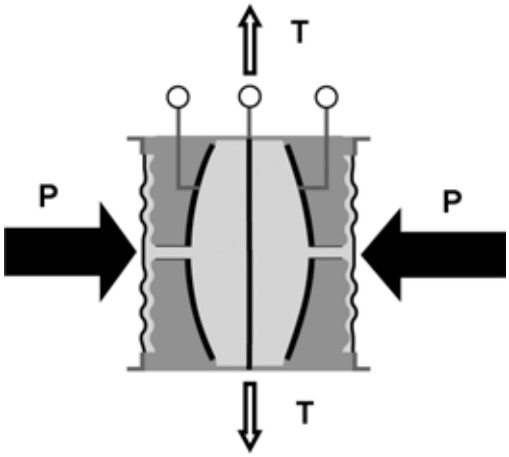
Second, transmitter span is also affected by static pressure. To understand this effect, it is necessary to understand the inner workings of the δ-cell sensor.

The δ-cell sensor is a variable capacitance device. Differential pressure is sensed as a capacitance that varies with the position of a movable plate, or sensing diaphragm, between two fixed plates. See Figure 4-4.

In the actual cell design, the sensing diaphragm is stretched between the fixed plates and welded to the cylindrical body of the cell.

When high pressure is applied to *both* sides of the cell, a slight deformation takes place, increasing tension in the sensing diaphragm. See Figure 4-5.

Figure 4-5. Static Pressure Effect on the δ-Cell Sensor.



This increase in tension causes a reduction in transmitter output; as static pressure increases, output for any given differential decreases. In other words, as static pressure increases, a slightly higher differential pressure is required to move the sensing diaphragm a given amount. This static pressure effect is repeatable and linear, because it is within the realm governed by Hooke's Law, which states that a body acted upon by an external force will deform linearly, proportional to the stress, so long as a certain limit is not exceeded.

High static pressure causes a systematic span shift in the transmitter. Because static pressure always acts to reduce span and is linear, it is easy to correct the effect during calibration by performing a sensor trim. Table 4-2 shows the amount of systematic span shift for Range Codes 3 through 8.

Table 4-2. Systematic Span Shift

Range Code	316L SST	Alloy C-276
3	–1.75%	–1.0%
4	–0.90%(1)	–0.60%
5	–0.80%(1)	–0.70%
6	–1.50%(1)	–1.45%
7	–1.00%(1)	–1.05%
8	–0.65%	–0.65%

(1) Applies also to Rosemount 1151HP.

Correction for systematic error is made by simply calculating a correction factor for the high trim and low trim and inputting this correction into the transmitter.

To correct for systematic error due to static line pressure, use the following formulas to determine a corrected value for Low Trim and High Trim.

Low Trim (LT) = LRV + S (LRV) P

WhereLT = Corrected Low Trim Value at Atmosphere
LRV = Lower Range Value at Pressure P
S = Span Shift from Table 4-2
P = Static Line Pressure

High Trim (HT) = URV + S (URV) P

WhereHT = Corrected High Trim Value at Atmosphere
URV = Upper Range Value at Pressure P
S = Span shift from Table 4-2
P = Static Line Pressure

Example 1

A Rosemount 1151DP Range 4 transmitter is to be calibrated 0–90 inH_2O and used in an application where static line pressure is 1,200 psi.

Looking at Table 4-2 you see the Range 4 span is reduced by 0.90% per 1,000 psig. At 1,200 psi the span would be reduced by 1.08 percent.
0.009 X 1.2 = 1.08%

Analog Electronics
There are two ways to calibrate an analog transmitter for this application. One method is to increase the pressure when adjusting the span. Another method is to apply the span pressure and increase the mA output.

1. Apply 0 inH_2O pressure and adjust the output to 4mA. then apply 90.97 inH_2O pressure and adjust the output to 20 mA.
   90 inH_2O × 1.08% =0.97 inH_2O
   90 inH_2O ±0.97 inH_2O = 89.03 inH_2O
2. Apply 0 inH_2O pressure and adjust the output to 4mA. then apply 90 inH_2O pressure and adjust the output to 20.173 mA.
   16 mA × 1.08% =0.173 mA

Smart Electronics

There are also two ways to calibrate a smart transmitter for the above mentioned application. One way is to rerange the transmitter; the other way is to perform a sensor trim.

1. Using a Field Communicator, configure the range points to 0–89.03 inH_2O.
2. Using a Field Communicator, perform a sensor trim. Select Hi Val and apply 90 inH_2O pressure. When the communicator asks what pressure you applied enter 89.03 inH_2O. Set the range points to 0–90 inH_2O.

Example 2

A Rosemount 1151HP Range 5 transmitter with Alloy C-276 diaphragms is to be calibrated at 0–220 inH_2O and used in an application where the static line pressure is 2,300 psi.

Looking at Table 4-2 we see the Range 5 with Alloy C-276 diaphragms span is reduced by 0.70 percent per 1,000 psig. At 2,300 psi the span would be reduced by 1.61 percent.
0.007×2.3 - 1.61%

Analog Electronics
Once again, there are two ways to calibrate an analog transmitter for this application. One method is to increase the pressure when adjusting the span. Another method is to apply the span pressure and increase the mA output.

1. Apply 0 inH_2O pressure and adjust the output to 4mA. then apply 223.54 inH_2O pressure and adjust the output to 20 mA.
   220 inH_2O X 1.61% = 3.54 inH_2O
   220 inH_2O ± 3.54 inH_2O = 216.46 inH_2O
2. Apply 0 inH_2O pressure and adjust the output to 4mA. then apply 220 inH_2O pressure and adjust the output to 20.257 mA.
   16 mA X 1.61% =.257 mA

Smart Electronics
There are also two ways to calibrate a smart transmitter for this application. One method is to rerange the transmitter. The other method is to perform a sensor trim.

1. Set the range points to 0–223.54 inH_2O by using the Field communicator.
2. Using the Field communicator, perform a Sensor Trim. Select Hi Val, and apply 216.96 inH_2O pressure. When the communicator asks what pressure was applied, enter 216.96 inH_2O. Set the range points to 0–220 inH2O.

Digital to Analog Converter Trim

Deciding Whether to Trim the D/A Converter

After the microprocessor conditions the sensor signals, it outputs a digital word. The digital-to-analog (D/A) output circuitry converts the word to an analog signal for the 4–20 mA communications line. It may be necessary to check and trim this circuitry after a period of time. The 4–20 mA output trim function can also be used to make adjustments to allow for peculiarities of a particular readout device in the loop.

To determine whether the output must be trimmed, connect the HART-based communicator and a precision milliammeter capable of reading ± 1 micromole in the loop as shown in Figure 4-3.

Next, perform a loop test as described on page 3-6. Follow the loop test procedure and set the transmitter to a 4 mA output. Then check the ammeter. The reading should be within ±3 μA of 4 mA.

Then set the transmitter to a 20 mA output and check the milliammeter. The reading should be within ± 3 μA of 20 mA. The output should be trimmed if the values on the meter exceed this tolerance range.

When trimming the output, adjustments are made to the output circuitry. The appropriate shift will be made for all intermediate points between 4 and 20 mA.

The communicator will allow the D/A converter to be trimmed by using a current meter or voltage meter. When using a current meter, follow the sequence outlined in **4–20 mA Analog Output Trim**. When using a voltage meter or a meter whose display does not read out in 4–20 mA, follow the sequence outlined under **4–20 mA Analog Output Trim Using Other Scale**.

It may be necessary to calibrate the current output circuitry after a period of time and use. The 4–20 mA output trim function can also be used to make adjustments to allow for peculiarities of a particular readout device in the loop.

4–20 mA Analog Output Trim

HART Comm. Fast Key Sequence	1, 2, 3, 2, 1

A 4–20 mA output trim adjusts the transmitter milliampere output to match a plant's current standard. Use this procedure when trimming the converter using a current meter.

4–20 mA Analog Output Trim Using Other Scale

HART Comm. Fast Key Sequence	1, 2, 3, 2, 2

To trim the output using a voltage or other meter, connect the meter across a resistor in the loop. For best accuracy, use a precision resistor. The scaling function may be used if the meter displays other units, such as 0–100%.

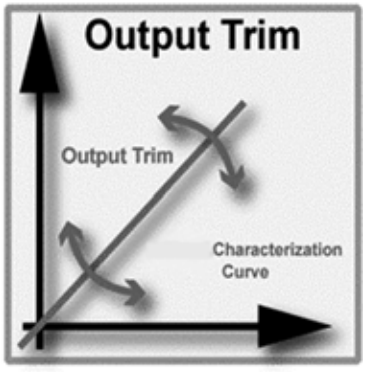
NOTE
If a resistor is added to the loop, before proceeding, ensure that the power supply is sufficient to power the transmitter to a 20 mA output with the additional loop resistance.

ANALOG CALIBRATION

Calibration Overview

Calibration of the Rosemount 1151 Analog Pressure Transmitter is simplified by its compact and explosion-proof design, external span and zero adjustments, separate compartments for electronics and wiring, and weatherproof construction. Descriptions of span, linearity, zero adjustments, and damping follow.

Figure 4-6. Output Trim



Quick Calibration Procedure (for E and G Electronics)

The following Quick Calibration Procedures are for those users who are already familiar with the Rosemount 1151 Analog.

NOTE
The zero and span adjustments are interactive. For applications requiring large elevated or suppressed values, refer to Elevated or Suppressed Zeros on page 3-7.

1. Apply 4 mA-point pressure and turn zero screw to output 4 mA.
2. Apply 20 mA-point pressure.
3. Subtract actual output from desired output.
4. Divide difference by 3.
5. Turn span screw above or below desired output by value in Step 4.
6. Repeat Steps 1 through 5 until calibrated.

Quick Calibration Procedure (For L and M Electronics)

1. Apply 1 V dc-point pressure for M electronics (0.8 V dc for L electronics) and turn zero screw to output 1 V dc (0.8 V dc for L electronics).
2. Apply 5 V dc-point pressure (M electronics) or 3.2 V dc (L electronics).
3. Subtract actual output from desired output.
4. Divide difference by 3.
5. Turn span screw above or below desired output by value in Step 4.
6. Repeat Steps 1 through 5 until calibrated.

Example for a Rosemount 1151 Analog DP Range 4: For a desired calibration of 0 to 100 inH2O, use the following procedure:

1. Adjust the zero. With zero input applied to the transmitter, turn the zero adjustment screw until the transmitter reads 4 mA.
2. Adjust the span. Apply 100 inH2O to the transmitter high side connection. Turn the span adjustment screw until the transmitter output reads approximately 20 mA.
3. Release the input pressure and readjust the zero output to read 4 mA ±0.032 mA.
4. Re-apply 100 inH2O to the transmitter. If the output reading is greater than 20 mA, divide the difference by 3, and subtract the result from 20 mA. Adjust the 100% output to this value.

If the output reading is less than 20 mA, divide the difference by 3 and add the result to 20 mA. Adjust the 100% output to this value.

Example: The full scale transmitter output is 20.100 mA. Dividing 0.100 by 3.0 gives the product 0.033. Subtracting the product 0.033 from 20.00 mA gives the difference 19.967 mA. Adjust the 100% output to this value.

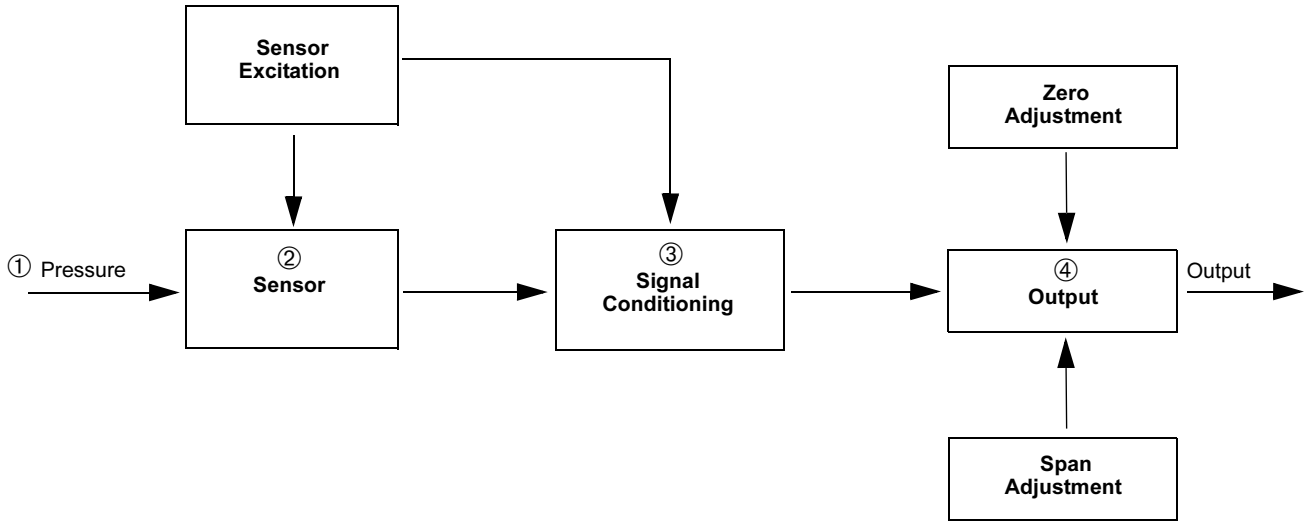
5. Release input pressure and readjust the zero.
6. Apply 100% input and repeat Steps 3 through 5 if the full scale output is not 20 ±0.032 mA.

NOTE
Under operating conditions that subject the transmitter to temperature extremes or significant vibration, mechanical backlash may occur in the zero and span adjustment screws. To improve the stability of zero and span settings in these circumstances, back off the adjustment screws slightly after final adjustment to break contact between the potentiometer blades and the adjustment screw slot surfaces.

Data Flow with Calibration Options

Figure 4-7 illustrates the Rosemount 1151 Analog Transmitter data flow with calibration tasks.

Figure 4-7. Rosemount 1151 Transmitter Data Flow with Calibration Options.



This data flow can be summarized in four major steps:

1. Pressure is applied to the sensor.
2. A change in pressure is measured by a change in the sensor output.
3. The sensor signal is conditioned for various parameters.
4. The conditioned signal is converted to an appropriate analog output.

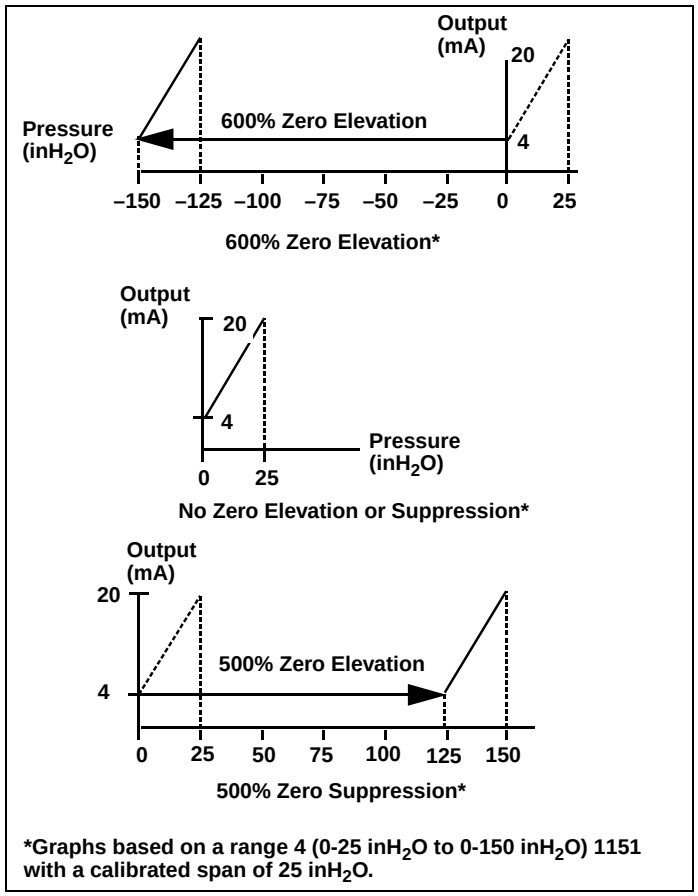
Span Adjustment Range

The span on a Rosemount 1151 Analog with E and G output options is continuously adjustable to allow calibration anywhere between maximum span and one-sixth of maximum span. For example, the span on a Range 4 transmitter can be adjusted between 25 and 150 inH_2O (6.2 and 37.2 kPa).

Zero Adjustment Range

The zero on a Rosemount 1151 Analog with the E or G output options can be adjusted for up to 500% suppression or 600% elevation. See Figure 4-8.

Figure 4-8. Zero Adjustment Range.

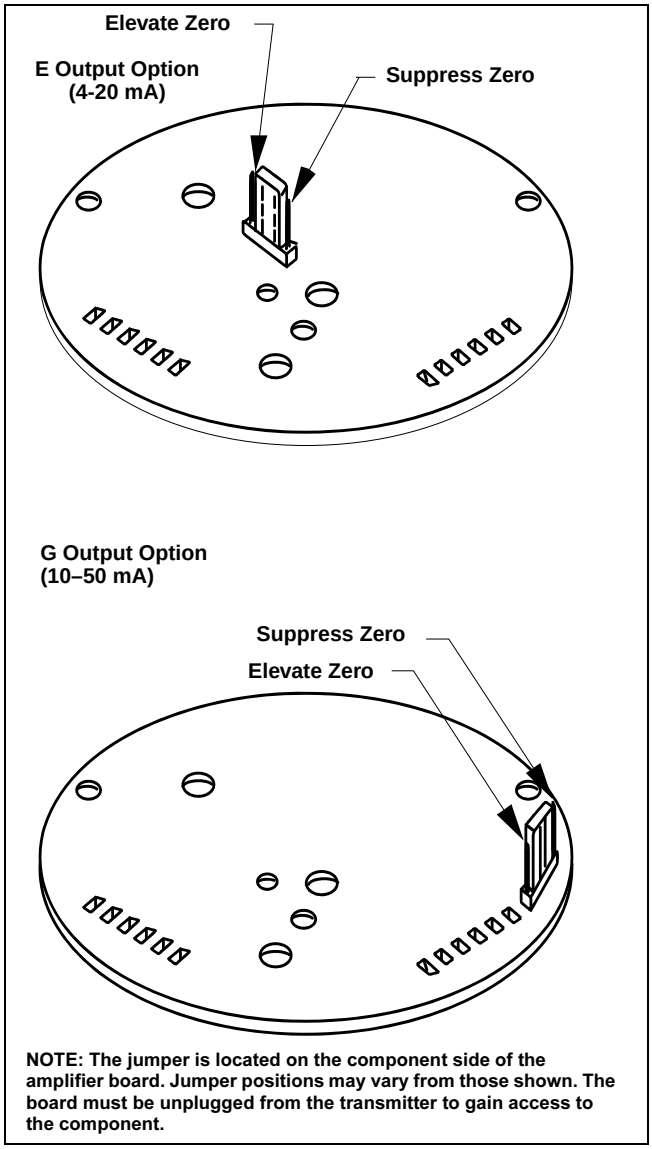


The zero may be elevated or suppressed to these extremes with the limitation that no pressure within the calibrated range exceeds the full-range pressure limit. For example, a Range 4 transmitter cannot be calibrated for 100 to 200 inH_2O (24.8 to 49.7 kPa) (only 100% zero suppression) because 200 inH_2O exceeds the 150 inH_2O full-range pressure limit of a Range 4.

To make large elevation or suppression adjustments, it is necessary to move the jumper on the component side of the amplifier board. Figure 4-9 on page -15 shows elevation and suppression jumper settings. The jumper has three positions. The middle position allows normal levels of elevation or suppression. For larger adjustments, move the jumper to the ELEVATE ZERO (EZ) or SUPPRESS ZERO (SZ) as marked.

NOTE
Always make sure that the jumper is fully seated on its pins. If the jumper has not been placed in any of the three positions, the amplifier board will provide normal levels of elevation or suppression. A slide switch replaces the jumper pin on some versions of the amplifier board.

Figure 4-9. Elevation and Suppression Jumper Settings.

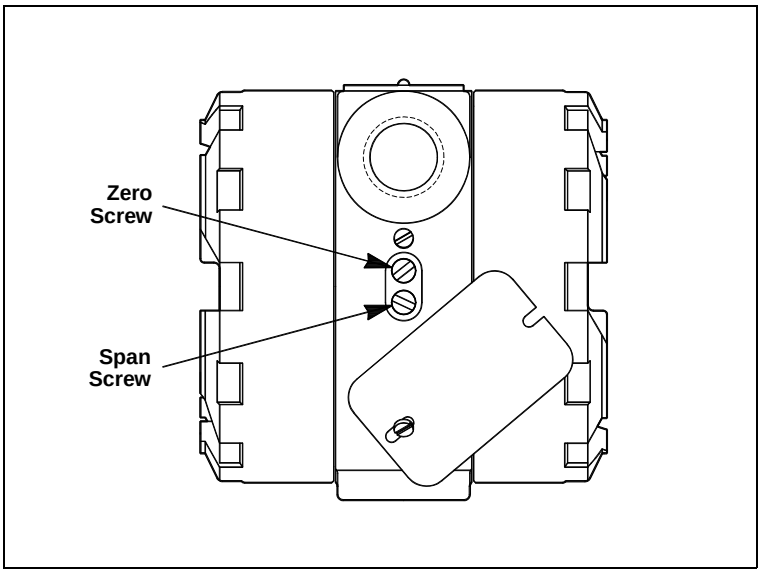


Zero and Span Adjustment

The zero and span adjustment screws are accessible externally behind the nameplate on the terminal side of the electronics housing. See Figure 4-10. The output of the transmitter increases with clockwise rotation of the adjustment screws. The zero adjustment screw and ELEVATE ZERO/SUPPRESS ZERO jumper do not affect the span. Span adjustment, however, does affect zero. This effect is minimized with zero-based spans. Therefore, when calibrations having elevated or suppressed zeros are made, it is easier to make a zero-based calibration and achieve the required elevation or suppression by adjusting the zero adjustment screw (and ELEVATE ZERO/SUPPRESS ZERO jumper as required).

A degree of mechanical backlash is present in the zero and span adjustments, so there will be a dead band when the direction of adjustment is changed. Because of the backlash, the simplest procedure is to purposely overshoot a larger amount before reversing the direction of the adjustment.

Figure 4-10. Zero and Span Adjustment Screws.



Elevated or Suppressed Zeros

Non-zero-based calibrations are termed as having “elevated” or “suppressed” zeros. Calibrations that have a lower calibrated value below zero are termed elevated. Compound ranges are included in this category. Calibrations that have a lower calibrated value above zero are termed suppressed.

The easiest way to calibrate transmitters with elevated or suppressed zeros is to perform a zero-based calibration and then elevate or suppress the zero by adjusting the zero adjustment screw.

Rosemount 1151 Analog DP Range 4 Suppression Example: For a desired calibration of 20 to 120 inH_2O (4.9 to 29.8 kPa), proceed as follows:

1. Calibrate the transmitter to 0 to 100 inH_2O (0 to 24.8 kPa) as described in the zero and span adjustment information.
2. Apply 20 inH_2O (4.9 kPa) to the high side process connection, and adjust the zero until the transmitter output reads 4 mA.
   Do not use the span adjustment.

Rosemount 1151 Analog DP Range 4 Elevation Example: For a calibration of –120 to –20 inH_2O (–29.8 to –4.9 kPa), proceed as follows:

1. Calibrate the transmitter to 0 to 100 inH_2O (0 to 24.8 kPa) as described in the zero and span adjustment information.
2. Apply 120 inH_2O (29.8 kPa) to the low side process connection, and adjust the zero until the transmitter output reads 4 mA.
   Do not use the span adjustment.

NOTE
For large amounts of elevation or suppression, it may be necessary to reposition the ELEVATE/SUPPRESS ZERO jumper. To do this, remove the amplifier board, and move the jumper to the ELEVATE or SUPPRESS position as required. See Figure 4-9 on page -15.

Linearity Adjustment

In addition to the span and zero adjustments, a linearity adjustment screw (marked LIN) is located on the solder side of the amplifier board. See Figure 4-11. This is a factory calibration adjusted for optimum performance over the calibrated range of the instrument and normally is not readjusted in the field. The user may, however, maximize linearity over a particular range using the following procedure:

1. Apply mid-range pressure and note the error between the theoretical and actual output signal.
2. Apply full-scale pressure. Multiply the error noted in Step 1 by six and then that product by the Range Down Factor, which is calculated as shown below:

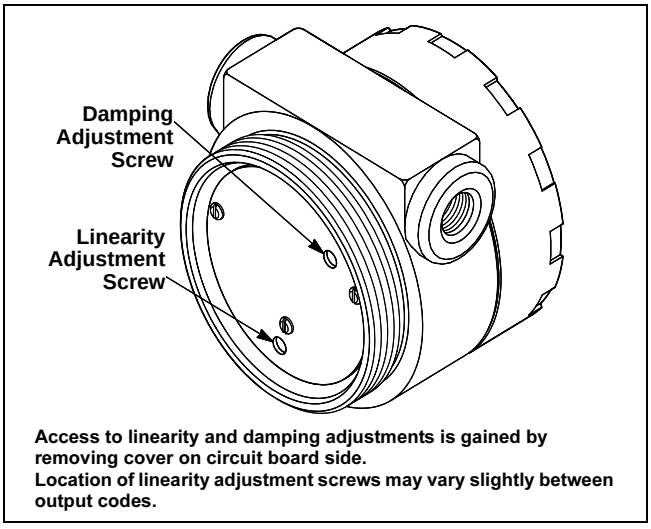
$$\text{Range Down Factor} = \frac{\text{Maximum Allowable Span}}{\text{Calibrated Span}}$$

Add this result to the full-scale output (for negative errors), or subtract the result from the full-scale output (for positive errors) by turning the linearity adjustment screw.

Example: At 4 to 1 Range Down Factor, the mid-scale point is low by 0.05 mA. Therefore, turn the linearity adjustment screw until full-scale output increases by (0.05 mA $\times$ 6 $\times$ 4) = 1.2 mA.

3. Readjust the zero and span.

Figure 4-11. Damping and Linearity Adjustment Screws.



Access to linearity and damping adjustments is gained by removing cover on circuit board side.
Location of linearity adjustment screws may vary slightly between output codes.

Damping Adjustment

The amplifier boards for output options E and G are designed to permit damping of rapid pulsations in the pressure source through adjustment of the damping screw shown in Figure 4-11 on page -17. The adjustment is marked DAMP on the solder side of the amplifier board.

The settings available provide time constant values between 0.2 and 1.66 seconds. The instrument is calibrated and shipped with this control set at the counterclockwise stop (0.2 second time constant). It is recommended that the shortest possible time constant setting be selected. Since the transmitter calibration is not influenced by the time constant setting, the damping may be adjusted with the transmitter connected to the process. Turn the damping control clockwise until the desired damping is obtained.

NOTE
The adjustment screw has positive stops at both ends. Forcing it beyond the stops may cause permanent damage.

Static Pressure Span Correction Factor

High static pressure causes a systematic span shift in the transmitter. It is linear and easily correctable during calibration. Table 4-3 shows the amount of span shift for range codes 3 through 8.

Table 4-3. Rosemount 1151 Analog DP/HP Span Shift.

Range Code	Span Shift % Input Per 1,000 psi	
	316L SST	Alloy C-276
3	–1.75%	–1.00%
4	–0.87%	–0.60%
5	–0.81%	–0.70%
6	–1.45%	–1.45%
7	–1.05%	–1.05%
8	–0.55%	–0.55%

The following examples illustrate a compensation method of accounting for the span shift. For more complicated calibration conditions, contact your local Emerson Process Management representative.

Example 1 - Refer to Table 4-3: One method is to adjust the input and allow the transmitter output to remain at 20 mA. Use the following formula:

Corrected Input

= Desired URV + [(S × URV) × (P/1000)],

Where S = Value from Table 4-3, divided by 100.

To calibrate a Range 4 transmitter 0 to 150 inH_2O (0 to 37.2 kPa) and correct for 1,500 psi static line pressure, use the following correction:

Corrected Input

= 150 + [(–0.0087 × 150) × (1500/1000)]

= 148.04 inches

With 148.04 inches applied as input at atmospheric pressure, set the transmitter to 20 mA. When the transmitter is exposed to 1,500 psi static line pressure, output will be 20 mA at 150 inches input.

Where computers or microprocessor receivers are used, the mathematical definitions used in the preceding tables can be used to automatically and continuously make the correction.

All transmitters should be rezeroed under line pressure to remove zero error.

Example 2 - Refer to Table 4-4: A Rosemount 1151 Analog DP Range 4 with a 4–20 mA output operating at 1,200 psi static pressure requires the output at 100% to be corrected to 20.168 mA. Therefore, the transmitter should be adjusted from 4–20.168 mA during calibration. After installation, and with both process inputs pressurized to 1,200 psi, readjust the zero to 4.000 mA to remove the small zero error.

Table 4-4. Rosemount 1151 Analog DP Static Pressure 4–20 mA Output Code E Corrected Output Calibration at 100% Input SST Isolators.

Static Pressure (psi)	Static Pressure (kPa)	Range 3	Range 4	Range 5
100	689	20.029	20.014	20.013
200	1379	20.057	20.028	20.026
300	2068	20.086	20.042	20.039
400	2758	20.114	20.056	20.052
500	3447	20.143	20.070	20.066
600	4137	20.171	20.084	20.079
700	4826	20.200	20.098	20.092
800	5516	20.228	20.112	20.104
900	6205	20.257	20.126	20.118
1000	6895	20.285	20.140	20.131
1100	7584	20.314	20.154	20.144
1200	8274	20.342	20.168	20.157
1300	8963	20.371	20.182	20.170
1400	9653	20.399	20.196	20.183
1500	10342	20.428	20.210	20.197
1600	11032	20.456	20.224	20.210
1700	11721	20.485	20.238	20.223
1800	12411	20.513	20.252	20.236
1900	13100	20.542	20.266	20.250
2000	13790	20.570	20.280	20.262

Example 3 - Refer to Table 4-5: The correction factor at 100% input shift for a Range 5 transmitter with a 4–20 mA output operating at 1,500 psi static pressure would be:

$S = 0.131 \times 1.5 = 0.197$ mA

Therefore, the calibration for this transmitter would be from 4–20.197 mA.

Table 4-5. Output Correction Factors SST Isolators.

Range Code	E Output 4–20 mA	G Output 10–50 mA
3	S = 0.285 P	S = 0.712 P
4	S = 0.140 P	S = 0.350 P
5	S = 0.131 P	S = 0.327 P
6	S = 0.235 P	S = 0.588 P
7	S = 0.170 P	S = 0.425 P
8	S = 0.088 P	S = 0.220 P

NOTE
Correction factors apply to E and G outputs at 100% input (P = static pressure in 1,000 psi).

Section 5 Troubleshooting

Overview . . . . . **page 5-1**
Safety Messages . . . . . **page 5-1**
Smart Troubleshooting . . . . . **page 5-3**
Analog Troubleshooting . . . . . **page 5-10**

OVERVIEW

This section is set up into two parts: Smart and Analog.

Table 5-1 on page 5-3 provides summarized troubleshooting suggestions for the most common operating problems on Smart transmitters. Table 5-2 on page 5-10 provides similar troubleshooting suggestions for analog transmitters.

If you suspect a malfunction despite the absence of any diagnostic messages on the communicator display, follow the procedures described here to verify that transmitter hardware and process connections are in good working order. Always deal with the most likely and easiest-to-check conditions first.

SAFETY MESSAGES

Warnings (⚠)

Procedures and instructions in this section that raise potential safety issues are indicated by a warning symbol (⚠). Refer to the following warning messages before performing an operation preceded by this symbol.

⚠WARNING

- Isolate a failed transmitter from its pressure source as soon as possible. Pressure that may be present could cause death or serious injury to personnel if the transmitter is disassembled or ruptures under pressure.
- Explosions can cause death or serious injury. Do not remove the instrument cover in explosive atmospheres when the circuit is alive.
- Explosions can cause death or serious injury. Do not break the housing seal in explosive environments. Breaking the housing seal invalidates the explosion-proof housing rating.
- Process leaks can cause death or serious injury. An incorrectly installed backup ring can destroy the o-ring and cause process leaks. Install the backup ring using the following procedure.
- Exposure to hazardous substances can cause death or serious injury. If a hazardous substance is identified, a Material Safety Data Sheet (MSDS), required by law to be available to people exposed to specific hazardous substances, must be included with the returned goods.
- Explosions can cause death or serious injury. Do not disassemble the glass in the meter cover in explosive atmospheres. Disassembling the glass in the meter cover invalidates the explosion-proof meter rating.

⚠WARNING

- The following performance limitations may inhibit efficient or safe operation. Critical applications should have appropriate diagnostic and backup systems in place. Pressure transmitters contain an internal fill fluid. It is used to transmit the process pressure through the isolating diaphragms to the pressure sensing element. In rare cases, oil leak paths in oil-filled pressure transmitters can be created. Possible causes include physical damage to the isolator diaphragms, process fluid freezing, isolator corrosion due to an incompatible process fluid, etc. A transmitter with an oil fill fluid leak can continue to perform normally for a period of time. Sustained oil loss will eventually cause one or more of the operating parameters to exceed published specifications while a small drift in operating point output continues. Symptoms of advanced oil loss and other unrelated problems include:
    - Sustained drift rate in true zero and span or operating point output or both
    - Sluggish response to increasing or decreasing pressure or both
    - Limited output rate or very nonlinear output or both
    - Change in output process noise
    - Noticeable drift in operating point output
    - Abrupt increase in drift rate of true zero or span or both
    - Unstable output
    - Output saturated high or low

SMART TROUBLESHOOTING

Table 5-1. Troubleshooting Symptoms and Corrective Action.

Symptom	Potential Source	Corrective Action
Transmitter does not communicate with the HART Communicator	Loop Wiring	Check for a minimum of 250 Ω resistance between the power supply and the communicator connection. Check for adequate voltage to the transmitter. (If the communicator is connected and 250 Ω resistance is properly in the loop, then the loop requires a minimum of 17 volts to operate.) Check for intermittent shorts, open circuits, and multiple grounds. Specify the transmitter by tag number. See the display sequence below.
	I.S. Barrier	Refer to appropriate I.S. Barrier documentation.
High Output	Primary Element	Check for restrictions at primary element.
	Impulse Piping	Check for leaks or blockage. Ensure that blocking valves are fully open. Check for entrapped gas in liquid lines and for liquid in dry lines. Ensure that the density of fluid in impulse lines is unchanged. Check for sediment in transmitter process flanges.
	Power Supply	Check the power supply output voltage at the transmitter. It should be 12 to 45 V dc.
	Transmitter Electronics	Connect the HART Communicator and enter the XMTR TEST mode to determine any electronic failures. Make sure that post connectors are clean. If the electronics are still suspect, substitute new electronics.
	Sensing Element	The sensing element is not field repairable and must be replaced if found to be defective. See “Disassembly procedure” later in this section for instructions on disassembly. Check for obvious defects, such as a punctured isolating diaphragm or fill fluid loss, and contact your local Emerson Process Management representative.

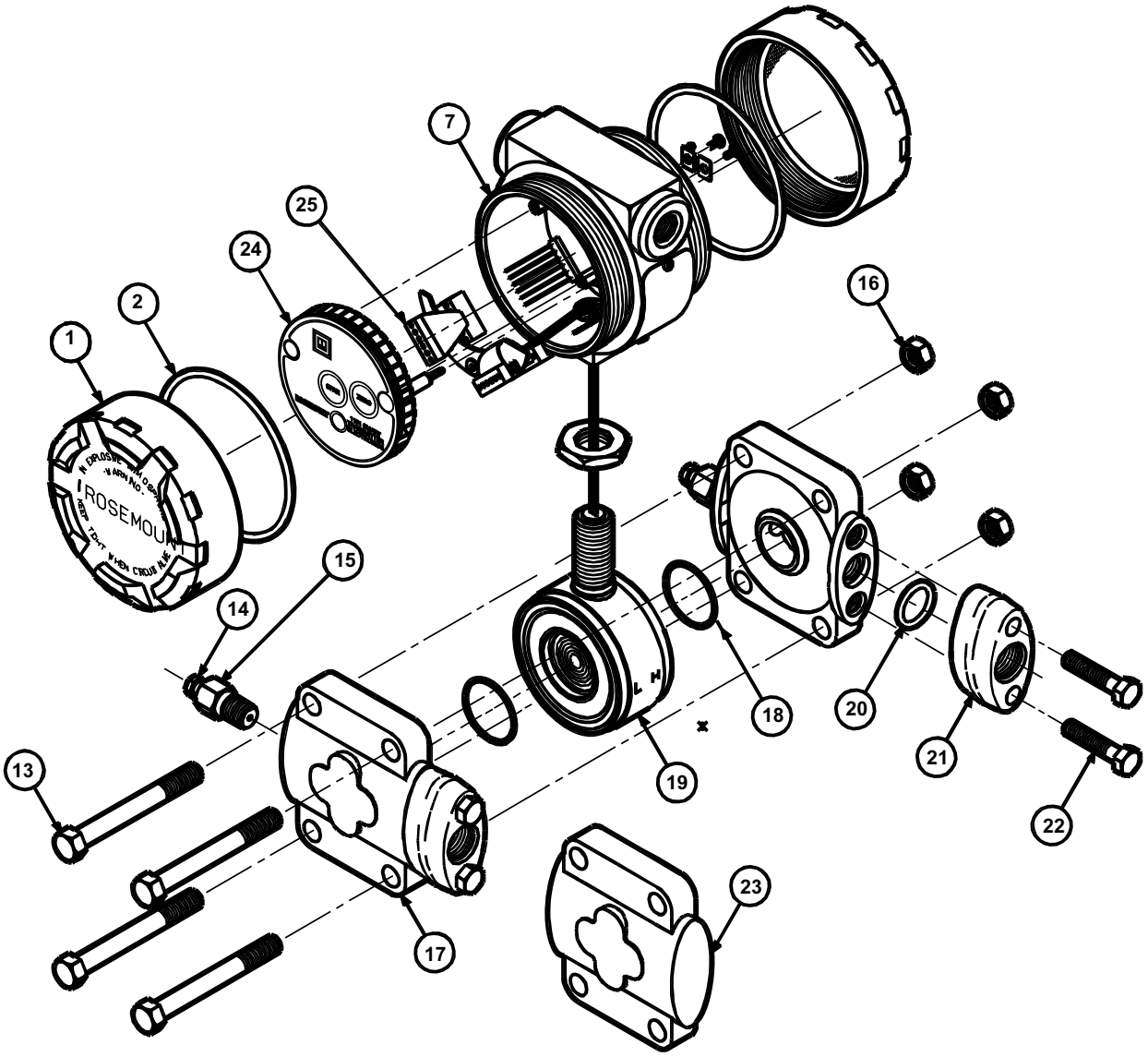
Symptom	Potential Source	Corrective Action
Erratic Output	Loop Wiring	Check for adequate voltage to the transmitter. It should be 12 to 45 V dc with no load. Check for intermittent shorts, open circuits and multiple grounds. **⚠CAUTION** Do not use over 45 volts to check the loop, or damage to the transmitter electronics may result. Connect the HART Communicator and enter the LOOP TEST mode to generate signals of 4 mA, 20 mA, and user-selected values.
	Process Pulsation	Adjust the electronic damping with the HART Communicator.
	Transmitter Electronics	Connect the communicator and perform a transmitter test to determine any electronic failures. Make sure the post connectors are clean. If the electronics are still suspect, substitute new electronics.
	Impulse Piping	Check for entrapped gas in liquid lines and for liquid in dry lines.
Low Output or No Output	Primary Element	Check the insulation and condition of primary element. Note any changes in process fluid properties that may affect output.

Symptom	Potential Source	Corrective Action
	Loop Wiring	Check for adequate voltage to the transmitter. It should be 12 to 45 V dc. Check the milliamp rating of the power supply against the total current being drawn for all transmitters being powered. Check for shorts and multiple grounds. Check for proper polarity at the signal terminal. Check loop impedance. Check whether the transmitter is in multidrop mode, thus locking the output at 4 mA. Connect the communicator and perform a loop test. **⚠CAUTION** Do not use over 45 volts to check the loop, or damage to the transmitter electronics may result. Check wire insulation to detect possible shorts to ground.
	Impulse Piping	Ensure that the pressure connection is correct. Check for leaks or blockage. Check for entrapped gas in liquid lines. Check for sediment in the transmitter process flange. Ensure that blocking valves are fully open and that bypass valves are tightly closed. Ensure that density of the fluid in the impulse piping is unchanged.
	Transmitter Electronics	Connect the communicator and check the sensor limits to ensure calibration adjustments are within the sensor range. Connect the communicator and perform a transmitter test to determine electronics failure. Make sure the post connectors are clean. If the electronics are still suspect, substitute new electronics.
	Sensing Element	The sensing element is not field repairable and must be replaced if found to be defective. See “Disassembly procedure” later in this section for instructions on disassembly. Check for obvious defects, such as punctured isolating diaphragm or fill fluid loss, and contact your local Emerson Process Management representative.
Transmitter Does Not Characterize Properly	Pressure Source/Correction	Check for restrictions or leaks. Check for proper leveling or zeroing of the pressure source. Check weights/gauge to ensure proper pressure setting. Determine if the pressure source has sufficient accuracy. (The pressure source should be at least three times more accurate that the Rosemount 1151 Smart.)
Transmitter Does Not Characterize Properly	mA Meter	Determine if the mA meter is functioning properly.
	Power Supply	Check the power supply output voltage at transmitter. It should be 12 to 45 V dc with no load. Check for a minimum of 250 Ω resistance between the HART Communicator and the power supply.
	Transmitter Electronics	Connect the communicator and perform a transmitter test to determine any electronic failures. Make sure the post connectors are clean. If electronics are still suspect, substitute with new electronics.
	Sensing Element	The sensing element is not field repairable and must be replaced if found to be defective. See “Disassembly procedure” later in this section for instructions on disassembly. Check for obvious defects, such as punctured isolating diaphragm or fill fluid loss, and contact your local Emerson Process Management representative.

Disassembly Procedure

⚠ Read the following information carefully before you disassemble a transmitter. General information concerning the process sensor body, electrical housing, and a procedure for their separation follow.
Figure 5-1 shows an exploded view of the transmitter.

Figure 5-1. Rosemount 1151 Smart Pressure Transmitter Exploded View.



Process Sensor Body

Be aware of the following:

- The transmitter should be removed from service before disassembling the sensor body.
- Process flanges can be detached by removing the four large bolts.

⚠CAUTION

Do not scratch, puncture, or depress the isolating diaphragms. Damaging the isolating diaphragms can inhibit transmitter performance.

- Isolating diaphragms may be cleaned with a soft rag, mild cleaning solution, and clear water rinse.

⚠CAUTION

Do not use chlorine or acid solutions to clean the diaphragms. Damaging the isolating diaphragms can inhibit transmitter performance.

- Flange adapters and process flanges may be rotated or reversed for mounting convenience.

Electrical Housing

⚠ Electrical connections are located in a compartment identified as TERMINAL SIDE on the nameplate. The signal and test terminals are accessible by unscrewing the cover on the terminal side. The terminals are permanently attached to the housing and must not be removed, or the housing seal between compartments will be broken.

To remove the smart electronics, refer to Appendix 6: Retrofitting the Rosemount 1151 Transmitter, and reverse the installation sequence described in steps 10 through 15.

Removing the Sensor from the Electrical Housing

1. Unscrew the cover on the field terminal side of the transmitter.
2. Disconnect the power source from the transmitter.
3. Remove the smart electronics and header board.
4. Loosen the lock nut.

⚠CAUTION

Do not damage the isolating diaphragms when unscrewing the sensor module. Damaging the isolating diaphragms can inhibit transmitter performance.

5. The threaded connection has a sealing compound on it and will initially be tight. Unscrew the sensing module from the electronics housing, being careful not to damage the sensor leads. Carefully pull the header assembly board through the hole.

The sensing module is a welded assembly and cannot be further disassembled.

Reassembly Procedure

Follow these procedures carefully to ensure proper reassembly.

Preliminary Precaution

Inspect all O-rings and replace if necessary. Lightly grease with silicone oil to ensure a good seal. Use halocarbon grease for inert fill options.

Connecting the Electrical Housing to the Sensor

⚠ 1. Insert the header assembly board through the electronics housing.
2. Use a sealing compound (Loctite® 222—Small Screw Threadlocker) on the threads of the sensor module to ensure a watertight seal on the housing.
3. Screw the sensor module into the electrical housing making sure that at least five threads are engaged. Be careful not to damage or twist the sensor leads.
4. Align the sensor module with the high and low pressure sides oriented for convenient installation.
5. Tighten the lock nut.

Electrical Housing

The smart electronics and header board can easily be installed in the electrical housing. Steps 10 through 15 in Section 6 Retrofitting the Rosemount 1151 Transmitter describe this assembly.

⚠CAUTION

An already characterized transmitter requires recharacterization whenever the sensor module or smart electronics are replaced. Failure to recharacterize can inhibit transmitter performance. (See Appendix 6: Retrofitting the Rosemount 1151 Transmitter.)

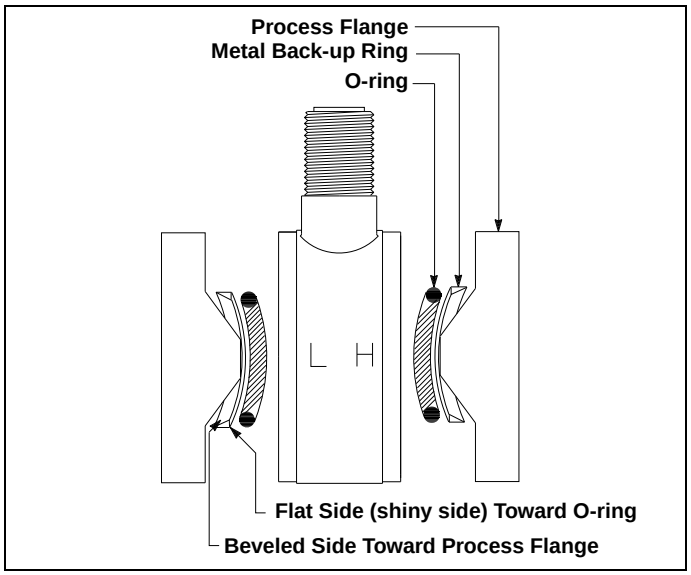
Process Sensor Body

All HP transmitters and GP Range 9 and 10 transmitters require metal backup rings to ensure O-ring integrity. Figure 5-2 illustrates the position and orientation of the metal backup rings. (Backup rings are not required on AP or DP transmitters or GP Range 3-8 transmitters.)

NOTE
Handle the backup ring carefully, as it is fragile. Examine the ring carefully. One side is beveled, while the other side is flat. The flat side appears more shiny when viewed from above.

1. Clean the sealing surfaces carefully.
2. Place the module on a flat surface, “H” side up.
3. Place the greased flange O-ring around the isolator and push it into the cavity.

Figure 5-2. Detail Showing Process O-ring and Backup Ring Installation of Module Seal for Rosemount 1151HP and GP Range 9 (GP Range 10 Requires Only One O-ring and Backup O-ring).



⚠ 4. For all HP transmitters and GP transmitters Ranges 9 and 10, place the backup ring, shiny side down, on top of the O-ring. This places the flat side of the backup ring against the O-ring.

5. Carefully place the flange on top of the module, beveled side down so that the beveled flange surface mates with the beveled surface of the backup ring.
6. Keeping the flange and module together, turn them over so the “L” side is up. Repeat Steps 3 through 5. As before, the flat side of the backup ring must rest against the O-ring.
7. Insert the four flange bolts.
8. Tighten the nuts finger tight, making sure the flanges remain parallel. The transmitter may now be moved without disturbing the O-rings.
   a. Tighten one bolt until the flanges seat.
   b. Torque down the bolt diagonally across.
   c. Torque down the first bolt.
   d. Torque down the two remaining bolts.
   e. Inspect the flange-to-sensor seating to be sure that the flanges are not cocked.
   f. Check that all four bolts are tightened to approximately 33 ft.-lb (39 Nm).
9. Recalibrate the transmitter.

Optional Plug-in Meters

The optional indicating meters available for Rosemount 1151 transmitters are listed in Section A: Reference Information. Please be aware of the following information while assembling the meter assembly. Refer to Table A-11 on page A-23 for part references.

- The display may be rotated in 90-degree increments for convenient reading.
- ⚠ If the display cover is removed for any reason, be sure the O-ring is in place between the cover and housing before reattachment. To maintain an explosion-proof condition, the glass in the meter cover should not be disassembled for any reason.

Sensor Module Checkout

The sensor module is not field repairable and must be replaced if found to be defective. If no obvious defect is observed (such as a punctured isolating diaphragm or fill fluid loss), the sensor module can be checked as follows.

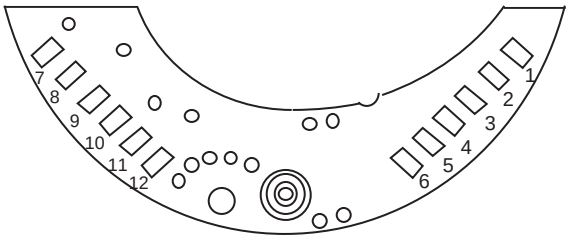
1. Carefully pull the header assembly board off of the post connectors. Rotate the board 180 degrees about the axis formed by the connecting leads. The sensor module and electronics housing can remain attached for checkout.
2. Check internal diode loops, forward and reverse bias: one loop is on pins one and two, the other is on pins three and four. See Figure 5-3. Loop resistance values should be nearly equal.

NOTE
Do not touch the transmitter housing when checking resistances, or a faulty reading can result.

3. Check the resistance between the sensor module housing and pins one through four. This checks the resistance between both capacitor plates and the sensing diaphragm, which is grounded to the housing. This resistance should be greater than 10 MΩ.
4. Check the resistance between pin eight and the sensor module to ensure that the module is grounded. Resistance should be zero.

NOTE
The above procedure does not completely test the sensor module. If circuit board replacement does not correct the abnormal condition, and no other problems are obvious, replace the sensor module.

Figure 5-3. Header Board Connections.



(COMPONENT SIDE UP)

ANALOG TROUBLESHOOTING

Hardware Diagnostics

If you suspect a malfunction, see Table 5-2 on page 5-10 to verify that transmitter hardware and process connections are in good working order. Under each of the five major symptoms, you will find specific suggestions for solving the problem. Always deal with the most likely and easiest to check conditions first.

⚠WARNING

Isolate a failed transmitter from its pressure source as soon as possible. Pressure that may be present could cause death or serious injury to personnel if the transmitter is disassembled or ruptures under pressure.

Table 5-2. Troubleshooting Symptoms and Corrective Action.

Symptom	Potential Source	Corrective Action
High Output	Primary Element	Check for restrictions at primary element.
	Impulse Piping	Check for leaks or blockage. Ensure that blocking valves are fully open. Check for entrapped gas in liquid lines and for liquid in dry lines. Ensure that the density of fluid in impulse lines in unchanged. Check for sediment in transmitter process flanges.
	Power Supply	Check the power supply output voltage at the transmitter.
	Transmitter electronics	Make sure that post connectors are clean. If the electronics are still suspect, substitute new electronics.
	Sensing Element	The sensing element is not field repairable and must be replaced if found to be defective. See “Transmitter Disassembly” later in this section for instructions on disassembly. Check for obvious defects, such as punctured isolating diaphragm or fill fluid loss, and contact your local Emerson Process Management representative.
Erratic Output	Loop Wiring	Check for adequate voltage to the transmitter. Check for intermittent shorts, open circuits and multiple grounds. **⚠CAUTION** Do not use higher than the specified voltage to check the loop, or damage to the transmitter electronics may result.
	Process Pulsation	Adjust Damping
	Transmitter Electronics	Make sure the post connectors are clean. If the electronics are still suspect, substitute new electronics.
	Impulse Piping	Check for entrapped gas in liquid lines and for liquid in dry lines.

Symptom	Potential Source	Corrective Action
Low Output or No Output	Primary Element	Check the insulation and condition of primary element. Note any changes in process fluid properties that may affect output.
	Loop Wiring	Check for adequate voltage to the transmitter. Check the milliamp rating of the power supply against the total current being drawn for all transmitters being powered. Check for shorts and multiple grounds. Check for proper polarity at the signal terminal. Check loop impedance. Check whether the transmitter is in multidrop mode, thus locking the output at 4 mA. **⚠CAUTION** Do not use higher than the specified voltage to check the loop, or damage to the transmitter electronics may result. Check wire insulation to detect possible shorts to ground.
	Impulse Piping	Ensure that the pressure connection is correct. Check for leaks or blockage. Check for entrapped gas in liquid lines. Check for sediment in the transmitter process flange. Ensure that blocking valves are fully open and that bypass valves are tightly closed. Ensure that density of the fluid in the impulse piping is unchanged.
	Sensing Element	The sensing element is not field repairable and must be replaced if found to be defective. See “Transmitter Disassembly” later in this section for instructions on disassembly. Check for obvious defects, such as punctured isolating diaphragm or fill fluid loss, and contact your local Emerson Process Management representative.
Transmitter Does Not Calibrate Properly	Pressure Source/Correction	Check for restrictions or leaks. Check for proper leveling or zeroing of the pressure source. Check weights/gauge to ensure proper pressure setting. Determine if the pressure source has sufficient accuracy.
	Meter	Determine if the meter is functioning properly.
	Power Supply	Check the power supply output voltage at transmitter.
	Transmitter Electronics	Make sure the post connectors are clean. If electronics are still suspect, substitute with new electronics.
	Sensing Element	The sensing element is not field repairable and must be replaced if found to be defective. See “Transmitter Disassembly” later in this section for instructions on disassembly. Check for obvious defects, such as punctured isolating diaphragm or fill fluid loss, and contact your local Emerson Process Management representative.

Transmitter Disassembly

Read the following information carefully before you disassemble a transmitter. General information concerning the process sensor body, electrical housing, and a procedure for their separation follow. Figure 5-4 shows an exploded view of the transmitter.

⚠WARNING

The following performance limitations may inhibit efficient or safe operation. Critical applications should have appropriate diagnostic and backup systems in place.

Pressure transmitters contain an internal fill fluid. It is used to transmit the process pressure through the isolating diaphragms to the pressure sensing element. In rare cases, oil leak paths in oil-filled pressure transmitters can be created. Possible causes include: physical damage to the isolator diaphragms, process fluid freezing, isolator corrosion due to an incompatible process fluid, etc.

A transmitter with an oil fill fluid leak can continue to perform normally for a period of time. Sustained oil loss will eventually cause one or more of the operating parameters to exceed published specifications while a small drift in operating point output continues. Symptoms of advanced oil loss and other unrelated problems include:

- Sustained drift rate in true zero and span or operating point output or both
- Sluggish response to increasing or decreasing pressure or both
- Limited output rate or very nonlinear output or both
- Change in output process noise
- Noticeable drift in operating point output
- Abrupt increase in drift rate of true zero or span or both
- Unstable output
- Output saturated high or low

⚠WARNING

Explosion can cause death or serious injury. Do not remove the instrument cover in explosive atmospheres when the circuit is alive.

⚠WARNING

Explosions can cause death or serious injury. Do not break the housing seal in explosive environments. Breaking the housing seal invalidates the explosion-proof housing rating.

Electrical connections are located in a compartment identified as TERMINAL SIDE on the nameplate. The signal and test terminals are accessible by unscrewing the cover on the terminal side. The terminals to the housing must not be removed, or the housing seal between compartments will be broken. (Not applicable to R1 Option.)

Process Sensor Body Removal

Be aware of the following guidelines:

- The transmitter should be removed from service before disassembling the sensor body.
- Process flanges can be detached by removing the four large bolts.

⚠CAUTION

Do not scratch, puncture, or depress the isolating diaphragms. Damaging the isolating diaphragms can inhibit transmitter performance.

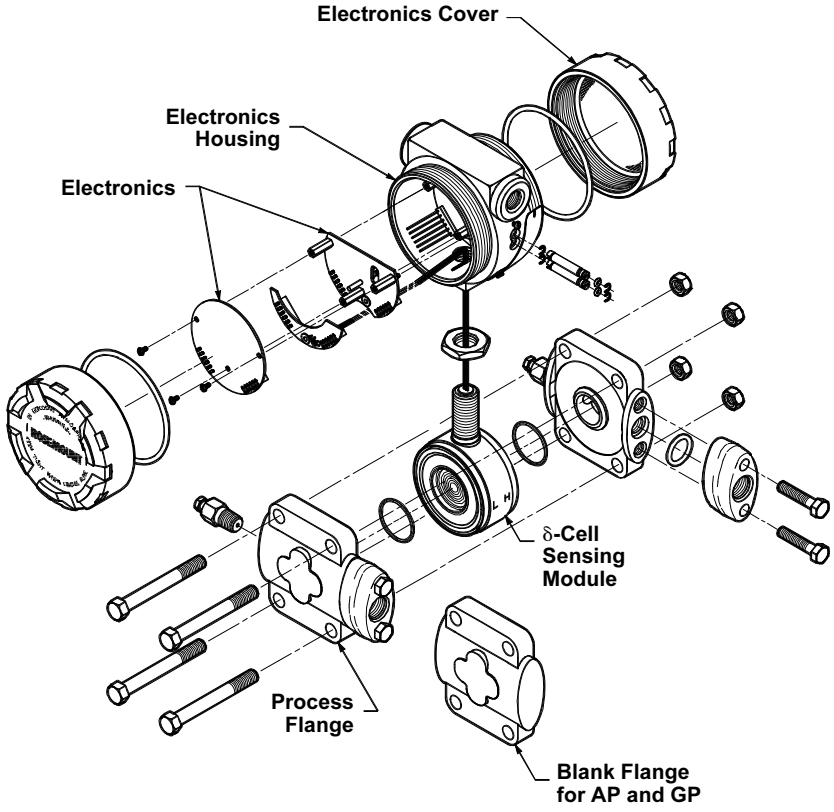
- Isolating diaphragms may be cleaned with a soft rag, mild cleaning solution, and clear water rinse.

⚠CAUTION

Do not use chlorine or acid solutions to clean the diaphragms. Damaging the isolating diaphragms can inhibit transmitter performance.

- Flange adapters and process flanges may be rotated or reversed for mounting convenience.

Figure 5-4. Differential Pressure (DP) Transmitter Exploded View.



Removing the Sensor from the Electrical Housing

- Disconnect the power source from the transmitter.
- Unscrew the cover on the terminal side of the transmitter.
- Remove the screws and unplug the electronics; see Figure 5-5.
- Loosen the lock nut.
- Remove the standoffs.

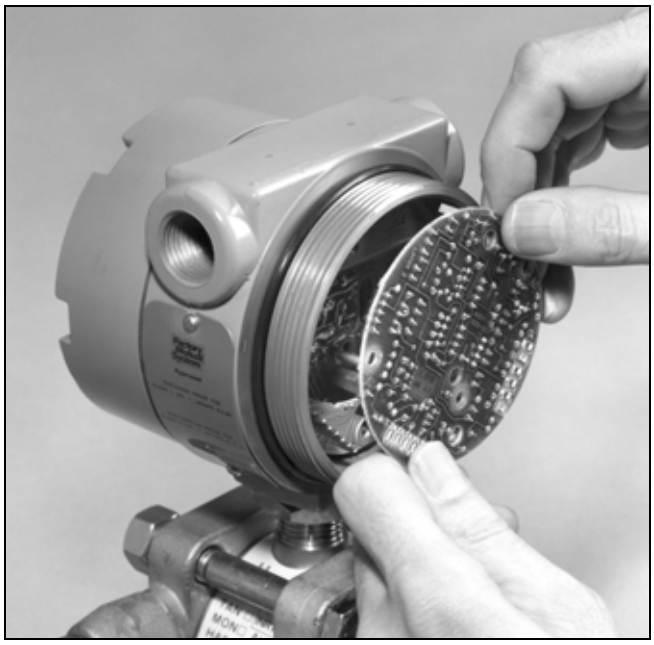
⚠CAUTION

Do not damage the isolating diaphragms when unscrewing the sensor module. Damaging the isolating diaphragms can inhibit transmitter performance.

1. Unscrew the sensing module from the electronics housing, being careful not to damage the sensor leads. Carefully pull the header assembly board through the hole. The threaded connection has a sealing compound on it and must be broken loose.

The sensing module is a welded assembly and cannot be further disassembled.

Figure 5-5. Removal of Electronics.



Sensor Module Checkout

The sensor module is not field repairable and must be replaced if found to be defective. If no obvious defect is observed (such as a punctured isolating diaphragm or fill fluid loss), the sensor module can be checked as follows.

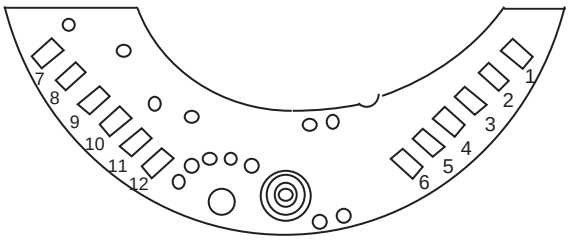
1. Carefully pull the header assembly board off of the post connectors. Rotate the board 180 degrees about the axis formed by the connecting leads. The sensor module and electronics housing can remain attached for checkout.

NOTE
Do not touch the transmitter housing when checking resistances, or a faulty reading can result.

2. Check the resistance between the sensor module housing and pins one through four. This checks the resistance between both capacitor plates and the sensing diaphragm, which is grounded to the housing. This resistance should be greater than 10 MΩ.
3. Check the resistance between pin eight and the sensor module to ensure that the module is grounded. Resistance should be zero.

NOTE
The above procedure does not completely test the sensor module. If circuit board replacement does not correct the abnormal condition, and no other problems are obvious, replace the sensor module.

Figure 5-6. Header Board Connections.



(COMPONENT SIDE UP)

Reassembly Procedure

Follow these procedures carefully to ensure proper reassembly.

Preliminary Precaution

Inspect all O-rings and replace if necessary. Lightly grease with silicone oil to ensure a good seal. Use halocarbon grease for inert fill options.

⚠WARNING

Explosions can cause death or serious injury. Both transmitter covers must be fully engaged to meet explosion-proof requirements.

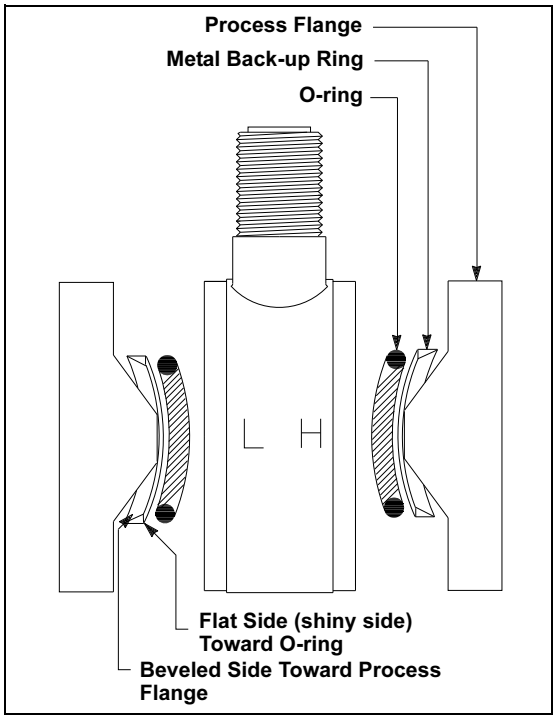
Connecting the Electrical Housing to the Sensor

1. Insert the header assembly board through the electronics housing.
2. Use a sealing compound (Loctite® *222* - Small Screw Threadlocker) on the threads of the sensor module to ensure a watertight seal on the housing.
3. Screw the sensor module into the electrical housing making sure that the threads are fully engaged. Be careful not to damage or twist the sensor leads.
4. Align the sensor module with the high and low pressure sides oriented for convenient installation.
5. Tighten the lock nut.

Backup Ring and O-ring Installation

All HP transmitters and GP Range 9 and 0 transmitters require metal backup rings to ensure O-ring integrity. Figure 5-7 on page 5-16 illustrates the position and orientation of the metal backup rings. (Backup rings are not required on AP or DP transmitters or GP Range 3-8 transmitters.)

Figure 5-7. Detail Showing Process O-ring and Backup Ring Installation of Module Seal for Rosemount 1151HP and GP Range 9 (GP Range 0 Requires Only One O-ring and Backup O-ring).



NOTE
Handle the backup ring carefully, as it is fragile. Examine the ring carefully. One side is beveled, while the other side is flat. The flat side appears more shiny when viewed from above.

1. Clean the sealing surfaces carefully.
2. Place the module on a flat surface, “H” side up.
3. Place the greased flange O-ring around the isolator and push it into the cavity.

⚠WARNING

Process leaks can cause death or serious injury. An incorrectly installed backup ring can destroy the o-ring and cause process leaks. Install the backup ring using the following procedure.

4. For all HP transmitters and GP transmitters Ranges 9 and 0, place the backup ring, shiny side down, on top of the O-ring. This places the flat side of the backup ring against the O-ring.
5. Carefully place the flange on top of the module, beveled side down so that the beveled flange surface mates with the beveled surface of the backup ring.
6. Keeping the flange and module together, turn them over so the “L” side is up. Repeat Steps 3 through 5. As before, the flat side of the backup ring must rest against the O-ring.
7. Insert the four flange bolts.
8. Tighten the nuts finger tight, making sure the flanges remain parallel. The transmitter may now be moved without disturbing the O-rings.
   a. Tighten one bolt until the flanges seat.
   b. Torque down the bolt diagonally across.
   c. Torque down the first bolt.
   d. Torque down the two remaining bolts.
   e. Inspect the flange-to-sensor seating to be sure that the flanges are not cocked.
   f. Check that all four bolts are tightened to approximately 33 ft-lb (39 Nm).
9. Recalibrate the transmitter.

NOTE
If the Rosemount 1151 Range 3 transmitter sensor module serial number is below 2,900,000, it must be temperature cycled whenever changing or rebolting flanges.

Optional Plug-in Meters

The optional indicating meters available for Rosemount 1151 transmitters are listed in Appendix A: Reference Information. Please be aware of the following information while assembling the meter assembly. Refer to Table A-11 on page A-23 for part references.

- The meter may be rotated in 90-degree increments for convenient reading.

⚠WARNING

Explosions can cause death or serious injury. Do not disassemble the glass in the meter cover in explosive atmospheres. Disassembling the glass in the meter cover invalidates the explosion-proof meter rating.

- If the meter cover is removed for any reason, be sure the O-ring is in place between the cover and housing before reattachment. To maintain an explosion-proof condition, the glass in the meter cover must not be disassembled for any reason.

Section 6 Retrofitting the Rosemount 1151 Transmitter

Overview . . . . . page 6-1
Safety Messages . . . . . page 6-1
Retrofitting Overview . . . . . page 6-2
Removing the Analog Electronics Assembly . . . . . page 6-2
Installing the Smart Retrofit Kit . . . . . page 6-10
Characterization . . . . . page 6-12

OVERVIEW

This section describes how the Rosemount Smart Retrofit Kit can be used to retrofit a Rosemount 1151AP, DP, GP, HP, or LT transmitter with 4-20 mA dc linear or square root output.

NOTE
The Rosemount 1151DR (Draft Range) Transmitter cannot be retrofitted with the 1151-0935-0001 Retrofit Kit. In addition, Rosemount 1151 transmitters with serial numbers below 10,000 and Rosemount 1151 AP Range Code 4 Transmitters with serial numbers between 1,318,500 and 1,690,000 may experience some degradation in performance from temperature effect if retrofitted. Therefore, retrofitting of these transmitters is not recommended.

SAFETY MESSAGES

Warnings (⚠)

Procedures and instructions in this section that raise potential safety issues are indicated by a warning symbol (⚠). Refer to the following warning messages before performing an operation preceded by this symbol.

⚠WARNING

- Explosions can result in serious injury or death. Before connecting a communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or nonincendiary field wiring practices.
- Toxic processes can result in serious injury or death. Transmitter can contain residue process. Use appropriate safety precautions when opening drain vents or disconnecting a transmitter from a process.
- DO NOT attempt to loosen drain vent valves or disconnect the transmitter from the process without taking precautionary measures.
- Install and tighten all four process adapter bolts or drain vent valves before applying pressure.
- Both transmitter covers must be fully engaged to meet explosion-proof requirements.

RETROFITTING OVERVIEW

The procedure for retrofitting a transmitter is divided into three parts:

1. Removing the analog electronics assembly.
2. Installing the smart electronics kit.
3. Characterizing the retrofitted transmitter.

Two tools are required to remove the analog electronics and to install the smart electronics:

- Flat-bladed screwdriver
- 1/4-in. nut driver or wrench

The following equipment is needed to characterize the retrofitted transmitter:

- A HART Communicator
- An accurate pressure source, preferably 0.025% accuracy or better
- A 250 ohm resistor

The Smart Retrofit Kit, P/N 01151-0935-0001, contains the following items:

Quantity	Description
1	Smart electronic assembly
1	Electronics cover
1	Cover O-ring
2	Terminal eyelets
2	Board spacers
2	Standoffs

REMOVING THE ANALOG ELECTRONICS ASSEMBLY

⚠CAUTION

Use proper earth grounding techniques when handling the smart electronics assembly. The smart electronics assembly is potentially sensitive to electric static discharge.

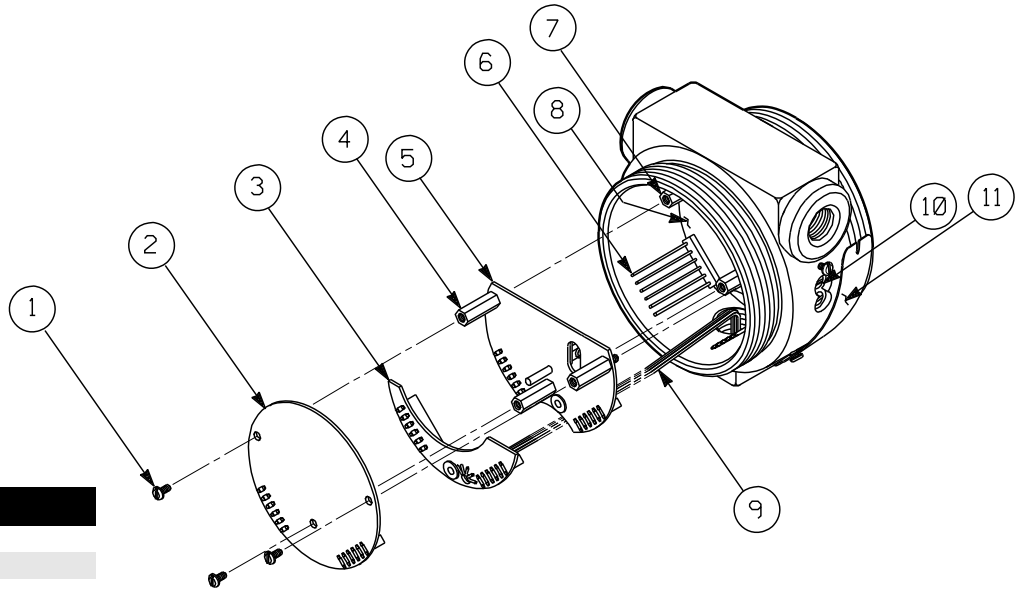
Confirm the output code of the Rosemount 1151 is analog (4-20 mA). It will have an “E” in the eighth character in the model number on the transmitter nameplate.

Example: (1151DP4 **E** 12M1)

The following steps describe how to remove the analog electronics assembly from transmitters with “E” output code for smart retrofitting. However, they can also be used as guidelines for retrofitting transmitters with “A” or “C” output codes. This process requires opening the electronics compartment on the circuit side of the transmitter and removing the amplifier or amplifier/squaring assembly, standoffs, and the calibration board.

NOTE
Numbers in parentheses indicate parts shown in Figure 6-1.

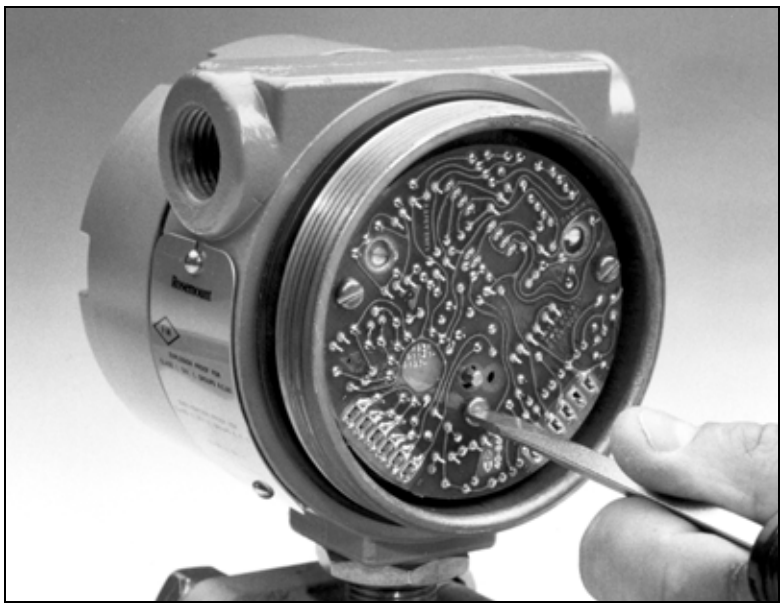
Figure 6-1. Rosemount 1151 Analog Electronics.



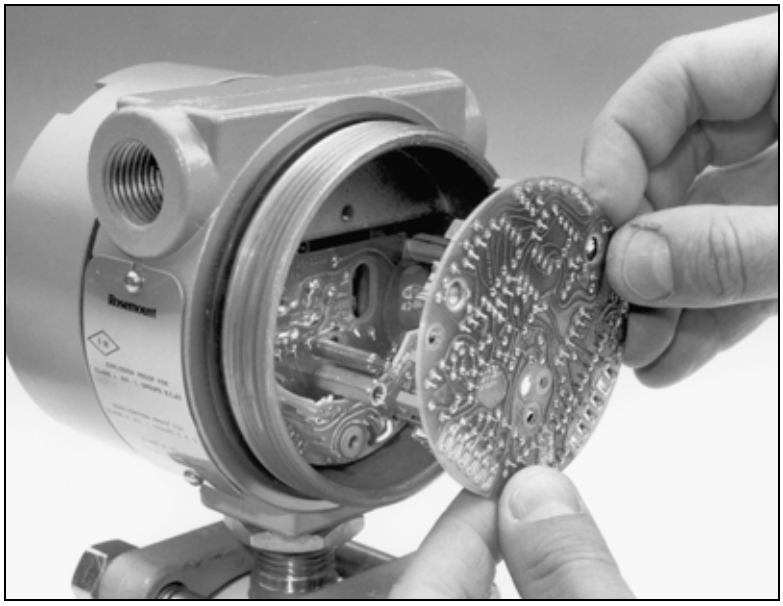
LINEAR OUTPUT

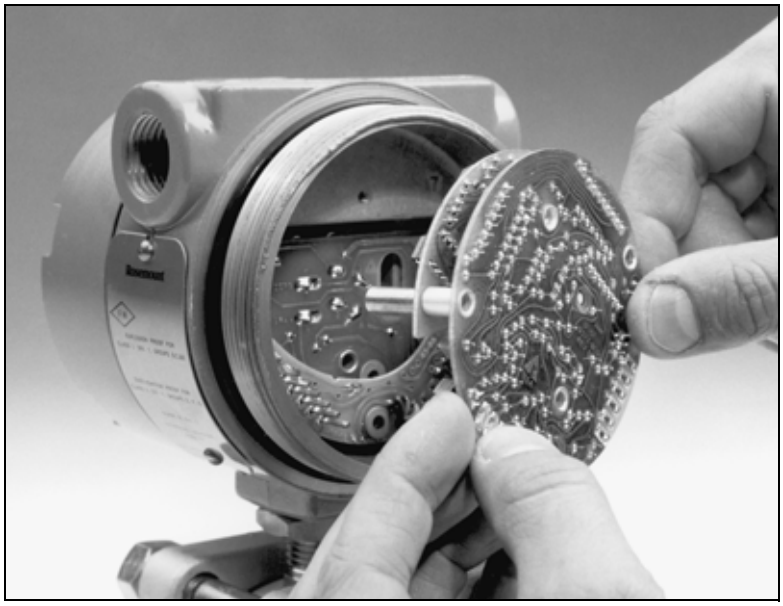
Ref. No.	Part Description
1	Retainer Screws (Linear)
2	Amplifier Board (Linear)
3	Header Board Assembly
4	Standoff Screws (Linear)
5	Calibration Board (Linear)
6	Bayonet Connector Pins
7	Standoff Screws (Linear)
8	Sensor Module Electronics
9	Wiring
10	Zero and Span Adjust Screws
11	Housing Cover

1. Ensure that power is removed from the transmitter before beginning the retrofit procedure.
2. ⚠ Remove the cover from the circuit side of the transmitter.
3. Remove the three retainer screws (1 or 12).



4. Pull the amplifier board (2) or amplifier/squaring assembly (13) directly off the bayonet connectors (6).

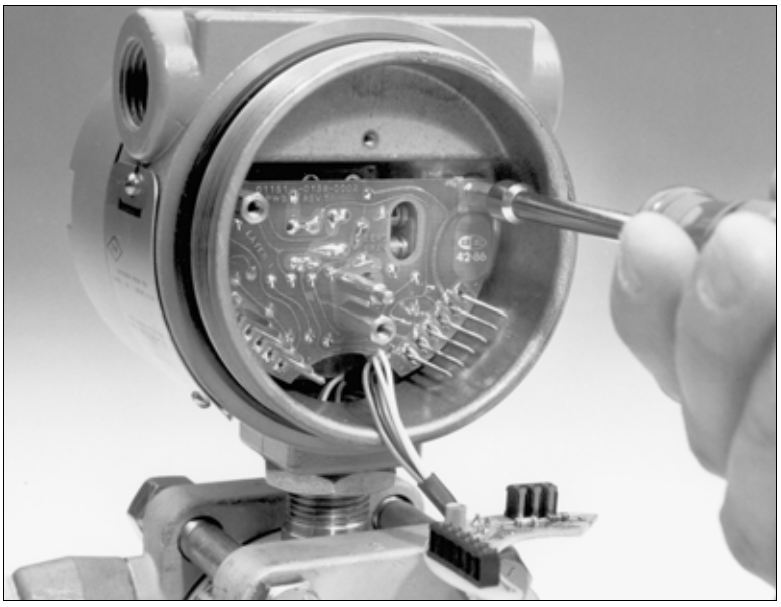




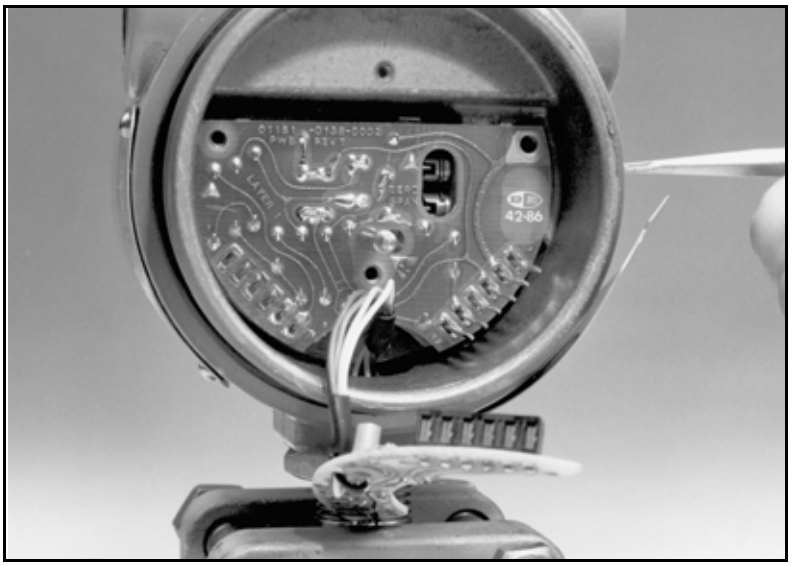
5. Pull the header board assembly (3) off the bayonet connectors. The header board must be reinserted. Do not cut the wires (9) or remove the header board.



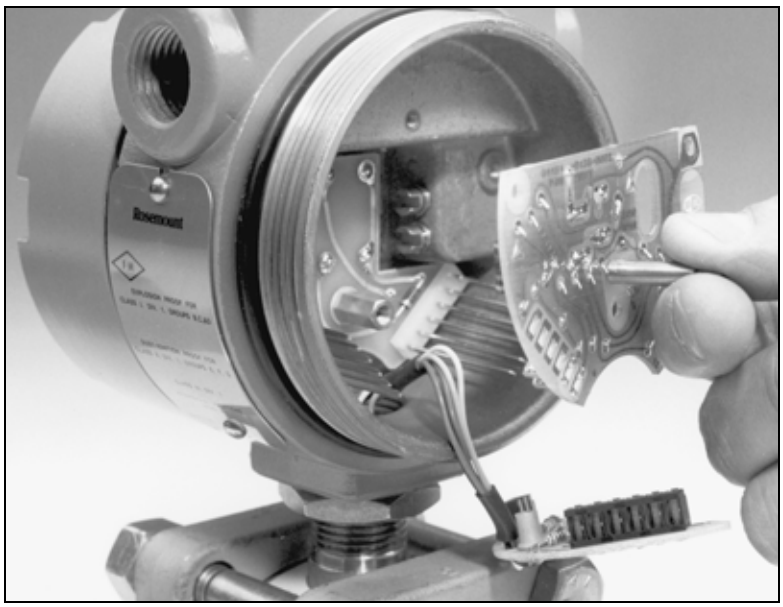
6. If the transmitter has linear output electronics, remove the three standoffs (4). Use a 1/4-in. nut driver or wrench.

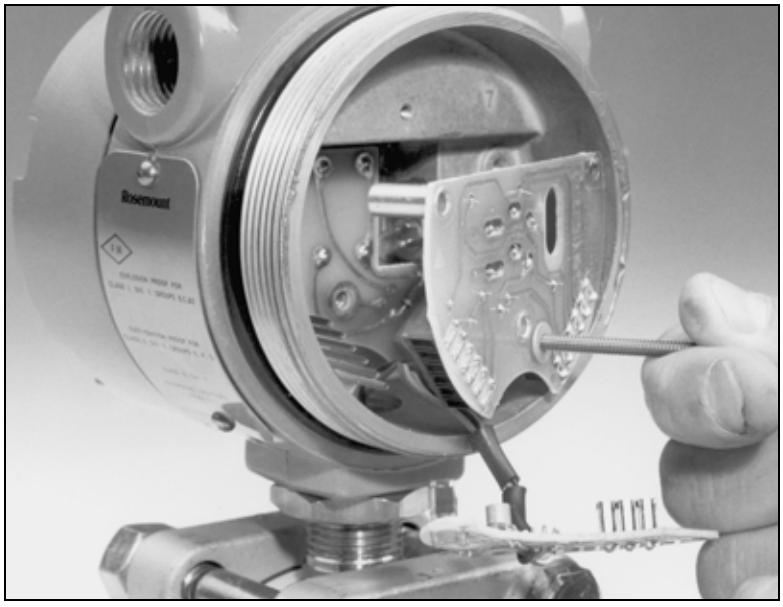


7. Align the zero and span adjust screws (10) so that the potentiometer blades are perpendicular to the board.

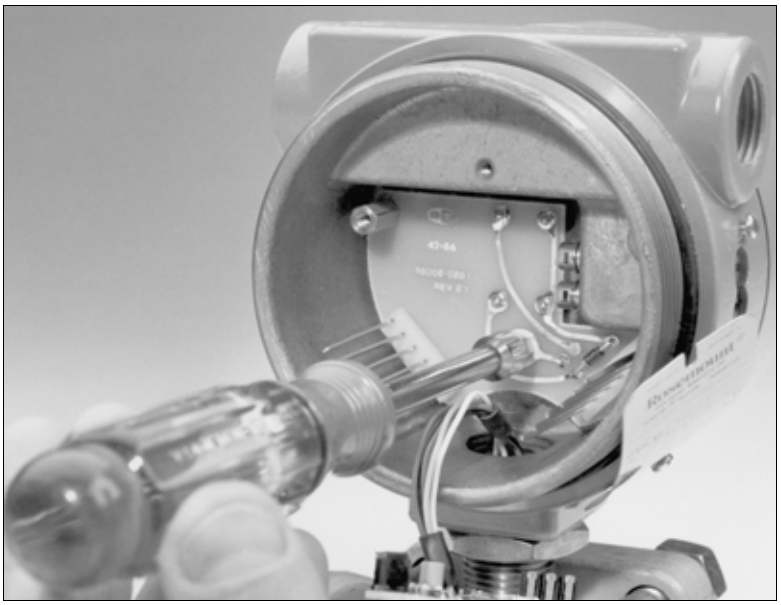


8. For linear output models, grip the calibration board (5) by the interface pin. (Removing the calibration board disables the conventional zero and span screws.)





Insert the standoffs (7), if necessary. The transmitter is now ready to receive the plug-in smart electronics assembly.



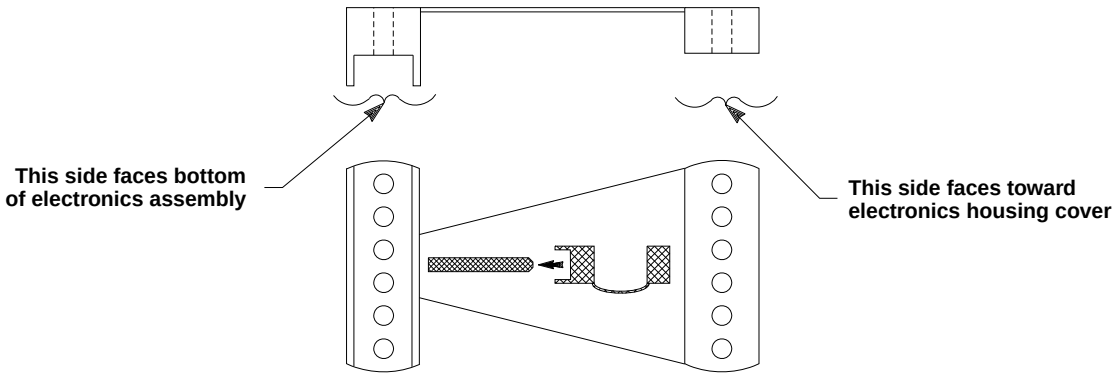
INSTALLING THE SMART RETROFIT KIT

Installing the smart retrofit electronics kit in the transmitter requires installing plastic spacers to accommodate the retrofit kit and securing the retrofit electronics. After the retrofit kit has been installed, it is necessary to attach eyelets to the terminal side of the transmitter. The eyelets enable hook-up with a HART-based communicator (see Figure 6-2).

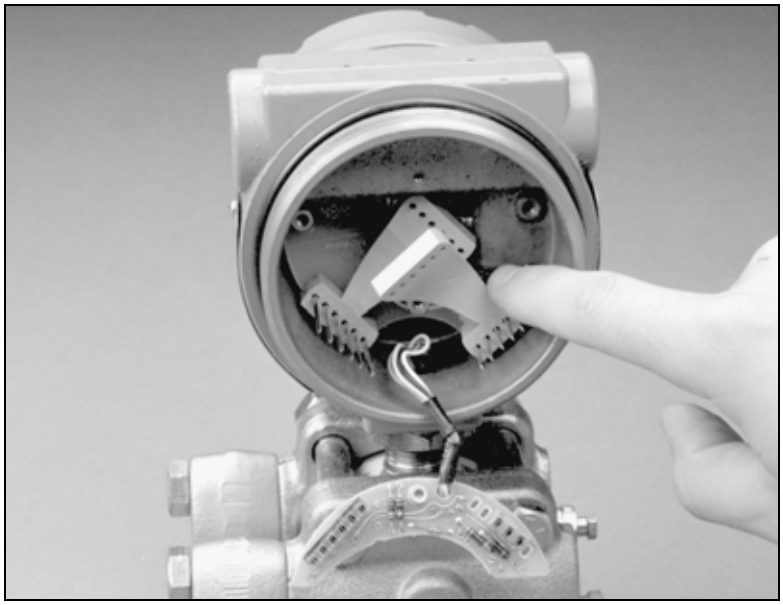
⚠CAUTION

Use proper earth grounding techniques when handling the smart electronics assembly. The smart electronics assembly is potentially sensitive to electric static discharge.

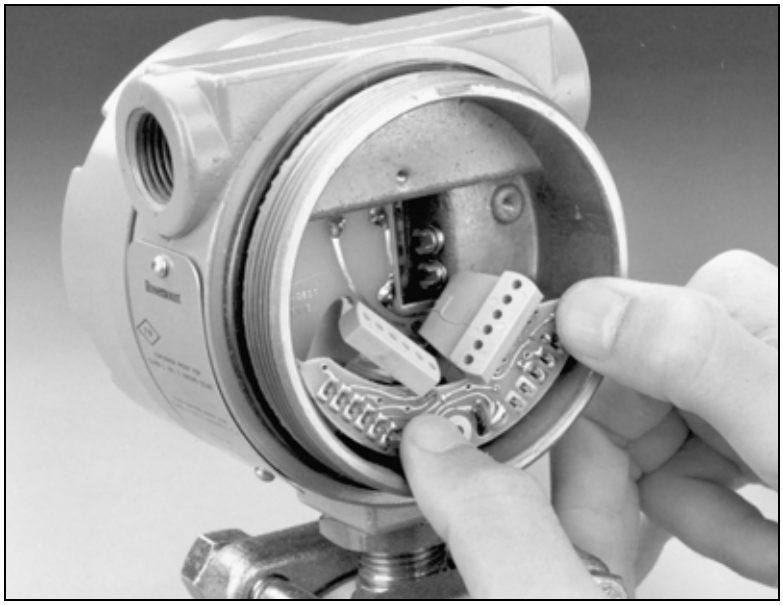
Figure 6-2. Spacer Assembly.



1. Slide the bottom half of one spacer over one of the rows of bayonet connectors. Then repeat the procedure for the other row.



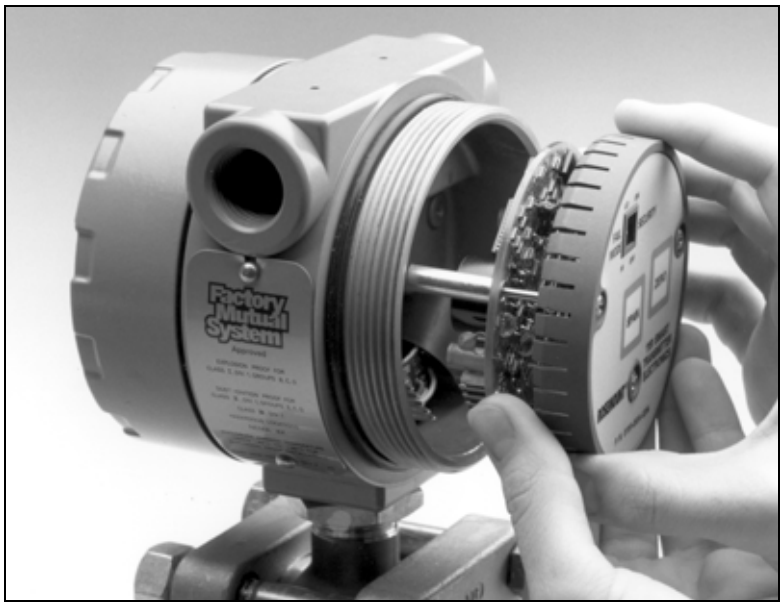
2. Align the header board with the bayonet connector pins, and slide the header board halfway down the pins.



3. Align the tops of both spacers with the bayonet connector pins, and slide them down the pins, pushing firmly on both the spacers and the header board to seat the board.



4. Align the smart electronics assembly with the bayonet connector pins, making sure all pins line up with the proper receptacles. Next, push the assembly slowly inward until it is fully seated.



5. Tighten the three captive screws on the smart electronics assembly to secure it in place.

⚠ 6. Attach the electronics cover provided in the smart retrofit kit, and tighten securely.

7. Remove the cover from the terminal side of the transmitter.

Two eyelets that fit under the + and – signal terminal screws are provided to facilitate connections to HART-based communicator. The signal terminal is the upper block as indicated on the transmitter housing.

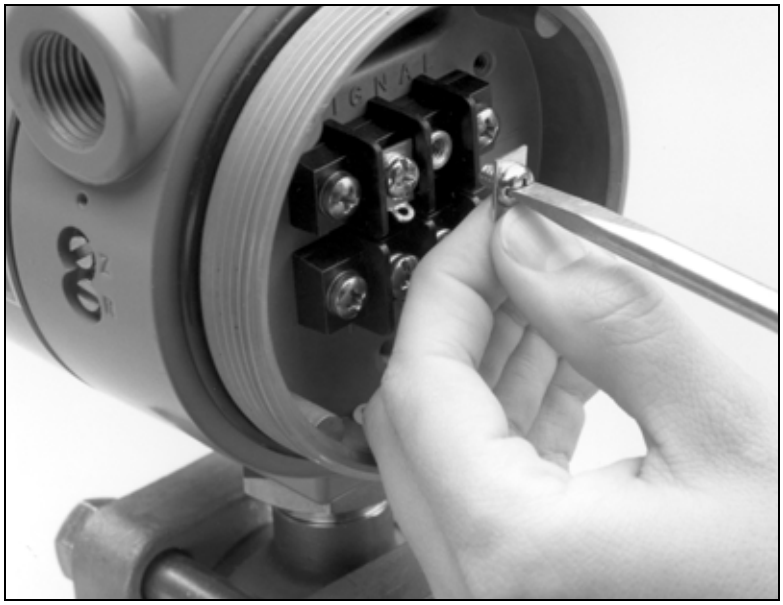
⚠ 8. Remove the signal terminal + and – screws. Attach an eyelet to each screw, and reinsert the screws.

9. Reattach the cover on the terminal side, and tighten securely.

CHARACTERIZATION

The transmitter is now ready to be characterized. Characterization is a one-time calibration of the sensor in the Rosemount 1151 Transmitter. During characterization, known pressures are applied to the sensor, and corresponding digital values are stored in the EEPROM located in the smart transmitter electronics. The microprocessor uses these values to make linearization corrections. The digital-to-analog converter then converts the corrected digital signal into a 4–20 mA dc output. The Rosemount 1151 Transmitter will stay in high alarm (approximately 22 mA output) until the characterization sequence is completed.

NOTE
The transmitter must be re-characterized if either the sensor module or the smart transmitter electronics are repaired or replaced.



Before Characterizing the Transmitter

1. Be prepared to answer the following questions:
   - Module type (AP, DP, HP, LT) on the transmitter S/N tag?
   - Module range on the transmitter module tag?
   - Pressure units on your pressure source?
   - Serial number on the transmitter S/N tag?
2. ⚠ Connect the pressure source.
3. ⚠ Remove the terminal side cover of the Rosemount 1151 Pressure Transmitter.
4. ⚠ Connect power supply leads to the terminal block. Apply power to the transmitter.

NOTE
Failure to use accurate equipment may result in a transmitter that cannot meet its accuracy specification.

Characterizing with a HART Communicator

⚠

1. Connect the HART communicator electrical connections to the SIGNAL terminal block. The HART Communicator connections are not polarity sensitive.
2. Turn the HART Communicator on by pushing the I/O button.
3. Follow the HART Communicator menus to characterize:
   - Device setup
   - Detailed setup
   - Sensor
   - Pressure sensor
   - Sensor service
   - Characterize
4. Follow the instructions on the screen.
5. Verify the new transmitter configuration:
   - Tag
   - Range points
   - Linear/square root
   - Damping
6. Verify that the Fail Safe Mode Switch and the Transmitter Security Switch on the smart electronics circuit board are correct.
7. Attach the electronics cover and tighten.
8. Put the transmitter back in service.

Appendix A Reference Information

Performance Specifications . . . . . **page A-1**
Functional Specifications . . . . . **page A-4**
Physical Specifications . . . . . **page A-9**
Dimensional Drawings . . . . . **page A-12**
Ordering Information . . . . . **page A-17**
1151 Parts List . . . . . **page A-23**
1151LT Parts List . . . . . **page A-29**
Display Specifications . . . . . **page A-35**

PERFORMANCE SPECIFICATIONS

(Zero-based calibrated ranges, reference conditions, silicone oil fill, 316 SST isolating diaphragms.)

Accuracy

Output	Model	Accuracy Specification and Span
Output Code S	Ranges 3 through 8 for DP and GP; Ranges 4 through 7 for HP	±0.075% of calibrated span between 1:1 to 10:1 of URL $\text{Accuracy} = \pm\left[0.02\left(\frac{\text{URL}}{\text{span}}\right) - 0.1\right]$% of calibrated span between 10:1 and 50:1 of URL
	Square Root Mode	$\text{Accuracy} = \pm\left[0.2 + 0.05 \times \frac{\text{URL}}{\text{span}}\right]$% of calibrated flow span for all spans
	All other ranges and transmitters	±0.25% of calibrated span for all spans
Output Codes E, G, L, and M	Ranges 3 through 5 for DP and GP	±0.2% of calibrated span for all spans
	P8 Option: Ranges 3 through 8 for DP and GP, all HP and all LT	±0.1% of calibrated span for > 10 inH_2O
	All other ranges and transmitters	±0.25% of calibrated span for all spans

Output Code S

Ranges 3 through 8, DP and GP transmitters;
Ranges 4 through 7, HP transmitters
±0.075% of calibrated span for spans from 1:1 to 10:1 of URL. Between 10:1 and 50:1 of URL.

$$\text{Accuracy} = \pm\left[0.02\left(\frac{\text{URL}}{\text{span}}\right) - 0.1\right]\% \text{ of calibrated span}$$

All other ranges and transmitters:
±0.25% of calibrated span

Square root mode:

$$\text{Accuracy} = \pm\left[0.2 + 0.05 \times \frac{\text{URL}}{\text{span}}\right]\% \text{ of calibrated flow span}$$

Output Codes E, G, L, and M

±0.2% of calibrated span for 1151DP and GP Ranges 3 through 5. All other ranges and transmitters, ±0.25% of calibrated span.

P8 Improved Performance Option:

±0.1% of calibrated span for ranges DP/GP ranges 3-8, all HP and all LT transmitters (only available with SST isolators and it must have a span great than 10 inH_20).

All other ranges and transmitters:

±0.25% of calibrated span

Stability

Output Code S
±0.1% of URL for two years for DP and GP Ranges 3 through 8. (±0.25% for all other ranges and transmitters.)

Output Codes E and G
±0.2% of URL for six months for Ranges 3 through 5. (±0.25 for all other ranges.)

Output Codes L and M
±0.25% of URL for six months.

Temperature Effect

Output Code S [–20 to 185 °F (–29 to 85 °C)]
For DP and GP transmitter Range 4 through 8:
Zero Error = ±0.2% URL per 100 °F (56 °C)
Total Error = ±(0.2% URL + 0.18% of calibrated span) per 100 °F; double the effect for other ranges and transmitters.

Output Code E, G, L, and M [–20 to 200 °F (–29 to 93 °C)]
For Ranges 4 through 0:
Zero Error = ±0.5% URL per 100 °F.
Total Error = ±(0.5% URL + 0.5% of calibrated span) per 100 °F (56 °C); double the effect for Range 3.

Static Pressure Effect

DP Transmitters
Zero Error: ±0.25% of URL for 2,000 psi (13790 kPa) for Range 4 and 5 or ±0.5% for other ranges, correctable through rezeroing at line pressure.

Span Error: Correctable to ±0.25% of input reading per 1,000 psi (6895 kPa), or to ±0.5% for Range 3.

HP Transmitters
Zero Error: ±2.0% of URL for 4,500 psi (31027 kPa), correctable through rezeroing at line pressure.

Span Error: Correctable to ±0.25% of input reading per 1,000 psi (6895 kPa).

Vibration Effect

0.05% of URL per g to 200 Hz in any axis.

Power Supply Effect

Output Code S, E, G
Less than 0.005% of output span per volt.

Output Codes L, M
Output shift of less than 0.05% of URL for a 1 V dc power supply shift.

Load Effect

Output Code S, E, G
No load effect other than the change in power supplied to the transmitter.

Output Codes L, M
Less than 0.05% of URL effect for a change in load from 100 kV to infinite ohms.

Short Circuit Condition (Output Codes L and M only)

No damage to the transmitter will result when the output is shorted to common or to power supply positive (limit 12 V).

EMI/RFI Effect

Output shift of less than 0.1% of span when tested to SAMA PMC 33.1 from 20 to 1000 MHz and for field strengths up to 30 V/m (covers on).

Mounting Position Effect

Zero shift of up to 1 inH_2O (0.25 kPa).

With liquid level diaphragm in vertical plane, zero shift of up to 1 inH_2O (0.25 kPa). With liquid level diaphragm in horizontal plane, zero shift of up to 5 inH_2O (1.25 kPa) plus extension length on extended units. All zero shifts can be calibrated out. No effect on span.

FUNCTIONAL SPECIFICATIONS

Service

Liquid, gas, and vapor applications.

Ranges

See Table A-1 for complete list of ranges for all Rosemount 1151 transmitters.

Table A-1. Rosemount 1151 Transmitter Range Availability by Model (URL = Upper Range Limit).

Range Code	Rosemount 1151 Ranges (URL)	DP	HP	GP	DP/GP/Seals	AP	LT
3	30 inH_20 (7.46 kPa)	•	NA	•	NA	NA	NA
4	150 inH_20 (31.08 kPa)	•	•	•	•	•	•
5	750 inH_20 (186.4 kPa)	•	•	•	•	•	•
6	100 psi (689.5 kPa)	•	•	•	•	•	•
7	300 psi (2068 kPa)	•	•	•	•	•	NA
8	1,000 psi (6895 kPa)	•	NA	•	NA	•	NA
9	3,000 psi (20684 kPa)	NA	NA	•	NA	NA	NA
0	6,000 psi (41369 kPa)	NA	NA	•	NA	NA	NA

Minimum span equals the upper range limit (URL) divided by rangedown. Rangedown varies with the output code (see Table A-2).

Table A-2. Rangeability.

Output Code	Minimum Span	Maximum Span
E, G	URL/6	URL
L	URL/1.1	URL
M	URL/2	URL
S (DP and GP, SST, Range 3–9, HP SST, Range 4-7)	URL/50	2 × URL(1)
S (All others)	URL/15	2 × URL(1)

(1) Transmitter is capable of measuring from –URL to URL.

Outputs

Code S, Smart
4–20 mA dc, user selectable for linear or square root output. Digital process variable superimposed on 4–20 mA signal, available to any host that conforms to the HART protocol.

Code E, Analog
4–20 mA dc, linear with process pressure.

Code G, Analog
10–50 mA dc, linear with process pressure. Not available with the CE mark.

Code L, Low Power
0.8 to 3.2 V dc, linear with process pressure.

Code M, Low Power
1 to 5 V dc, linear with process pressure.

Table A-3. Output Code Availability

Code	1151 Output Options/Damping	DP	HP	GP	DP/GP/Seals	AP	LT
S	4–20 mA, Digital, Smart/Variable	•	•	•	•	•	•
E	4–20 mA, Linear, Analog/Variable	•	•	•	•	•	•
G(1)	10–50 mA, Linear, Analog/Variable	•	•	•	•	•	•
L	0.8 to 3.2 V, Linear, Low Power/Fixed	•	•	•	•	•	NA
M	1 to 5 V, Linear, Low Power/Fixed	•	•	•	•	•	NA

(1) Not available with CE mark.

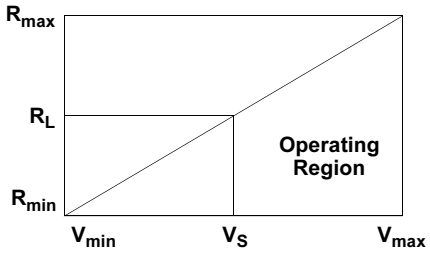
Power Supply

External power supply required. Transmitter operates on:

12 to 45 V dc with no load for Output Codes S and E.
30 to 85 V dc with no load for Output Code G.
5 to 12 V dc for Output Code L.
8 to 14 V dc for Output Code M.

Where:

Figure A-1. Power Supply Load Limitations



Code	V_{min}	V_{max}	R_{min}	R_{max}	R_L at Supply Voltage (V_S)
S(1)	12	45	0	1650	$R_L = 43.5 (V_S – 12)$
E(2)	12	45	0	1650	$R_L = 50 (V_S – 12)$
G	30	85	0	1100	$R_L = 20 (V_S – 30)$
L	5	12	Low Power Minimum Load Impedance: 100 kΩ		
M	8	14			

(1) A minimum of 250 ohms is required for communication.
(2) For CSA Approvals (code E), V_{max} = 42.4 V dc.

Current Consumption (Low Power Only) Under Normal Operating Conditions

Output Code L
1.5 mA dc.

Output Code M
2.0 mA dc.

Span and Zero

Output Code S
Span and zero may be accessed with local adjustments or remotely via a HART-based communicator.

Output Codes E, G, L, and M
Span and zero are continuously adjustable.

Zero Elevation and Suppression

Output Code S, E, and G.
Zero elevation and suppression must be such that the lower range value is greater than or equal to the (–URL) and the upper range value is less than or equal to the (+URL). The calibrated span must be greater than or equal to the minimum span.

Output Code L
Zero is adjustable ±10% of URL and span is adjustable from 90 to 100% of URL.

Output Code M
Zero is adjustable ±50% of URL and span is adjustable from 50 to 100% of URL.

Temperature Limits

Ambient

Code S:	–40 to 185 °F (–40 to 85 °C).
Code E:	–40 to 200 °F (–40 to 93 °C).
Code G, L, M:	–20 to 200 °F (–29 to 93 °C).

Storage
Code S:–60 to 185 °F (–51 to 85 °C).
Codes E, G, L, M:–60 to 250 °F (–51 to 121 °C).

Process *At atmospheric pressures and above.*

Table A-4. Rosemount 1151 Temperature Limits.

Rosemount 1151DP, HP, AP, GP, LT	
Silicone Fill Sensor	–40 to 220 °F (–40 to 104 °C)
Inert Fill Sensor	0 to 160 °F (–18 to 71 °C)
Rosemount 1151LT High-Side Temperature Limits (Process Fill Fluid)	
Syltherm® XLT	–100 to 300 °F (–73 to 149 °C)
D.C.® Silicone 704	60 to 400 °F (15 to 205 °C)
D.C. Silicone 200	–40 to 400 °F (–40 to 205 °C)
Inert	–50 to 350 °F (–45 to 177 °C)
Glycerin and Water(1)	0 to 200 °F (–18 to 93 °C)
Neobee M-20®(2)	0 to 400 °F (–18 to 205 °C)
Propylene Glycol and Water(2)	0 to 200 °F (–18 to 93 °C)
Sylthern 800	–50 to 400 °F (–45 to 205 °C)

(1) Not suitable for vacuum service.
(2) Not compatible with Buna-N or Ethylene-Propylene O-ring material.

NOTE
When specifying Option Codes W4 and W6, sensing element operating temperatures are 32 to 200 °F (0 to 93 °C) for silicone fill and 32 to 160 °F (0 to 71 °C) for inert fill.

Static Pressure Limits

Transmitters operate within specifications between the following limits:

Rosemount 1151DP
0.5 psia to 2,000 psig (3.45 kPa to 13790 kPa).

Rosemount 1151HP
0.5 psia to 4,500 psig (3.45 kPa to 31027 kPa).

Rosemount 1151AP
0 psia to the URL.

Rosemount 1151GP
0.5 psia (3.45 kPa) to the URL.

Rosemount 1151LT
Limit is 0.5 psia (3.45 kPa) to the flange rating or sensor rating, whichever is lower.

Overpressure Limits

Transmitters withstand the following limits without damage:

Rosemount 1151DP
0 psia to 2,000 psig (0 to 13790 kPa).

Rosemount 1151HP
0 psia to 4,500 psig (0 to 31027 kPa).

Rosemount 1151AP
0 psia to 2,000 psia (0 to 13790 kPa).

Rosemount 1151GP
Ranges 3–8: 0 psia to 2,000 psig (0 to 13790 kPa).
Range 9: 0 psia to 4,500 psig (31027 kPa).
Range 0: 0 psia to 7,500 psig (51710 kPa).

Rosemount 1151LT
Limit is 0 psia to the flange rating or sensor rating, whichever is lower. See Table A-5.

Table A-5. Rosemount 1151LT and Level Flange Rating Limits.

Standard	Class	Carbon Steel Rating	Stainless Steel Rating
ANSI	150	285 psig(1)	275 psig(1)
ANSI	300	740 psig(1)	720 psig(1)
ANSI	600	1,480 psig(1)	1,440 psig(1)
DIN	PN 10–40	40 bar(2)	40 bar(2)
DIN	PN 10/16	16 bar(2)	16 bar(2)
DIN	PN 25/40	40 bar(2)	40 bar(2)

(1) At 100 °F (38 °C), the rating decreases with increasing temperature.
(2) At 248 °F (120 °C), the rating decreases with increasing temperature.

Burst Pressure Limit
All models: 10,000 psig (68.95 MPa) burst pressure on the flanges.

Humidity Limits
0 to 100% relative humidity.

Volumetric Displacement
Less than 0.01 in^3 (0.16 cm^3).

Failure Mode Alarm (Smart only)

When not in multidrop mode, self-diagnosis detects a gross transmitter failure, the analog signal will be driven below 3.9 mA or above 21 mA to alert the user. High or low alarm signal is user selectable.

Level	4–20 mA Saturation Value	4–20 mA Alarm Value
Low	3.9 mA	3.8 mA
High	20.8 mA	21.75 mA

Transmitter Security (Smart only)

Activating the transmitter security function prevents changes to the transmitter configuration, including local zero and span adjustments. Security is activated by an internal switch.

Overpressure Alarm (Smart only)

If the sensor detects a negative overpressure value, the analog signal will be driven to 3.9 mA. If the sensor detects a positive overpressure value, the analog signal is driven to 20.8 mA.

Damping

Numbers given are for silicone fill fluid at room temperature. The minimum time constant is 0.2 seconds (0.4 seconds for Range 3).
Inert-filled sensor values would be slightly higher.

Output Code S
Time constant is adjustable in 0.1 second increments from minimum to 16.0 seconds.

Output Codes E and G
Time constant continuously adjustable between minimum and 1.67 seconds.

Output Codes L, M
Damping is fixed at minimum time constant.

Turn-on Time

Maximum of 2.0 seconds with minimum damping. Low power output is within 0.2% of steady state value within 200 ms after application of power.

PHYSICAL SPECIFICATIONS

Electrical Connections

1/2–14 NPT conduit with screw terminals and integral test jacks compatible with miniature banana plugs (Pomona 2944, 3690, or equivalent). The communicator connections are fixed to the terminal block on smart transmitters.

Process Connections

Rosemount 1151DP, HP, GP, AP

1/4–18 NPT on 2.125-in. (54-mm) centers on flanges for Ranges 3, 4, and 5.

1/4–18 NPT on 2.188-in. (56-mm) centers on flanges for Ranges 6 and 7.

1/4–18 NPT on 2.250-in. (57-mm) centers on flanges for Range 8.

1/2–14 NPT on adaptors.

For Ranges 3, 4, and 5, flange adaptors can be rotated to give centers of 2.0 in. (51 mm), 2.125 in. (54 mm), or 2.250 in. (57 mm).

Rosemount 1151LT

High pressure side: 2-, 3-, or 4-in., Class 150, 300 or 600 flange; 50, 80, or 100 mm, PN 40 or 10/16 flange.

Low pressure side: 1/4–18 NPT on flange. 1/2–14 NPT on adapter.

1151 Process Wetted Parts

Isolating Diaphragms

316L SST, Alloy C-276, or Tantalum. See ordering table for availability per model type.

Drain/Vent Valves

316 SST or Alloy C-276. See ordering table for availability per model type.

Process Flanges and Adaptors

Plated carbon steel, 316 SST or CW-12MW (Cast version Alloy C-276, material per ASTM-A494). See ordering table for availability per model type.

Wetted O-rings

Viton® (other materials also available). See ordering table for availability per model type.

1151LT Process Wetted Parts

Flanged Process Connection (Transmitter High Side)

Process diaphragms, including process gasket surface
316L SST, Alloy C-276, or Tantalum.

Extension
CF-3M (cast version to 316L SST, material per ASTM-A743) or CW-12MW (Cast version of Alloy C-276, material per ASTM-A494); fits schedule 40 and 80 pipe.

Mounting Flange
Carbon steel or SST.

Reference Process Connection (Transmitter Low Side)

Isolating Diaphragms
316L SST, Alloy C-276, or tantalum.

Reference Flange and Adapter
CF-8M (Cast version of 316 SST, material per ASTM-A743).

Non-wetted Materials

Fill Fluid

Silicone oil or inert fill.

Nuts and Bolts

Plated carbon steel

Blank flange (GP and AP only)

Plated carbon steel

Electronics Housing

Low-copper aluminium. NEMA 4X.

Cover O-rings

Buna-N.

Paint

Polyurethane.

Weight

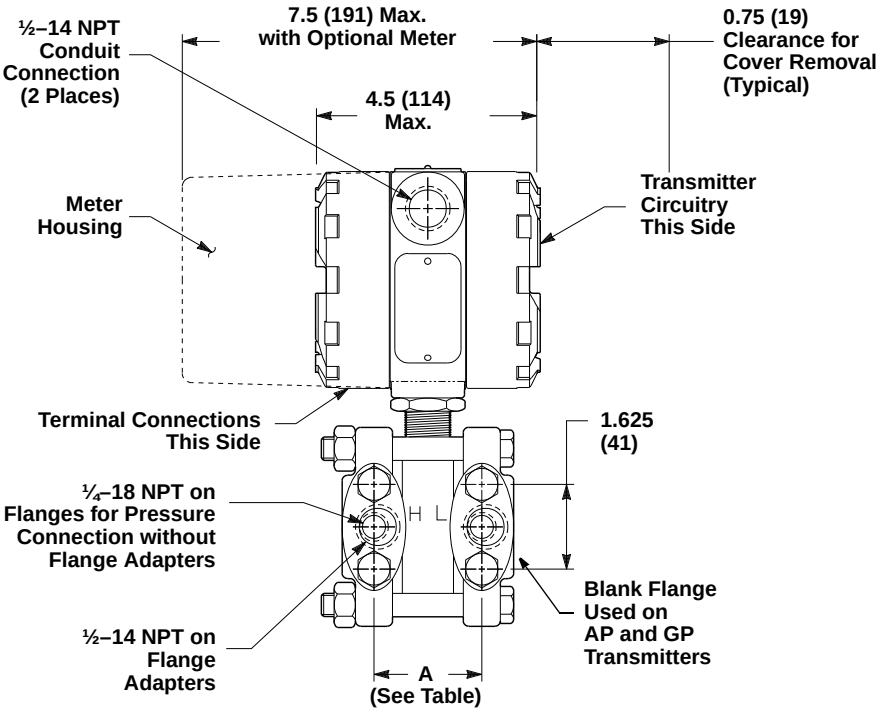
12 lb (5.4 kg) for AP, DP, GP, and HP transmitters, excluding options. See Table A-6.

Table A-6. Flange Weights with Rosemount 1151LT Transmitter.

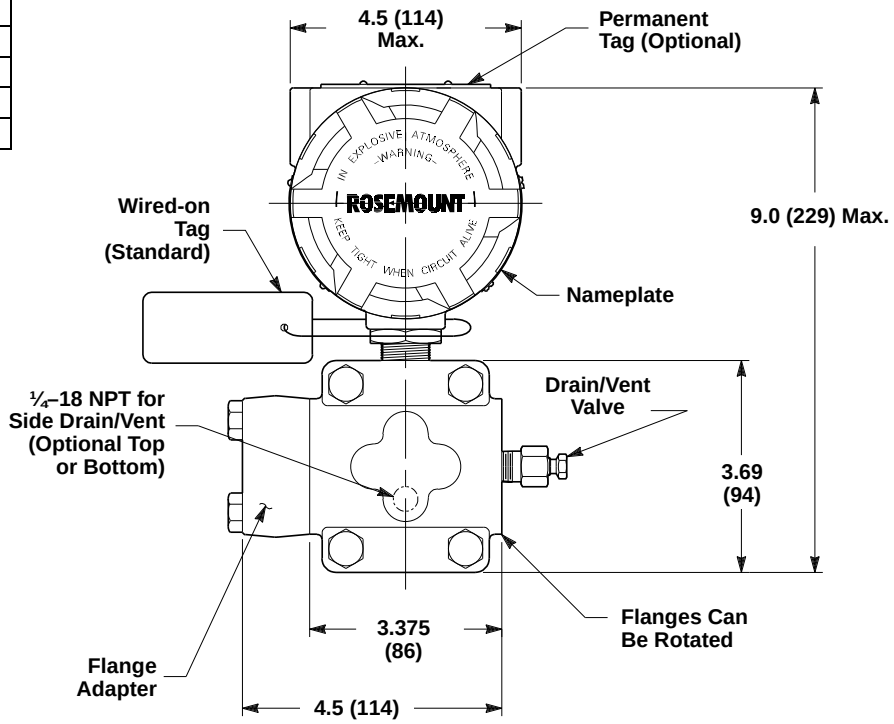
Flange[1]	Flush Mount	2-inch (50mm) Extension	4-inch (100mm) Extension	6-inch (150mm) Extension
2-in., Class 150	18 (8.2)	N/A	N/A	N/A
3-in., Class 150	23 (10.4)	25 (11.3)	26 (11.8)	27 (12.3)
4-in., Class 150	29 (13.2)	32 (14.5)	34 (15.4)	36 (16.3)
2-in., Class 300	20 (9.1)	N/A	N/A	N/A
3-in., Class 300	28 (12.7)	30 (13.6)	31 (14.1)	32 (14.5)
4-in., Class 300	38 (17.2)	41 (18.6)	43 (19.5)	45 (20.4)
2-in., Class 600	22 (10.0)	N/A	N/A	N/A
3-in., Class 600	31 (14.1)	33 (15.0)	34 (15.4)	35 (15.9)
DN 50, PN10-40	20 (9.1)	N/A	N/A	N/A
DN 80, PN 25/40	25 (11.3)	27 (12.3)	28 (12.7)	29 (13.2)
DN 100, PN 10/16 DN	25 (11.3)	28 (12.7)	30 (13.6)	32 (14.5)
100, PN 25/40	29 (13.2)	32 (14.5)	34 (15.4)	36 (16.3)

(1) Stainless steel flange weights are listed.

DIMENSIONAL DRAWINGS

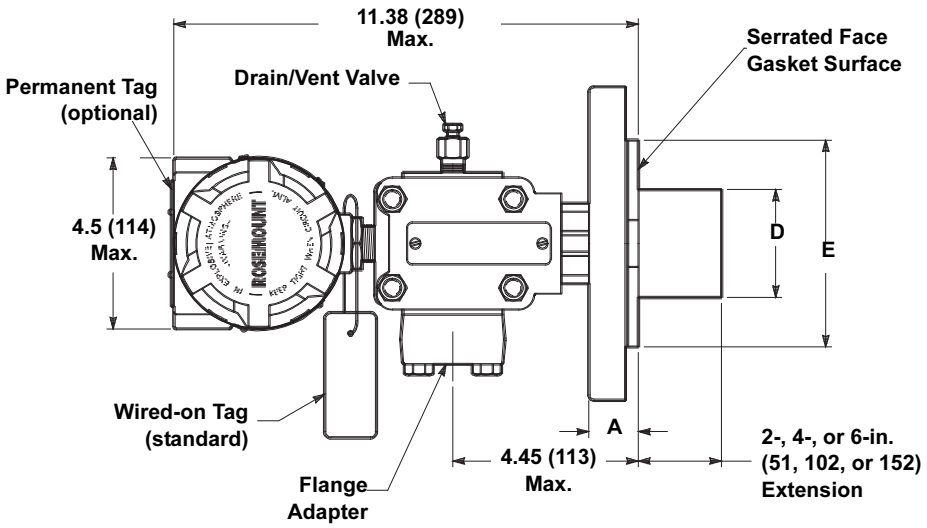


Range	Flange Distance "A" Center to Center	
	inches	mm
3, 4, 5	2.125	54
6, 7	2.188	56
8	2.250	57
9	2.281	58
0	2.328	59

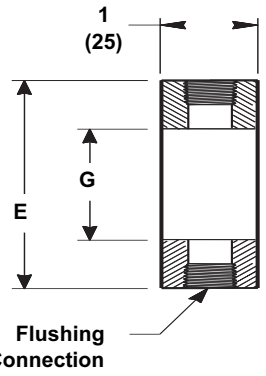


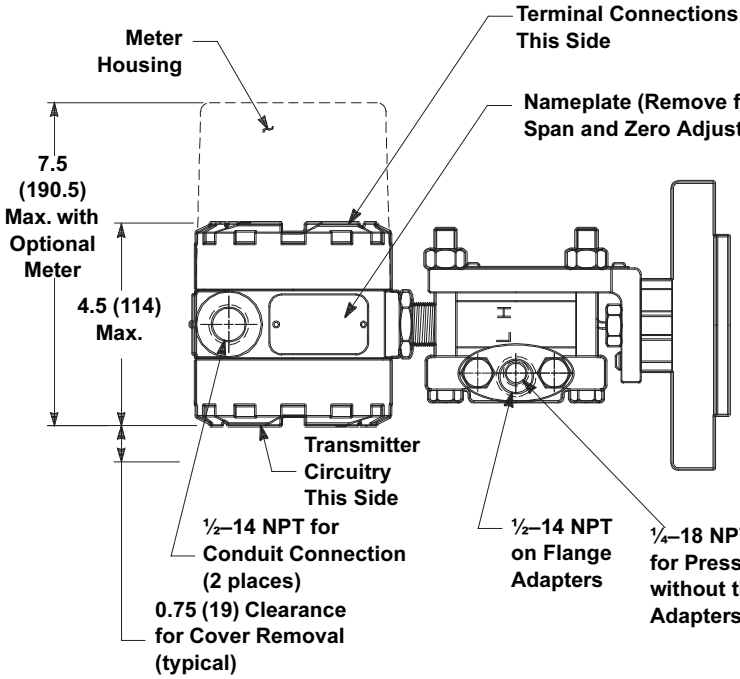
NOTE
Dimensions are in inches (millimeters).

1151LT

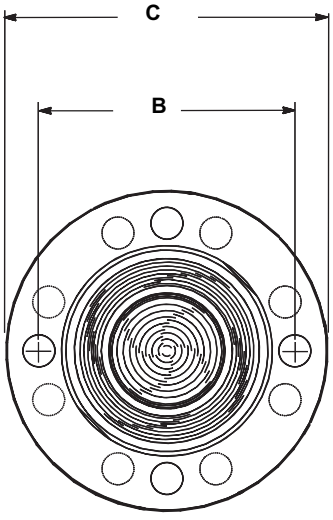


OPTIONAL FLUSHING CONNECTION RING (LOWER HOUSING)





DIAPHRAGM ASSEMBLY AND MOUNTING FLANGE



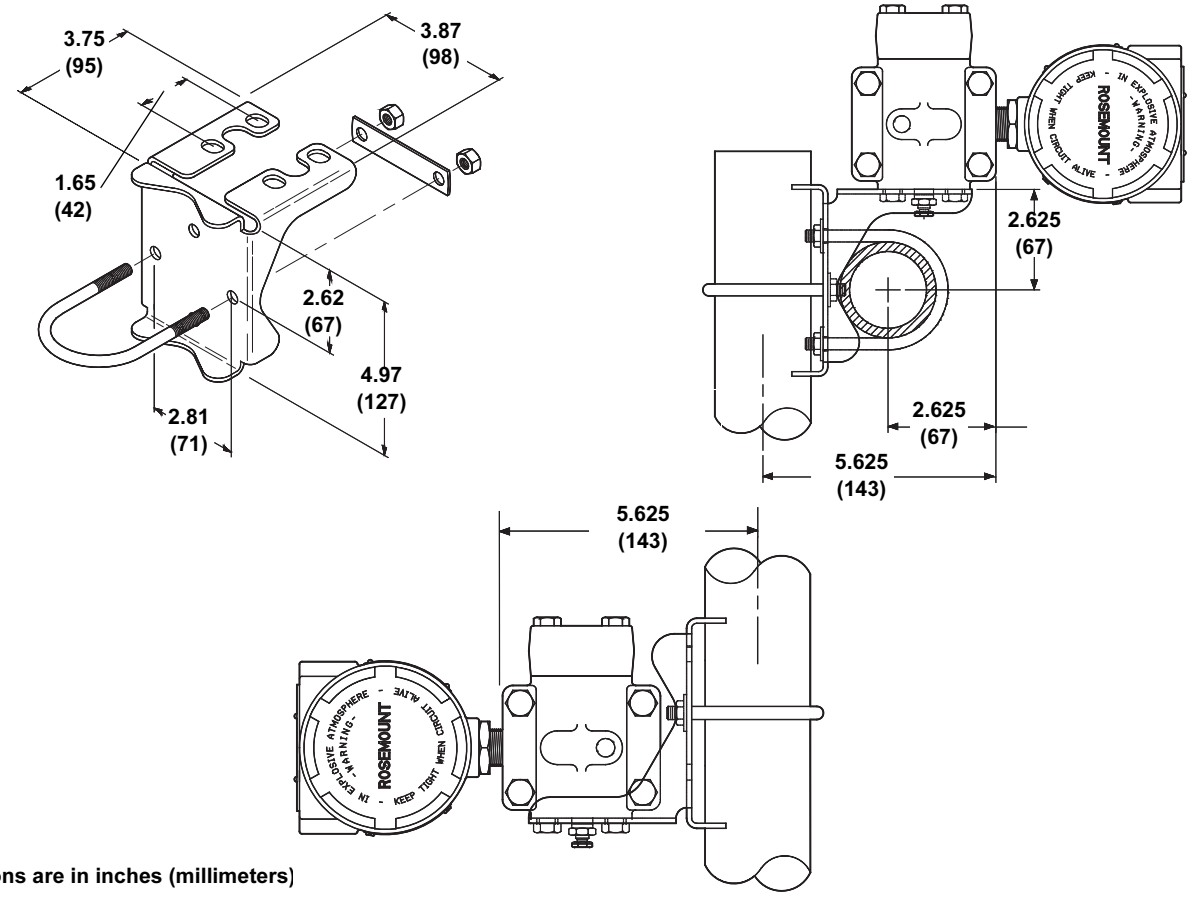
NOTE
Dimensions are in inches (millimeters).

Table A-7. 1151LT Dimensional Specifications

Class	Pipe Size	Flange Thickness A	Bolt Circle Diameter B	Outside Diameter C	No. of Bolts	Bolt Hole Diameter	Exten. Diam. D (1)	O.D. Gask. Surf. E	Proc. Side G
ANSI 150	2 (51)	1.12 (28)	4.75 (121)	6.0 (152)	4	0.75 (19)	NA	3.6(92)	2.12 (54)
	3 (76)	1.31 (33)	6.0 (152)	7.5 (191)	4	0.75 (19)	2.58 (66)	5.0 (127)	3.5 (89)
	4 (102)	1.31 (33)	7.5 (191)	9.0 (229)	8	0.75 (19)	3.5 (89)	6.2 (158)	4.5 (114)
ANSI 300	2 (51)	1.25 (32)	5.0 (127)	6.5 (165)	8	0.75 (19)	NA	3.6(92)	2.12 (54)
	3 (76)	1.50 (38)	6.62 (168)	8.25 (210)	8	0.88 (22)	2.58 (66)	5.0 (127)	3.5 (89)
	4 (102)	1.62 (41)	7.88 (200)	10.0 (254)	8	0.88 (22)	3.5 (89)	6.2 (158)	4.5 (114)
ANSI 600	2 (51)	1.12 (28)	5.0 (127)	6.5 (165)	8	0.75 (19)	NA	3.6(92)	2.12 (54)
	3 (76)	1.37 (35)	6.62 (168)	6.62 (168)	8	0.88 (22)	2.58 (66)	5.0 (127)	3.5 (89)
DIN PN10-40	DN 50	26 mm	125 mm	165 mm	4	18 mm	NA	4.0 (102)	2.5 (63)
DIN PN 25/40	DN 80	30 mm	160 mm	200 mm	8	18 mm	65 mm	5.4 (138)	3.7 (94)
	DN 100	30 mm	190 mm	235 mm	8	22 mm	89 mm	6.2 (158)	4.5 (114)
DIN PN 10/16	DN 100	26 mm	180 mm	220 mm	8	18 mm	89 mm	6.2 (158)	4.5 (114)

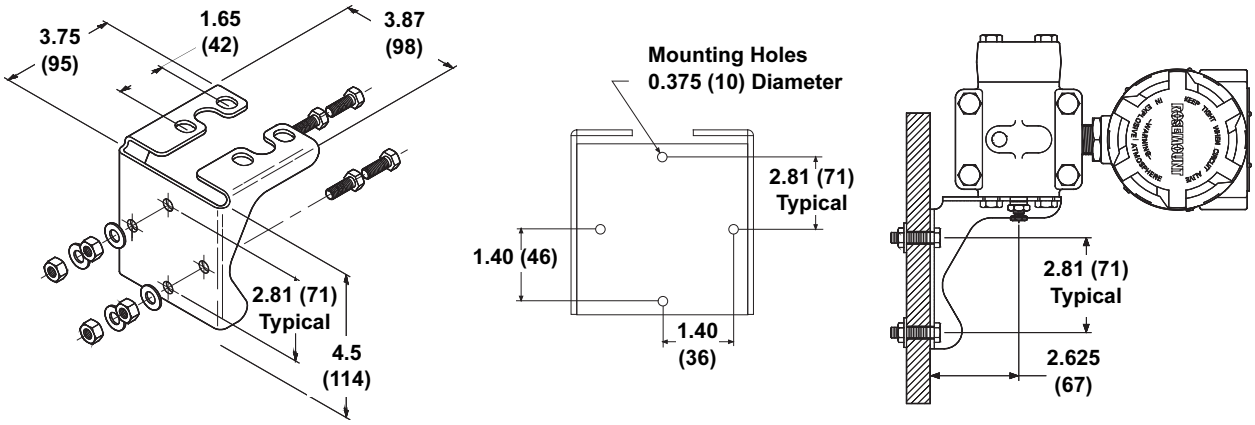
(1) Tolerances are 0.040 (1.02), –0.020 (0.51).

Mounting Bracket Option Codes B1, B4, and B7



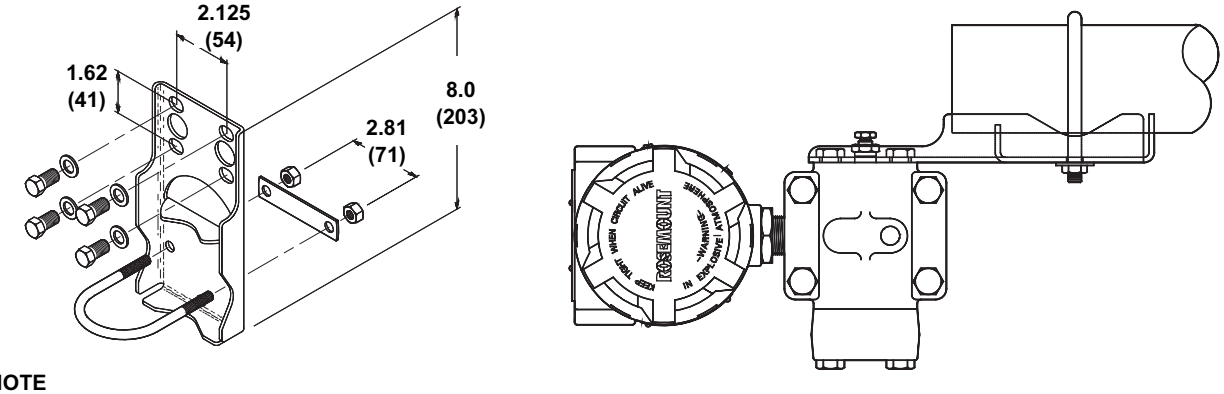
NOTE
Dimensions are in inches (millimeters)

Panel Mounting Bracket Option Codes B2 and B5



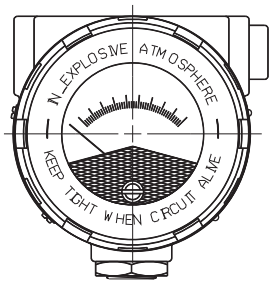
NOTE
Dimensions are in inches (millimeters).

Flat Mounting Bracket Option Codes B3, B6, and B9

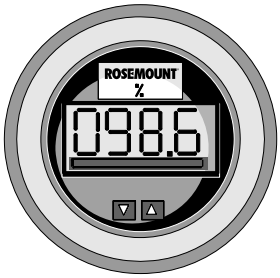


NOTE
Dimensions are in inches (millimeters).

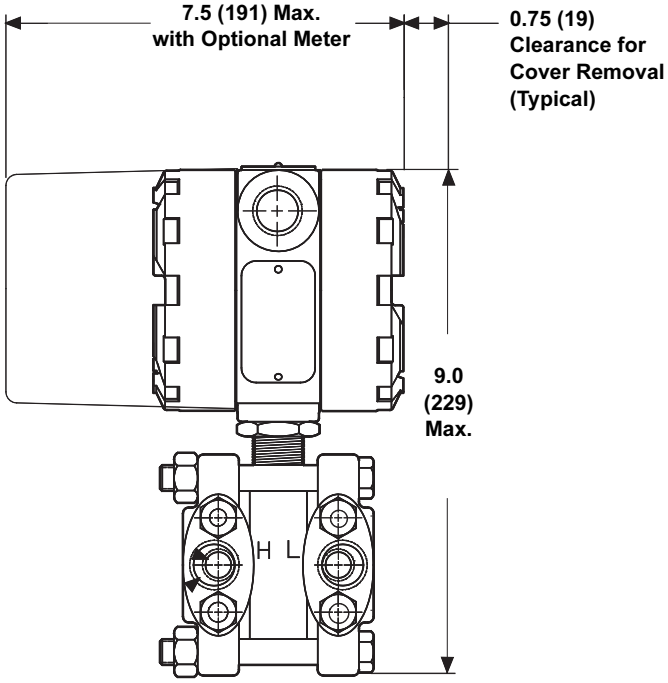
Meter Options



OPTION CODE M1
LINEAR SCALE

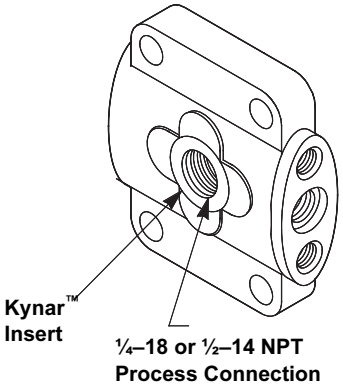


OPTION CODE M4
LINEAR SCALE

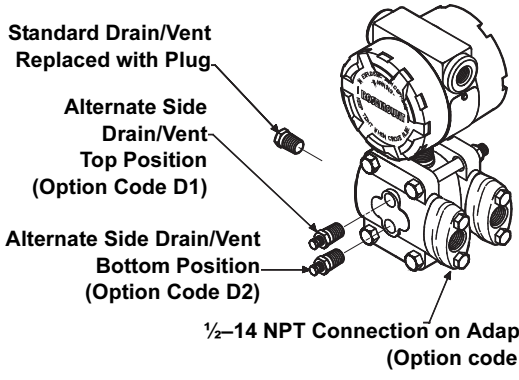


NOTE
Dlmensions are in inches (millimeters).

Flange Insert



1151 Process Connections



ORDERING INFORMATION

Table A-8. Rosemount 1151 Ordering Information

• = Applicable — = Not Applicable

Model	Transmitter Type	DP	HP	GP	AP
1151DP	Differential Pressure Transmitter	•	—	—	—
1151HP	Differential Pressure Transmitter for High Line Pressures	—	•	—	—
1151GP	Gage Pressure Transmitter	—	—	•	—
1151AP	Absolute Pressure Transmitter	—	—	—	•
Code	**Pressure Ranges (URL) (select one)**	**DP**	**HP**	**GP**	**AP**
3	30 inH2O (7.46 kPa)	•	—	•	—
4	150 inH2O (37.3 kPa)	•	•	•	•
5	750 inH2O (186.4 kPa)	•	•	•	•
6	100 psi (689.5 kPa)	•	•	•	•
7	300 psi (2068 kPa)	•	•	•	•
8	1,000 psi (6895 kPa)	•	—	•	•
9	3,000 psi (20684 kPa)	—	—	•	—
0	6,000 psi (41369 kPa)	—	—	•	—
Code	**Transmitter Output (select one)**	**DP**	**HP**	**GP**	**AP**
S	4–20 mA with Digital Signal based on HART Protocol (Smart)	•	•	•	•
E	4–20 mA, Linear with Input	•	•	•	•
G[1]	10–50 mA, Linear with Input	•	•	•	•
L[2]	Low Power 0.8 to 3.2 Vdc	•	•	•	•
M[2]	Low Power 1 to 5 Vdc	•	•	•	•

		MATERIALS OF CONSTRUCTION[3]						
Code	**Flanges/Adapters**	**Drains/Vents**	**Diaphragms**	**Fill Fluid**	**DP**	**HP**	**GP[4]**	**AP[4]**
52	Nickel-plated Carbon Steel	316 SST	316L SST	Silicone	•	•	•	•
53	Nickel-plated Carbon Steel	316 SST	Alloy C-276	Silicone	•	•	•	•
55	Nickel-plated Carbon Steel	316 SST	Tantalum	Silicone	•	—	•	—
22	316 SST	316 SST	316L SST	Silicone	•	•	•	•
23	316 SST	316 SST	Alloy C-276	Silicone	•	•	•	•
25	316 SST	316 SST	Tantalum	Silicone	•	—	•	—
33[5]	Cast C-276	Alloy C-276	Alloy C-276	Silicone	•	•	•	•
35	Cast C-276	Alloy C-276	Tantalum	Silicone	•	—	•	—
73[5]	316 SST	Alloy C-276	Alloy C-276	Silicone	•	•	•	•
83[5]	Nickel-plated Carbon Steel	Alloy C-276	Alloy C-276	Silicone	•	•	•	•
5A	Nickel-plated Carbon Steel	316 SST	316L SST	Inert	•	—	•	—
5B	Nickel-plated Carbon Steel	316 SST	Alloy C-276	Inert	•	—	•	—
5D	Nickel-plated Carbon Steel	316 SST	Tantalum	Inert	•	—	•	—
2A	316 SST	316 SST	316L SST	Inert	•	—	•	—
2B	316 SST	316 SST	Alloy C-276	Inert	•	—	•	—
2D	316 SST	316 SST	Tantalum	Inert	•	—	•	—
3B	Cast C-276	Alloy C-276	Alloy C-276	Inert	•	—	•	—
3D	Cast C-276	Alloy C-276	Tantalum	Inert	•	—	•	—
7B[5]	316 SST	Alloy C-276	Alloy C-276	Inert	•	—	•	—
8B[5]	Nickel-plated Carbon Steel	Alloy C-276	Alloy C-276	Inert	•	—	•	—

Code	**Mounting Brackets (optional - select one)**	**DP**	**HP**	**GP**	**AP**
B1	Bracket, 2-in. Pipe Mount	•	•	•	•
B2	Bracket, Panel Mount	•	•	•	•
B3	Bracket, Flat, 2-in. Pipe Mount	•	•	•	•
B4	B1 Bracket w/Series 316 SST Bolts	•	•	•	•
B5	B2 Bracket w/Series 316 SST Bolts	•	•	•	•
B6	B3 Bracket w/Series 316 SST Bolts	•	•	•	•
B7	316 SST B1 Bracket with 316 SST Bolts	•	•	•	•
B9	316 SST B3 Bracket with 316 SST Bolts	•	•	•	•
Code	**LCD Display[6] (optional - select one)**	**DP**	**HP**	**GP**	**AP**
M1	Analog Scale, Linear Meter, 0–100%	•	•	•	•

Table A-8. Rosemount 1151 Ordering Information

M2	Analog Scale, Square Root Meter, 0–100% Flow		•	•	—	—
M4[7]	LCD Display, Linear Meter, 0–100%		•	•	•	•
M6	Analog Scale, Square Root Meter, 1–10$\sqrt{}$		•	•	—	—
M7[7][8]	LCD Display, Linear Meter, Special Configuration		•	•	•	•
M8[7]	LCD Display Square Root Meter, 0–100% Flow		•	•	—	—
M9[7]	LCD Display, Square Root Meter, 0–10$\sqrt{}$		•	•	—	—
Code	**Product Certifications (optional - select one)**		**DP**	**HP**	**GP**	**AP**
E8	ATEX Flameproof		•	•	•	•
I1[9]	ATEX Intrinsic Safety	**NOTE**	•	•	•	•
N1[9]	ATEX Type n	FM explosion-proof approval is standard.	•	•	•	•
I5[9]	FM Intrinsically Safe, Division 2		•	•	•	•
K5[9]	FM Explosion-Proof, Dust Ignition-proof, Intrinsically Safe, Division 2		•	•	•	•
C6[9]	CSA Explosion-Proof, Intrinsically Safe		•	•	•	•
I6[9]	CSA Intrinsically Safe		•	•	•	•
K6[9]	CSA Explosion-Proof, Dust Ignition-proof, Intrinsically Safe, Division 2		•	•	•	•
E6	CSA Explosion-Proof, Dust Ignition-proof, Division 2		•	•	•	•
E7	SAA Flameproof, Dust Ignition-proof		•	•	•	•
I7[9]	SAA Intrinsic Safety		•	•	•	•
N7[9]	SAA Type n		•	•	•	•
C5[10]	Measurement Canada Accuracy Approval		•	•	•	•
Code	**Housing (optional - select one)**		**DP**	**HP**	**GP**	**AP**
H1[11]	SST Non-wetted Parts on Transmitter without Meter		•	•	•	•
H2[11]	SST Non-wetted Parts on Transmitter with Meter		•	•	•	•
H3	SST Housing, Covers, Conduit Plug, Lock-nut, without Meter		•	•	•	•
H4	SST Housing, Covers, Conduit Plug, Lock-nut, with Meter		•	•	•	•
C2[12]	M20 Conduit Threads		•	•	•	•
J1	G½ Conduit Threads		•	•	•	•
Code	**Terminal Blocks (optional - select one)**		**DP**	**HP**	**GP**	**AP**
R1	Integral Transient Protection (Only available with output options S and E)		•	•	•	•
Code	**Bolts for Flanges and Adapters (optional - select one)**		**DP**	**HP**	**GP**	**AP**
L3	ASTM A193-B7 Flange and Adapter Bolts		•	•	•	•
L4	316 SST Flange and Adapter Bolts		•	•	•	•
L5	ASTM A193-B7M Flange and Adapter Bolts		•	•	•	•
Code	**Process Connections (optional[13])**	**Materials**	**DP**	**HP**	**GP**	**AP**
D1	Side Drain/ Vent, Top	316 SST	•	•	•	•
		Cast C-276	•	•	•	•
D2	Side Drain/ Vent, Bottom	316 SST	•	•	•	•
		Cast C-276	•	•	•	•
DF	½–14 NPT Flange adapter(s)- Material determined by flange material	Carbon Steel	•	•	•	•
		316 SST	•	•	•	•
		Cast C-276	•	•	•	•
D4[14]	Conformance to DIN EN61518 Ranges 3, 4, 5 with ¼ NPT Process Connections Thread (Available in Germany Only)		•	•	—	—
D5[14]	Conformance to DIN EN61518 Ranges 6, 7, 8, without ¼ NPT Process Connections Thread (Available in Germany Only)		•	•	—	—
D6	316 SST Low Side Blank Flange		—	—	•	•
D9	JIS Process Connection–RC ¼ Flange with RC ½ Flange Adapter	Carbon Steel	•	•	•	•
		316 SST	•	•	•	•
		Cast C-276	•	•	•	•
G1	DIN Spacing (Single Entry Port, No Side V/D Hole Flange)		•	•	•	•
G2	DIN Spacing (Single Entry Port, Two Side V/D Hole Flange)		•	•	•	•
G3	DIN Spacing (Dual Entry Port, No Side V/D Hole Flange)		•	•	•	•
G4	DIN Spacing (Dual Entry Port, One Top Side V/D Hole Flange)		•	•	•	•
G5	DIN Spacing (Dual Entry Port, One Bottom Side V/D Hole Flange)		•	•	•	•
G6	DIN Spacing (Dual Entry Port, Two Side V/D Hole Flange)		•	•	•	•
K1[15]	Kynar insert, ¼–18 NPT		•	—	•	—
K2[15]	Kynar insert, ½–14 NPT		•	—	•	—
S1[16][17]	Assemble to one Rosemount 1199 diaphragm seal		•	—	•	—
S2[16][17]	Assemble to two Rosemount 1199 diaphragm seals		•	—	—	—

Table A-8. Rosemount 1151 Ordering Information

S4[17][18]	Assemble to Rosemount 1195 Integral Orifice	•	—	—	—
S6[17]	Assemble to Rosemount 304 Manifold or Connection System	•	•	•	•
Code	**Wetted O-ring Material (optional - select one)**	**DP**	**HP**	**GP**	**AP**
W2	Buna-N	•	•	•	•
W3	Ethylene-Propylene	•	•	•	•
W4	Aflas	•	•	•	•
W6[19][20]	Spring-loaded PTFE	•	—	•	•
W7[20][21]	PTFE	•	—	•	•
Code	**Special Configuration (Software) (optional - select one)**	**DP**	**HP**	**GP**	**AP**
CN[22][23]	Analog Output Levels Compliant with NAMUR Recommendation NE43: 27-June-1996 and Low Alarm Level	•	•	•	•
C4[22][23]	Analog Output Levels Compliant with NAMUR Recommendation NE43: 27-June-1996 and High Alarm Level	•	•	•	•
C9[23]	Software Configuration (Requires completed Configuration Data Sheet)	•	•	•	•
Code	**Special Certifications (optional - select one)**	**DP**	**HP**	**GP**	**AP**
Q4	Calibration Certificate	•	•	•	•
Q8[24]	Material Traceability per EN 10204 3.1.B	•	•	•	•
Q16[25]	Surface Finish Certification for Sanitary Remote Seals	•	•	•	•
Code	**Toolkit Total System Performance Reports (optional - select one)**	**DP**	**HP**	**GP**	**AP**
QZ[25]	Remote Seal System Performance Calculation Report	•	—	•	—
Code	**Procedures (optional - select one)**	**DP**	**HP**	**GP**	**AP**
P1[26]	Hydrostatic Testing, 150% Maximum Working Pressure	•	•	•	•
P2[27]	Cleaning for Special Service	•	•	•	•
P3	Cleaning for <1 PPM Chlorine/Fluorine	•	•	•	•
Code	**Outputs (optional - select one)**	**DP**	**HP**	**GP**	**AP**
V1[28]	Reverse Output	—	—	•	—
V2[29]	4–20 mV Test Signal	•	•	•	•
V3[29]	20–100 mV Test Signal	•	•	•	•
Typical Model Number: 1151DP 4 S 52 B3 M4					

(1) Output Code G is not available with CE Mark.
(2) Meter or SST housing not valid with this option.
(3) Bolts and conduit plugs are plated carbon steel.
(4) On GP and AP transmitters, the low-side flange is plated carbon steel. For a stainless-steel low-side flange, order process connection Option Code D6.
(5) These selections meet NACE material recommendations per MR 01-75.
(6) Not available with Output Codes L or M, or Option Codes V2 or V3.
(7) Not available with Output Codes G, V2, or V3.
(8) Specify the range, mode, and engineering units. The 20 mA value must be greater than the 4 mA value.
(9) Not available with Output Codes E, G, L, or M.
(10) Limited availability depending on transmitter type and range. Contact an Emerson Process Management representative.
(11) Option includes SST housing, covers, conduit plug, locknut, L4 bolting, and D6 low side blank flange for GP and AP transmitters. Option Codes L4 and D6 parts are included with housing Option Codes H1 and H2.
(12) Not available with Output Codes L or M. Available only with aluminum housing.
(13) Allowable combinations are: D1, D2, D6 or D6, S1.
(14) Material Traceability Certificate Option Q8 available.
(15) The maximum working pressure on this option is 300 psig. Available only with materials of construction Option Code 2x.
(16) This option may only be used on Ranges 4–8.
(17) "Assemble-to" items are specified separately and require a completed model number.
(18) This option has a maximum static pressure rating of 3,000 psi, and is available only for Ranges 3, 4, and 5.
(19) Contains a Alloy C-276 spring that is wetted by the process.
(20) Available for the ranges of DP (3-8), AP (4-8), and GP (3-8).
(21) PTFE O-ring has seal property limitations; Consult an Emerson Process Management representative for more information.
(22) NAMUR-Compliant operation is pre-set at the factory and cannot be changed to standard operation in the field.
(23) Available with Output Code S only.
(24) This option is available for the transmitter flange and adapters only.
(25) Requires one of the Diaphragm Seal Assembly codes (S1 or S2).
(26) Hydrostatic testing for Range 0, 125% maximum working pressure.
(27) Fluorolube® grease on wetted O-rings.
(28) Reverse output option is not needed with smart electronics; configured via HART-based communicator.
(29) Not available with Output Codes L or M.

Table A-9. Rosemount 1151LT Flange Mounted Liquid Level Transmitter.

Model	Product Description			
1151LT	Flange-Mounted Liquid Level Transmitter			
Code	**Range**			
4	150 inH2O (0–635 to 0–3,810 mmH2O)			
5	750 inH2O (0–3,175 to 0–19,050 mmH2O)			
6	2,770 inH2O (0–11.96 to 0–70.36 mmH2O)			
Code	**Output**			
S	4–20 mA with Digital Signal based on HART Protocol (Smart)			
E	4–20 mA, Linear with Input			
G[1]	10–50 mA, Linear with Input			
Code	**Size**	**Material**	**Extension Length**	
G0	2 in./DN 50	316L SST	Flush Mount Only	When specifying these option codes, a lower housing must be selected from the flushing connection options.
H0	2 in./DN 50	Alloy C-276	Flush Mount Only	
J0	2 in./DN 50	Tantalum	Flush Mount Only	
A0	3 in./DN 80	316L SST	Flush Mount	
A2	3 in./DN 80	316L SST	2 in./50 mm	
A4	3 in./DN 80	316L SST	4 in./100 mm	
A6	3 in./DN 80	316L SST	6 in./150 mm	
B0	4 in./DN 100	316L SST	Flush Mount	**NOTE** Extension diameters are sized to fit Schedule 80 pipe. Consult factory for Schedule 40 pipe.
B2	4 in./DN 100	316L SST	2 in./50 mm	
B4	4 in./DN 100	316L SST	4 in./100 mm	
B6	4 in./DN 100	316L SST	6 in./150 mm	
C0	3 in./DN 80	Alloy C-276	Flush Mount	
C2	3 in./DN 80	Alloy C-276	2 in./50 mm	
C4	3 in./DN 80	Alloy C-276	4 in./100 mm	
C6	3 in./DN 80	Alloy C-276	6 in./150 mm	
D0	4 in./DN 100	Alloy C-276	Flush Mount	
D2	4 in./DN 100	Alloy C-276	2 in./50 mm	
D4	4 in./DN 100	Alloy C-276	4 in./100 mm	
D6	4 in./DN 100	Alloy C-276	6 in./150 mm	
E0	3 in./DN 80	Tantalum	Flush Mount Only	
F0	4 in./DN 100	Tantalum	Flush Mount Only	
	MOUNTING FLANGE			
Code	**Size**	**Rating**	**Material**	**Applicable with these High Pressure Side Diaphragm Sizes**
M	2-in.	Class 150	CS	2 in./DN 50
A	3-in.	Class 150	CS	3 in./DN 80
B	4-in.	Class 150	CS	4 in./DN 100
N	2-in.	Class 300	CS	2 in./DN 50
C	3-in.	Class 300	CS	3 in./DN 80
D	4-in.	Class 300	CS	4 in./DN 100
P	2-in.	Class 600	CS	2 in./DN 50
E	3-in.	Class 600	CS	3 in./DN 80
X	2-in.	Class 150	SST	2 in./DN 50
F	3-in.	Class 150	SST	3 in./DN 80
G	4-in.	Class 150	SST	4 in./DN 100
Y	2-in.	Class 300	SST	2 in./DN 50
H	3-in.	Class 300	SST	3 in./DN 80
J	4-in.	Class 300	SST	4 in./DN 100
Z	2-in.	Class 600	SST	2 in./DN 50
L	3-in.	Class 600	SST	3 in./DN 80
Q	DN 50	PN 10-40	CS	2 in./DN 50
R	DN 80	PN 40	CS	3 in./DN 80
S	DN 100	PN 40	CS	4 in./DN 100
V	DN 100	PN 10/16	CS	4 in./DN 100

Table A-9. Rosemount 1151LT Flange Mounted Liquid Level Transmitter.

K	DN 50	PN 10-40	SST	2 in./DN 50
T	DN 80	PN 40	SST	3 in./DN 80
U	DN 100	PN 40	SST	4 in./DN 100
W	DN 80	PN 10/16	SST	4 in./DN 100
SENSOR MODULE AND LOW-SIDE MATERIALS OF CONSTRUCTION				
Code	**Low-Side Flange and Adapter**	**Drain/ Vent Valves**	**Low-Side Isolator Diaphragm**	**Low-Side Fluid Fill**
52	Nickel-plated CS	316 SST	316L SST	Silicone
55	Nickel-plated CS	316 SST	Tantalum	Silicone
22	316 SST	316 SST	316L SST	Silicone
23	316 SST	316 SST	Alloy C-276	Silicone
25	316 SST	316 SST	Tantalum	Silicone
33	Cast C-276	Alloy C-276	Alloy C-276	Silicone
35	Cast C-276	Alloy C-276	Tantalum	Silicone
5D	Nickel-plated CS	316 SST	Tantalum	Inert
2A	316 SST	316 SST	316L SST	Inert
2B	316 SST	316 SST	Alloy C-276	Inert
2D	316 SST	316 SST	Tantalum	Inert
3B	Cast C-276	Alloy C-276	Alloy C-276	Inert
3D	Cast C-276	Alloy C-276	Tantalum	Inert
Code	**Process Fill - High Pressure Side**		**Temperature Limits**	
A	Syltherm XLT		–100 to 300 °F (–73 to 135 °C)	
C	D. C. Silicone 704		60 to 400 °F (15 to 205 °C)	
D	D. C. Silicone 200		–40 to 400 °F (–40 to 205 °C)	
H	Inert		–50 to 350 °F (–45 to 177 °C)	
G	Glycerin and Water		0 to 200 °F (–17 to 93 °C)	
N	Neobee M-20		0 to 400 °F (–17 to 205 °C)	
P	Propylene Glycol and Water		0 to 200 °F (–17 to 93 °C)	
Code	**Options**			
S1[2][3]	Assemble to one Rosemount 1199 diaphragm seal			
	LCD Display			
M1[4]	Analog Scale, Linear Meter 0-100%			
M4[4]	LCD Display, 0–100%			
M7[4][5]	LCD Display, Linear, Special Configuration			
	HARZARDOUS LOCATIONS CERTIFICATIONS			
E8	ATEX Flameproof			
I1[6]	ATEX Intrinsic Safety			
N1[6]	ATEX Type n			
I5[6]	FM Intrinsically Safe, Division 2			
K5[6]	FM Explosion-Proof, Dust Ignition-proof, Intrinsically Safe, Division 2			
C6[6]	CSA Explosion-Proof, Intrinsically Safe			
I6[6]	CSA Intrinsically Safe			
K6[6]	CSA Explosion-Proof, Dust Ignition-proof, Intrinsically Safe, Division 2			
E6	CSA Explosion-Proof, Dust Ignition-proof, Division 2			
E7	SAA Flameproof, Dust Ignition-proof			
I7[6]	SAA Intrinsic Safety			
N7[6]	SAA Type n			
C5[7]	Measurement Canada Accuracy Approval			
	OTHER OPTIONS			
W5	Copper O-ring for Vacuum Service (Nonwetted)			
C2[8]	M20 Conduit Threads			
Q4	Calibration Data Sheet			
Q8[9]	Material Traceability per EN 10204 3.1B			
Q16	Surface Finish Certification for Sanitary Remote Seals (all options)			
QZ	Remote Seal System Performance Calculation Report			

NOTE
FM explosion-proof approval is standard.

Table A-9. Rosemount 1151LT Flange Mounted Liquid Level Transmitter.

V1[10]	Reverse Output
V2	4–20 mV Test Signal
V3	20–100 mV Test Signal
F_	Select One Code from Flushing Connections Lower Housing Option. See Table A-10.

Typical Model Number: 1151LT 4 S A0 A 52 D F1

(1) Not available with Output Codes E and G.
(2) For welded capillary assemblies, order sensor module and low-side materials of construction Option Code 22 (refer to 00813-0100-4016 for more information).
(3) "Assemble-to" items are specified separately and require a completed model number.
(4) Not available with Option Codes V2, or V3.
(5) Specify the Range, Mode, and Engineering Units. Also, the 20 mA value must be greater than the 4 mA value.
(6) Not available with Output Codes E and G.
(7) Limited availability depending on transmitter type and range. Contact an Emerson Process Management representative.
(8) Not available with Output Codes L or M. Available only with aluminum housing.
(9) Available for the diaphragm, upper housing, flange, adapter, extension, and lower housing.
(10) Reverse output option is not needed with smart electronics; configured via HART-based communicator.

Table A-10. Flushing Connections Lower Housing Options

• = Applicable — = Not Applicable

Code	Flushing Connection Ring Material (Lower Housing)	Flushing Connections	Size	Diaphragm Size 2-in.	3-in.	4-in.
F1	SST	1	1/4 - 18 NPT	•	•	•
F2	SST	2	1/4 - 18 NPT	•	•	•
F3[1]	Cast C-276	1	1/4 - 18 NPT	•	•	•
F4[1]	Cast C-276	2	1/4 - 18 NPT	•	•	•
F7	SST	1	1/2 - 14 NPT	•	•	•
F8	SST	2	1/2 - 14 NPT	•	•	•
F9	Cast C-276	1	1/2 - 14 NPT	•	•	•
F0	Cast C-276	2	1/2 - 14 NPT	•	•	•

(1) Not available with high pressure side Option Codes A0, B0, and G0.

Tagging

The transmitter will be tagged, at no charge, in accordance with customer requirements. All tags are stainless steel. The standard tag is wired to the transmitter. Tag character height is 0.125 in. (0.318 cm). A permanently attached tag is available upon request.

Calibration

Transmitters are factory calibrated to customer's specified range. If calibration is not specified, the transmitters are calibrated at maximum range. Calibration is performed at ambient temperature and pressure.

1151 PARTS LIST

Item numbers are references to figure callouts (page A-29 and page A-30).

Table A-11. Rosemount 1151 DP, HP, GP, and AP Pressure Transmitters

Electronics – One spare part recommended for every 25 transmitters.			
	Part Description	**Item No.**	**Part Number**
S	**Smart Output Code**		
	Smart Retrofit Kit(1)		01151-0935-0001
	Smart Transmitter Electronics(2)	24	01151-0948-0203
	Board Spacer Kit (pkg of 12)	25	01151-0813-0001
	Terminal Eyelet Kit (pkg of 12)		01151-0814-0001
	Standoff Kit (pkg of 12)		01151-0815-0001
	Cover(2)		01151-1045-0001
	Cover O-ring (pkg of 12)		01151-0033-0003
E	**Output Code, 4–20 mA dc**		
	Amplifier Circuit Board	4	01151-0137-0007
	Calibration Circuit Board	6	01151-0139-0001
G	**Output Code, 10–50 mA dc**		
	Amplifier Circuit Board	4	01151-0597-0001
	Calibration Circuit Board	6	01151-0139-0001
L	**Output Code, 0.8–3.2 V, Low Power**		
	Amplifier Circuit Board	4	01151-0507-0001
	Calibration Circuit Board	6	01151-0509-0001
M	**Output Code, Output Code, 1-5 V, Low Power**		
	Amplifier Circuit Board	4	01151-0507-0002
	Calibration Circuit Board	6	01151-0509-0002
Sensor Modules (Silicone Fill)–One spare part recommended for every 50 transmitters.			
	Part Description	**Item No.**	**Part Number**
	Range 3 DP, GP (30 in H_2O)	19	
	316L SST		01151-0011-0032
	Alloy C-276		01151-0011-0033
	Tantalum		01151-0011-0035
	Range 4 DP, GP (150 in H_2O)	19	
	316L SST		01151-0011-0042
	Alloy C-276		01151-0011-0043
	Tantalum		01151-0011-0045
	Range 4 HP (150 in H_2O)	19	
	316L SST		01151-0112-0042
	Alloy C-276		01151-0112-0043
	Range 4 AP (11 in H_gA)	19	
	316L SST		01151-0054-0042
	Alloy C-276		01151-0054-0043

(1) Kit contains enough parts for one transmitter and includes the smart transmitter electronics, board spacers, terminal eyelets, standoffs, cover, and cover O-ring.
(2) Package contains quantity required for one transmitter.

Sensor Modules (Silicone Fill)–One spare part recommended for every 50 transmitters.		
Part Description	**Item No.**	**Part Number**
Range 5 DP, GP (750 in H_2O)	19	
316L SST		01151-0011-0052
Alloy *C-276*		01151-0011-0053
Tantalum		01151-0011-0055
Range 5 HP (750 in H_2O)	19	
316L SST		01151-0112-0052
Alloy *C-276*		01151-0112-0053
Range 5 AP (55 in H_gA)	19	
316L SST		01151-0054-0052
Alloy *C-276*		01151-0054-0053
Range 6 DP, GP (100 psi)	19	
316L SST		01151-0041-0062
Alloy *C-276*		01151-0041-0063
Tantalum		01151-0041-0065
Range 6 HP (100 psid)	19	
316L SST		01151-0112-0062
Alloy *C-276*		01151-0112-0063
Range 6 AP (100 psia)	19	
316L SST		01151-0054-0062
Alloy *C-276*		01151-0054-0063
Range 7 DP, GP (300 psi)	19	
316L SST		01151-0041-0072
Alloy *C-276*		01151-0041-0073
Tantalum		01151-0041-0075
Range 7 HP (300 psid)	19	
316L SST		01151-0112-0072
Alloy *C-276*		01151-0112-0073
Range 7 AP (300 psia)	19	
316L SST		01151-0054-0072
Alloy *C-276*		01151-0054-0073
Range 8 DP, GP (1,000 psi)	19	
316L SST		01151-0041-0082
Alloy *C-276*		01151-0041-0083
Tantalum		01151-0041-0085
Range 8 AP (1,000 psia)	19	
316L SST		01151-0054-0082
Alloy *C-276*		01151-0054-0083
Range 9 GP (3,000 psig)	19	
316L SST		01151-0112-0092
Alloy *C-276*		01151-0112-0093
Range 10 GP (6,000 psig)	19	
316L SST		01151-0112-0002
Alloy *C-276*		01151-0112-0003

Sensor Modules (Inert Fill)–One spare part recommended for every 50 transmitters.		
Part Description	**Item No.**	**Part Number**
Range 3 DP, GP (30 in H_2O)	19	
316L SST		01151-0230-0032
Alloy *C-276*		01151-0230-0033
Tantalum		01151-0230-0035
Range 4 DP, GP (150 in H_2O)	19	
316L SST		01151-0230-0042
Alloy *C-276*		01151-0230-0043
Tantalum		01151-0230-0045
Range 5 DP, GP (750 in H_2O)	19	
316L SST		01151-0230-0052
Alloy *C-276*		01151-0230-0053
Tantalum		01151-0230-0055
Range 6 DP, GP (100 psi)	19	
316L SST		01151-0230-0062
Alloy *C-276*		01151-0230-0063
Tantalum		01151-0230-0065
Range 7 DP, GP (300 psi)	19	
316L SST		01151-0230-0072
Alloy *C-276*		01151-0230-0073
Tantalum		01151-0230-0075
Range 8 DP, GP (1,000 in psi)	19	
316L SST		01151-0230-0082
Alloy *C-276*		01151-0230-0083
Tantalum		01151-0230-0085

Housings, Covers, Flanges, And Valves – One spare part recommended for every 25 transmitters.		
Part Description	**Item No.**	**Part Number**
Electronics Housing Kit[1]	7	
Aluminum		01151-0060-0007
SST		01151-0060-0023
Electronics Cover	1	
Aluminum		01151-1045-0001
SST		01151-0620-0001
Transient Protection	7	
Electronics Housing (Aluminum) for R1 Option without Terminal Block		01151-2594-0001
Electronics Housing (SST) for R1 Option without Terminal Block		01151-2594-0004
Transient Terminal Block Assembly (Optional R1)		01151-2591-0003
Transient Protection Retrofit Kit		01151-2630-0001
Process Flange	17	
Nickel-plated Carbon Steel		01151-0236-0005
316 SST		01151-0213-0002
Cast *C-276*		01151-0213-0004
Process Flange for Single Side Drain/Vent Valve		
Nickel-plated Carbon Steel		01151-0236-0015
316 SST		01151-0213-0012
Cast *C-276*		01151-0213-0014
Blank Flange	23	
Nickel-plated Carbon Steel		90043-0046-0002
Flange Adapter	21	
Nickel-plated Carbon Steel		01151-0211-0005
316 SST		01151-0211-0002
Cast *C-276*		01151-0211-0004
DP and HP Valve Stem and Seat, 316 SST[2]	14,15	01151-0028-0022
GP and AP Valve Stem and Seat, 316 SST[1]	14,15	01151-0028-0012
DP and HP Valve Stem and Seat, Alloy *C-276*[1]	14,15	01151-0028-0023
GP and AP Valve Stem and Seat, Alloy *C-276*[1]	14,15	01151-0028-0013
Plug, 316 SST (used with side drain/vent)		C50246-0002
Plug, Alloy *C-276* (used with side drain/vent)		01151-0063-0001

(1) Kit includes electronics housing and terminal block only. Order electronics cover separately.
(2) Package contains quantity required for one transmitter.

Hardware–One spare part recommended for every 50 transmitters.		
Part Description	**Item No.**	**Part Number**
Adjustment Kit		01151-0029-0001
Adjustment Screw	10	
O-ring for Adjustment Screw	11	
Retaining Ring	12	
O-ring for Adjustment Screw (pkg of 12)	11	01151-0032-0001
O-ring for Electronics Cover (pkg of 12)	2	01151-0033-0003
O-ring for Process Flange, Viton (pkg of 12)	18	01151-0034-0020
O-ring for Process Flange, Viton and Backup Ring (pkg of 4)	18	01151-0034-0014
O-ring for Process Flange, Buna-N (pkg of 12)	18	01151-0034-0002
O-ring for Process Flange, Buna-N and Backup Ring (pkg of 4)	18	01151-0034-0016
O-ring for Process Flange, Ethylene-propylene (pkg of 12)	18	01151-0034-0004
O-ring for Process Flange, Ethylene-propylene and Backup Ring (pkg of 4)	18	01151-0034-0015
O-ring for Process Flange, Aflas (pkg of 4)[1]	18	01151-0034-0019
O-ring for Process Flange, PTFE with Alloy C-276 Spring, W6 Option (pkg of 4)	18	01151-0034-0021
O-ring for Process Flange, PTFE, W7 Option (pkg of 12)	18	01151-0034-0003
O-ring for Flange Adapter, Viton (pkg of 12)	20	01151-0035-0009
O-ring for Flange Adapter, Buna-N (pkg of 12)	20	01151-0035-0002
O-ring for Flange Adapter, Ethylene-propylene (pkg of 12)	20	01151-0035-0004
O-ring for Flange Adapter, Aflas (pkg of 12)[2]	20	01151-0035-0008
O-ring for Flange Adapter, PTFE, W6 and W7 Option (pkg of 12)	20	01151-0035-0003

(1) Kit contains enough parts for two differential or four gage/absolute transmitters. Backup rings are included.
(2) Part number is for package of 12 O-rings–only two required per transmitter.

Hardware (continued)–One spare part recommended for every 50 transmitters.		
Part Description	**Item No.**	**Part Number**
Electronics Assembly Hardware(1)		01151-0030-0001
Standoff	8	
Standoff	5	
Screw	9	
Screw	3	
Locknut		
DP and HP Flange Kits, Carbon Steel(1)		01151-0031-0001
Bolt for Flange Adapter	22	(DP & HP Ranges 3–5) or
Bolt for Process Flange	13	01151-0031-0034
Nut for Process Flange	16	(DP Ranges 6–8, HP Ranges 6–7)
GP and AP Flange Kits, Carbon Steel(1)		01151-0031-0002
Bolt for Flange Adapter, Carbon Steel	22	(AP Ranges 4–5, GP Ranges 3–5)
Bolt for Process Flange, Carbon Steel	13	or
Nut for Process Flange, Carbon Steel	16	01151-0031-0035 (AP & GP Ranges 6–8) or 01151-0031-0003 (GP Range 9) or 01151-0031-0019 (GP Range 0)
DP and HP Flange Kits, 316 SST(1)		01151-0031-0023
Bolt for Flange Adapter	22	(DP & HP Ranges 3–5) or
Bolt for Process Flange	13	01151-0031-0038
Nut for Process Flange	16	(DP Ranges 6–8, HP Ranges 6–7)
GP and AP Flange Kits, 316 SST(1)		01151-0031-0024
Bolt for Flange Adapter, 316 SST	22	(AP Ranges 4–5, GP Ranges 3–5)
Bolt for Process Flange, 316 SST	13	or
Nut for Process Flange, 316 SST	16	01151-0031-0039 (AP & GP Ranges 6–8) or 01151-0031-0025 (GP Range 9) or 01151-0031-0026 (GP Range 0)
DP and HP Flange Kits, ANSI 193-B7(1)		01151-0031-0012
Bolt for Flange Adapter	22	(DP & HP Ranges 3–5) or
Bolt for Process Flange	13	01151-0031-0036
Nut for Process Flange	16	(DP Ranges 6–8, HP Ranges 6–7)
GP and AP Flange Kits, ANSI 193-B7(1)		01151-0031-0013
Bolt for Flange Adapter, ANSI 193-B7	22	(AP Ranges 4–5, GP Ranges 3–5)
Bolt for Process Flange, ANSI 193-B7	13	or
Nut for Process Flange, ANSI 193-B7	16	01151-0031-0037 (AP & GP Ranges 6–8) or 01151-0031-0014 (GP Range 9) or 01151-0031-0022 (GP Range 0)

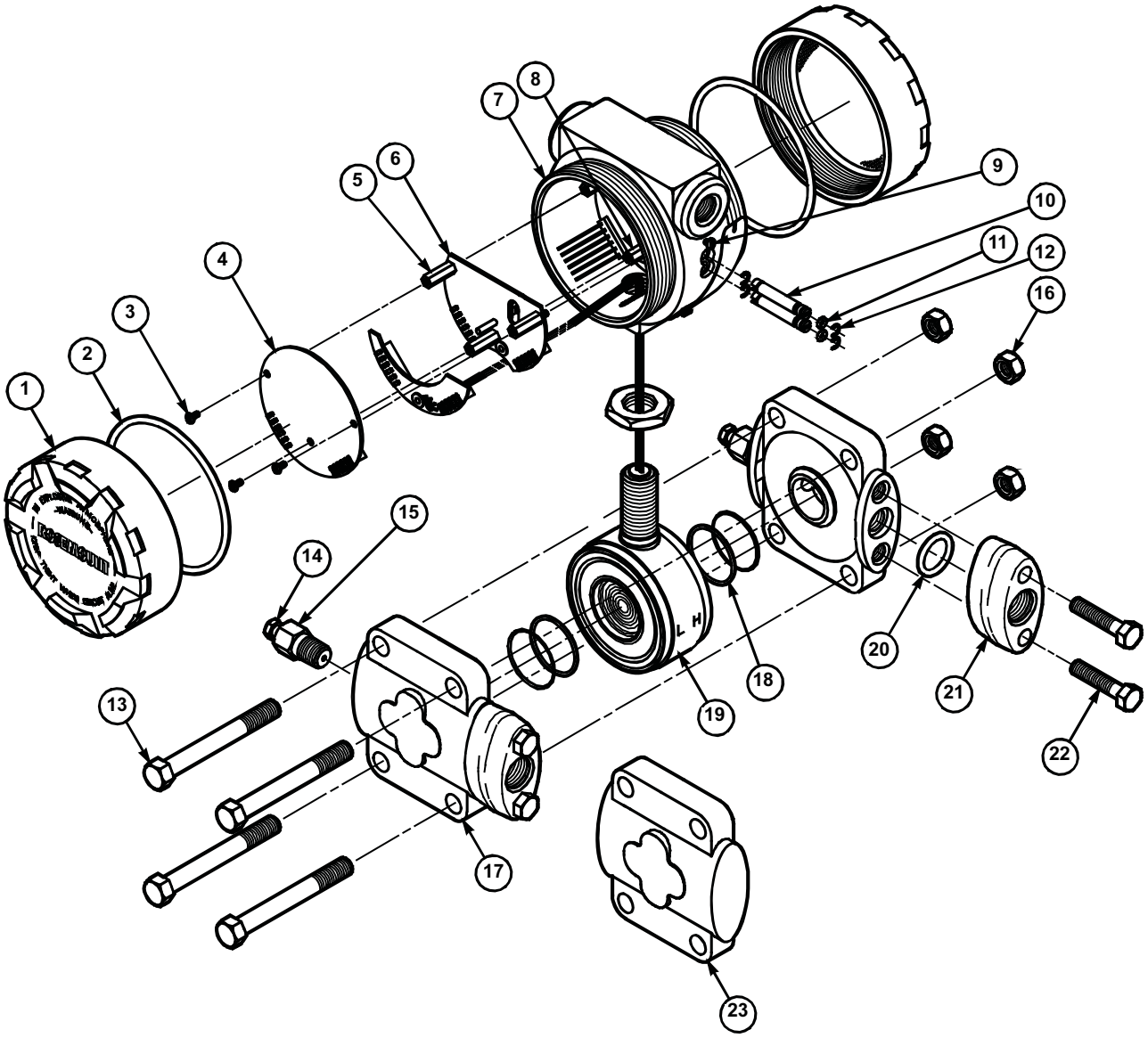
(1) Package contains quantity required for one transmitter.

Indicating Displays (Select approved meter kits for use in intrinsically safe and /or Type N installations)		
Part Description	**Item No.**	**Part Number**
Display Kits (includes LCD display, hardware, and housing cover assembly)		
Analog Display Kit, 4–20 mA dc, Linear Scale	NA	01151-1046-0007
Analog Display Kit, 4–20 mA dc, Square Root, 0-100% Flow		01151-1046-0009
Analog Display Kit, 10–50 mA dc, Linear Scale		01151-1046-0011
Analog Display Kit, 10–50 mA dc, Square Root, 0–100% Flow		01151-1046-0013
Approved Analog Display Kit, 4–20 mA dc, Linear Scale		01151-2615-0007
Approved Analog Display Kit, 4–20 mA dc, Square Root, 0-100% Flow		01151-2615-0009
Approved Analog Display Kit, 10–50 mA dc, Linear Scale		01151-2615-0011
Approved Analog Display Kit, 10–50 mA dc, Square Root, 0–100% Flow		01151-2615-0013
LCD Display Kit, Linear, 0–100%		01151-1046-0019
LCD Display Kit, Square Root, 0–100% Flow		01151-1046-0021
Displays Only		
Analog Display, 4–20 mA dc, Linear Scale		01151-0687-0004
Analog Display, 4–20 mA dc, Square Root, 0–100% Flow		01151-0687-0005
Analog Display, 4–20 mA dc, Square Root, 0–10 $\sqrt{}$		01151-0687-0008
Analog Display, 10–50 mA dc, Linear Scale		01151-0687-0006
Analog Display, 10–50 mA dc, Square Root, 0–100% Flow		01151-0687-0007
Analog Display, 10–50 mA dc, Square Root, 0–10 $\sqrt{}$		01151-0687-0009
Approved Analog Display, 4–20 mA dc, Linear Scale		01151-2614-0004
Approved Analog Display, 4–20 mA dc, Square Root, 0–100% Flow		01151-2614-0005
Approved Analog Display, 4–20 mA dc, Square Root, 0–10 $\sqrt{}$		01151-2614-0008
Approved Analog Display, 10–50 mA dc, Linear Scale		01151-2614-0006
Approved Analog Display, 10–50 mA dc, Square Root, 0–100% Flow		01151-2614-0007
Approved Analog Display, 10–50 mA dc, Square Root, 0–10 $\sqrt{}$		01151-2614-0009
LCD Display, Linear, 0–100%		01151-1300-1000
LCD Display, Square Root, 0–100% Flow		01151-1300-1001
LCD Display, Special Configuration(1)		See note (1) below
Display Hardware		
LCD Display Engineering Unit Labels		01151-1419-0001
Mounting Hardware and Cover Assembly Kit		01151-1046-0005
Mounting Hardware Kit		01151-1046-0006
Housing Cover Assembly Kit		01151-1047-0001
O-ring for Cover (pkg of 12)		01151-0033-0003

Mounting Brackets		
Part Description	**Item No.**	**Part Number**
B1—Right-angle Bracket for 2-in. Pipe Mounting	NA	01151-0036-0001
B2—Right-angle Bracket for Panel Mounting		01151-0036-0004
B3—Flat Bracket for 2-in. Pipe Mounting		01151-0036-0005
B4—Bracket for 2-in. Pipe with Series 316 SST Bolts		01151-0036-0003
B5—Bracket for Panel with Series 316 SST Bolts		01151-0036-0006
B6—Flat Bracket for 2-in. Pipe with Series 316 SST Bolts		01151-0036-0007
B7—316 SST B1 Bracket with 316 SST Bolts		01151-0036-0021
B9—316 SST B3 Bracket with 316 SST Bolts		01151-0036-0022

(1) To order a display with a special configuration, order the appropriate display and indicate configuration required. Since this is not a kit, order the mounting hardware and housing cover assembly separately.

Figure A-2. Rosemount 1151 Analog Pressure Transmitter Exploded View.



1151LT PARTS LIST Item numbers are references to figure callouts (page A-33 and page A-34).

Figure A-3. Rosemount 1151 Smart Pressure Transmitter Exploded View.

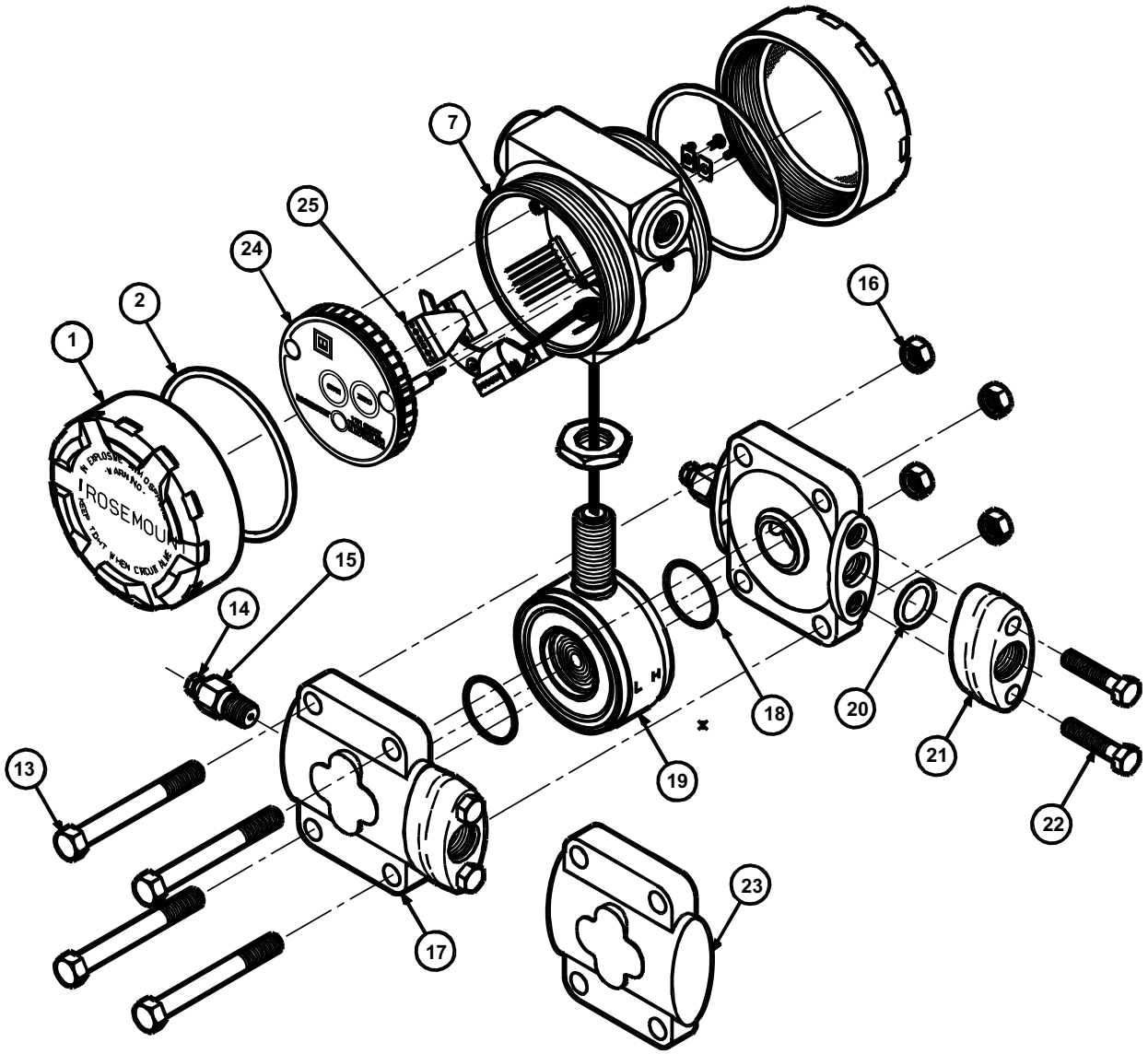


Table A-12. Rosemount 1151LT Flange-Mounted Liquid Level Pressure Transmitter.

Part Description	Item No.	Part Number	Spares Category[1]
Diaphragm and Sensor Module Assembly	13	See Note Below	B
Flange Adapter			
316 SST	21	01151-0211-0002	
Cast C-276		01151-0211-0004	
Valve Stem and Seat, 316 SST	18, 19	01151-0028-0012	
Plug, 316 SST (used with side drain/vent)		C50246-0002	A
Valve Stem and Seat, Alloy C-276	18, 19	01151-0028-0013	
Plug, Alloy C-276 (used with side drain/vent)		C50246-0202	A
Bolt for Flange Adaptor			
316 SST	20	01151-0031-0024	
ANSI 193-B7	20	01151-0031-0013	
O-ring for Flange Adapter			
Viton (pkg of 12)	22	01151-0035-0009	
Buna-N (pkg of 12)	22	01151-0035-0002	
Aflas (pkg of 12)	22	01151-0035-0008	
Ethylene-Prop. (pkg of 12)	22	01151-0035-0004	
PTFE (pkg of 12)	22	01151-0035-0003	
SMART OUTPUT CODE – See next page for details	—	01151-0935-0001	B
Electronics Housing (Aluminum)	7	01151-0060-0007	
Electronics Cover (Aluminum)	1	01151-1045-0001	
Adjustment Screw, Retaining Ring, and O-ring for Adjustment Screw Kit	10, 11, 12	01151-0029-0001	
O-ring for Electronics Cover [1]	2	01151-0033-0003	
Electronics Assembly Hardware			
Standoff			
Standoff	8	01151-0030-0001	
Screw	5		
Screw	9		
Locknut	3		
Output Code, 4-20 mA dc			E
Amplifier Circuit Board	4	01151-0137-0007	
Calibration Circuit Board	6	01151-0139-0001	
Output Code, 10-50 mA dc			G
Amplifier Circuit Board	4	01151-0597-0001	
Calibration Circuit Board	6	01151-0139-0001	

(1) Rosemount recommends one spare part for every 25 transmitters in Category A, and one spare part for every 50 transmitters in Category B.

NOTE
The Diaphragm and Sensor Module Assembly is an oil filled system and must be serviced using the proper equipment. Contact your nearest Emerson Process Management service facility should it become necessary to replace or service this assembly.

S Output Code (Smart) Part/Kit Description	Item No.	Part Number
Smart Retrofit Kit(1)		01151-0935-0001
Smart Transmitter Electronics(2)	24	01151-0948-0203
Board Spacer Kit (pkg of 12)	25	01151-0813-0001
Terminal Eyelet Kit (pkg of 12)		01151-0814-0001
Standoff Kit (pkg of 12)		01151-0815-0001
Cover(2)		01151-1045-0001
Cover O-ring (pkg of 12)		01151-0033-0003
Indicating Displays Part Description		**Part Number**
Display Kits (includes LCD display, hardware, and housing cover assembly)		
Analog Display Kit, 4–20 mA dc, Linear Scale		01151-1046-0007
Analog Display Kit, 10–50 mA dc, Linear Scale		01151-1046-0011
Approved Analog Display Kit, 4–20 mA dc, Linear Scale		01151-2615-0007
Approved Analog Display Kit, 10–50 mA dc, Linear Scale		01151-2615-0011
LCD Display Kit, Linear, 0–100%		01151-1046-0019
Displays Only		
Analog Display, 4–20 mA dc, Linear Scale		01151-0687-0004
Analog Display, 10–50 mA dc, Linear Scale		01151-0687-0006
Approved Analog Display, 4–20 mA dc, Linear Scale		01151-2614-0004
Approved Analog Display, 10–50 mA dc, Linear Scale		01151-2614-0006
LCD Display, Linear, 0–100%		01151-1300-1000
LCD Display, Special Configuration(3)		See note (3) below
Display Hardware		
LCD Display Engineering Unit Labels		01151-1419-0001
Mounting Hardware and Cover Assembly Kit		01151-1046-0005
Mounting Hardware Kit		01151-1046-0006
Housing Cover Assembly Kit		01151-1047-0001
O-ring for Cover (pkg of 12)		01151-0033-0003

(1) Kit contains enough parts for one transmitter and includes the smart transmitter electronics, board spacers, terminal eyelets, standoffs, cover, and cover O-rings.
(2) Kit contains enough parts for one transmitter.
(3) To order a display with a special configuration, order the appropriate display and indicate configuration required. Since this is not a kit, order the mounting hardware and housing cover assembly separately.

Figure A-4. Rosemount 1151LT Smart Pressure Transmitter Exploded View.

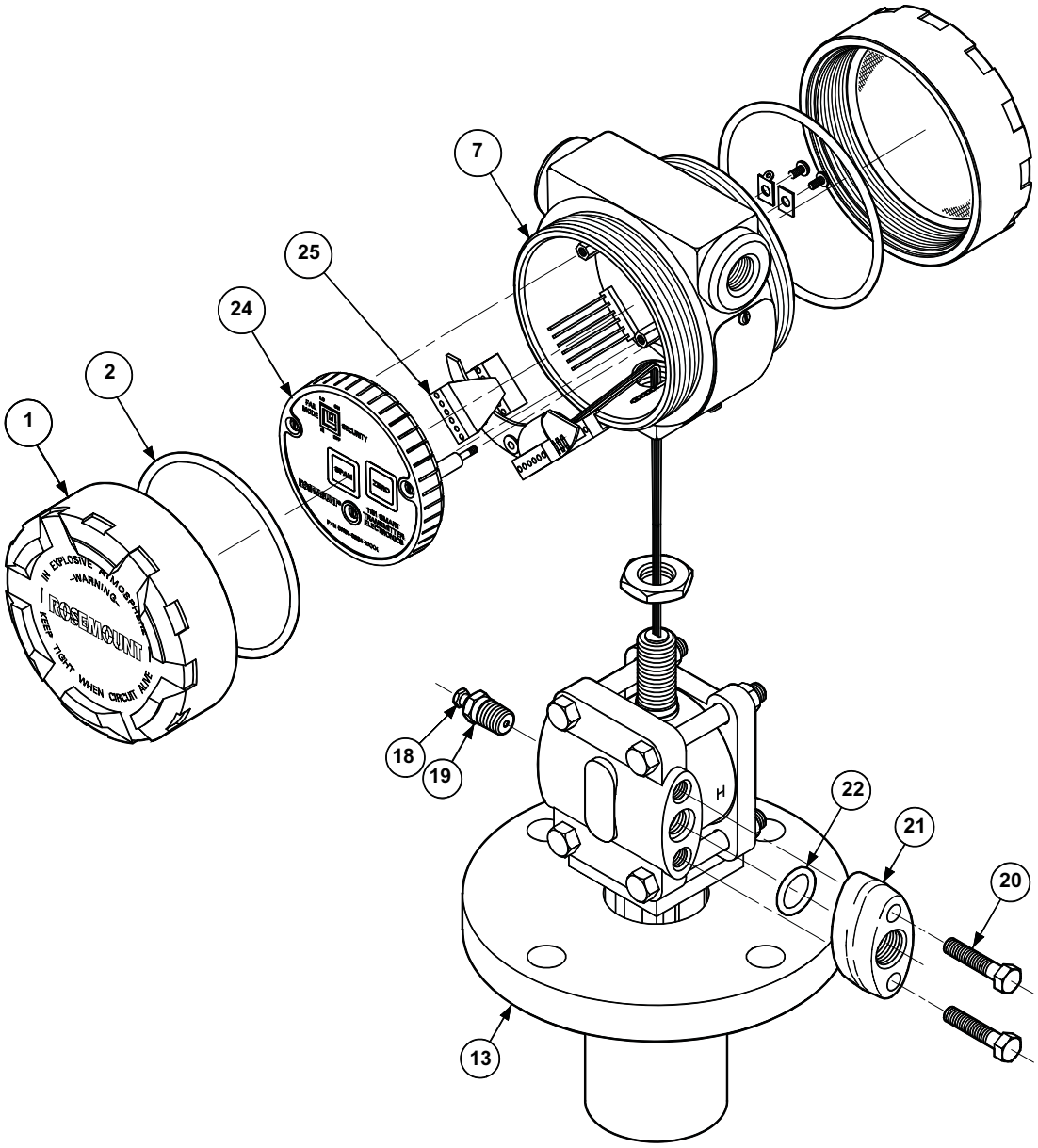
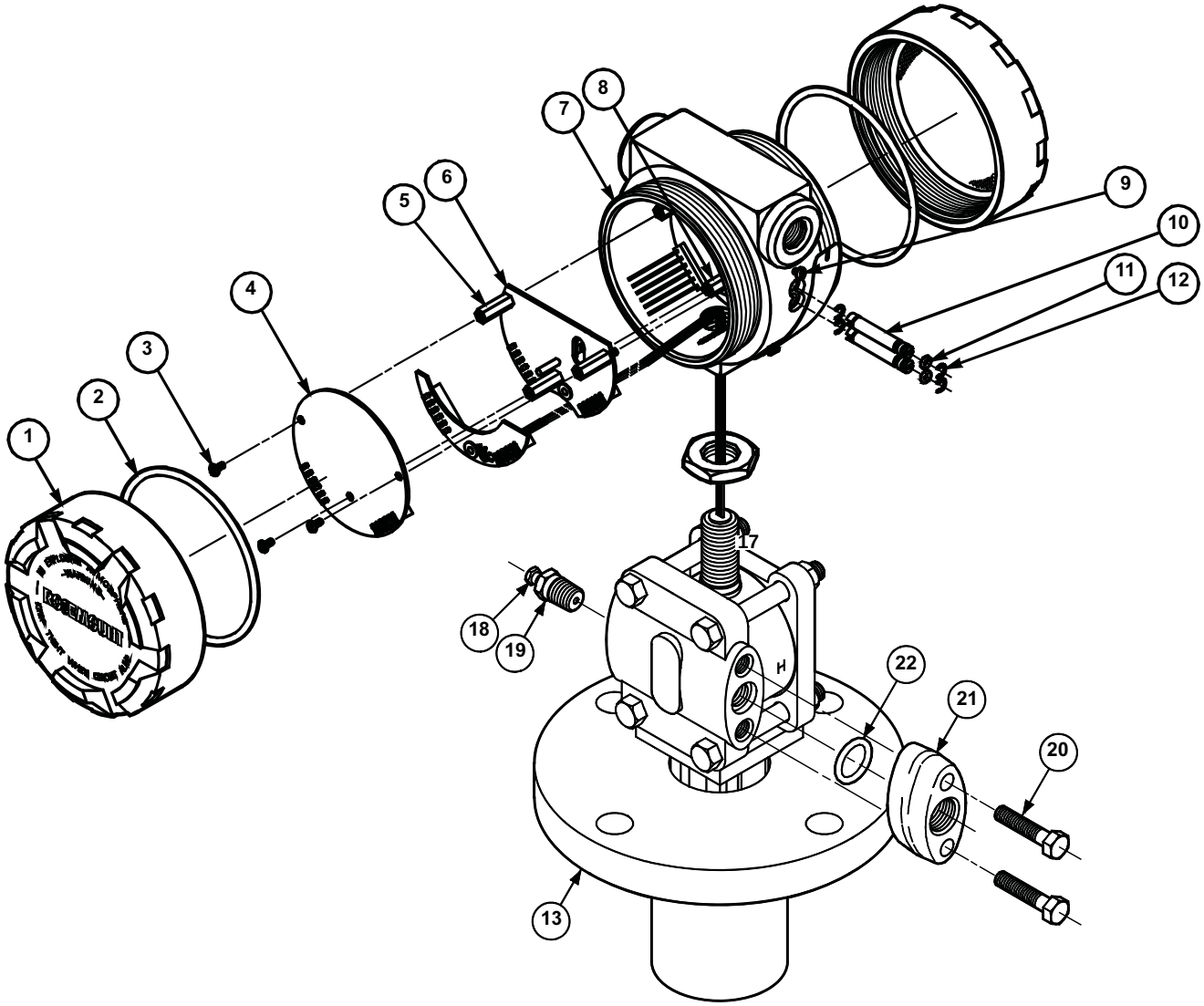


Figure A-5. Rosemount 1151LT Analog Pressure Transmitter Exploded View.



DISPLAY SPECIFICATIONS

Analog

- Meters have 2-in. (50.8 mm) scale
- Plug-in mounting configuration
- Indication accuracy ±2%
- Operating temperature limit: –40 to 150 °F (–40 to 65 °C)
- Meters are enclosed in a housing certified by Factory Mutual as Explosion-Proof for Class I, Division 1, Groups B, C, and D; Class II, Division 1, Groups E, F, and G and Class III, Division 1
- For optional CSA explosion-proof approval, see certification Option Code E6
- M1 Linear Analog Meter, 0–100% Scale
- M2 Square Root Analog Meter, 0–100% Flow Scale
- M6 Square Root Analog Meter, 0– 10√ Scale

LCD

- 4-digit display
- Indication accuracy ±0.25% of calibrated span ±1 digit
- Display resolution at ±0.5% of calibrated span ±1 digit
- Operating temperature limit: –4 to 158 °F (–20 to 70 °C)
- Plug-in mounting configuration
- Meters are enclosed in a housing certified by FM as Explosion-Proof for Class I, Division 1, Groups B, C, and D; Class II, Division 1, Groups E, F, and G and Class III, Division 1
- For Optional CSA explosion-proof approval, see certification Option Code E6
- M4 Linear LCD Meter, 0 to 100%
- M7 Special Scale LCD Meter
  - Specify:
    - Range (20 mA value must be greater than 4 mA value)
    - Mode
    - Engineering Units
- M8 Square Root LCD Meter, 0 to 100% Flow
- M9 Square Root LCD Meter, 0–10√ Scale

NOTES
Meter Options are not available with Output Codes L or M, or Option Codes V2 or V3. Meter Options M4, M7, M8, and M9 are not available with Output Code G.

Appendix B Product Certifications

Approved Manufacturing Locations . . . . . page B-1
European Directive Information . . . . . page B-1
Hazardous Locations Certifications . . . . . page B-2
Approval Drawings . . . . . page B-4

APPROVED MANUFACTURING LOCATIONS

Rosemount Inc. — Chanhassen, Minnesota, USA
Emerson Process Management GmbH & Co. — Wessling, Germany
Emerson Process Management Asia Pacific
Private Limited — Singapore
Beijing Rosemount Far East Instrument Co., Limited – Beijing, China

EUROPEAN DIRECTIVE INFORMATION

The EC declaration of conformity for all applicable European directives for this product can be found on the Rosemount website at www.rosemount.com. A hard copy may be obtained by contacting our local sales office.

ATEX Directive (94/9/EC)

Emerson Process Management complies with the ATEX Directive.

European Pressure Equipment Directive (PED) (2004/108/EC)

1151GP9, 0; 1151HP4, 5, 6, 7, Pressure Transmitters

— QS Certificate of Assessment - EC No. PED-H-100
Module H Conformity Assessment

All other 1151 Pressure Transmitters

— Sound Engineering Practice

Transmitter Attachments: Diaphragm Seal - Process Flange - Manifold

— Sound Engineering Practice

Electro Magnetic Compatibility (EMC) (2004/108/EC)

All models

— EN 61326-1: 1997 with Amendments A1, A2, and A3;

HAZARDOUS LOCATIONS CERTIFICATIONS

North American Certifications

Ordinary Location Certification for Factory Mutual

As standard, the transmitter has been examined and tested to determine that the design meets basic electrical, mechanical, and fire protection requirements by FM, a nationally recognized testing laboratory (NRTL) as accredited by the Federal Occupational Safety and Health Administration (OSHA).

Factory Mutual (FM) Approvals

FM Explosion-Proof tag is standard. Appropriate tag will be substituted if optional certification is selected.

Explosion-Proof: Class I, Division 1, Groups B, C, and D. Dust-Ignition Proof: Class II, Division 1, Groups E, F, and G; Class III, Division 1. Indoor and outdoor use. NEMA 4X. Factory Sealed.

I5 Intrinsically safe for Class I, II, and III Division 1, Groups A, B, C, D, E, F, and G hazardous locations in accordance with entity requirements and Control drawing 01151-0214 and 00268-0031. Non- incendive for Class I, Division 2, Groups A, B, C and D hazardous locations.

For entity parameters see control drawing 01151-0214.

Canadian Standards Association (CSA) Approvals

E6 Explosion-Proof for Class I, Division 1, Groups C and D; Class II, Division 1, Groups E, F, and G; Class III, Division 1 Hazardous Locations. Suitable for Class I, Division 2, Groups A, B, C, and D; CSA enclosure type 4X. Factory Sealed.

I6 Intrinsically safe for Class I, Division 1, Groups A, B, C, and D hazardous locations when connected per Drawing 01151-2575. For entity parameters see control drawing 01151-2575. Temperature Code T2D.

European Certifications

I1 ATEX Intrinsically Safe and Combustible Dust
(1151 Smart only)
Certificate No.: BAS99ATEX1294X
ATEX Marking ⟨Ex⟩ II 1 GD
EEx ia IIC T5 (-60°C ≤ Ta ≤ 40°C)
EEx ia IIC T4 (-60°C ≤ Ta ≤ 80°C)
CE 1180
IP66

Table B-1. IS Entity Parameters

Ui = 30 V
Ii = 125 mA
Pi = 1.0 W (T4) or 0.67 W (T5)
Ci = 0.034 μF
Li = 20 μH

Special Conditions for Safe Use (x):

The apparatus, is not capable of withstanding the 500V test as required by EN 50020: 1994. This must be taken into account when installing the apparatus.

N1 ATEX Type n and Combustible Dust
(1151 Smart only)
Certificate No.: BAS 99ATEX3293X
ATEX marking: ⟨Ex⟩ II 3 GD
EEx nL IIC T5 (-40°C ≤ Ta ≤ 40°C)
EEx nL IIC T4 (-40°C ≤ Ta ≤ 80°C)
Dust Rating: T90 °C (Ta = -20°C to 40°C)
U_i = 45 Vdc Max
CE
IP66

Special Conditions for Safe Use (x):
The apparatus is not capable of withstanding the 500V insulation test required by EN 50021: 1999. This must be taken into account when installing the apparatus.

E8 ATEX Flame-Proof
Certification Number CESI03ATEX037
ATEX Marking ⟨Ex⟩ II 1/2 G
EEx d IIC T6 (–40 ≤ Ta ≤ 40 °C)
EEx d IIC T4 (–40 ≤ Ta ≤ 80 °C)
CE 1180
V = 60 Vdc maximum

Australian Certifications

Standards Association of Australia (SAA) Certification

E7 SAA Flame-proof
Certificate Number Ex 494X
Ex d IIB + H_2 T6
DIP T6
IP65

Special Conditions for safe use (x):
For transmitters having NPT, PG or G cable entry threads, an appropriate flame-proof thread adaptor shall be used to facilitate application of certified flame-proof cable glands or conduit system.

I7 SAA Intrinsically Safe
Certificate Number: Ex 122X
Ex ia IIB T5 (T_{amb} = 40 °C)
Ex ia IIB T4 (T_{amb} = 80 °C)

Special Conditions for Safe Use (x):
The equipment has been assessed to the entity concept and accordingly the following electrical parameters must be taken into account during installation.

Table B-2. Entity Parameters

U_i = 30V
I_i = 125 mA
P_i = 1.0 W (T4) or 0.67W (T5)
C_i = 14.8 nF
L_i = 20 μH

N7 SAA Type n
Certificate Number: Ex 887X
Ex n IIC T6 (T_{amb} = 40 °C)
Ex n IIC T5 (T_{amb} = 80 °C)
IP66

Special Conditions for safe use (x):
The equipment must be connected to a supply voltage which does not exceed the rated voltage. The enclosure end caps must be correctly fitted whilst the equipment is energized.

Combination Certifications

Stainless steel certification tag is provided when optional approval is specified. Once a device labeled with multiple approval types is installed, it should not be reinstalled using any other approval types. Permanently mark the approval label to distinguish it from unused approval types.

C6 Combination of I6 and E6,

K5 Combination of FM Approvals Explosion-Proof and I5.

K6 Combination of E6, I6, I1, and E8

APPROVAL DRAWINGS

Index of intrinsically safe barrier systems and entity parameters for Rosemount 1151 transmitters and Rosemount 751 Field Indicators (Drawing Number 01151-0214, Rev. V), pages
B-5 through B-10.

Index of intrinsically safe C.S.A. barrier systems for Rosemount 1151 transmitters (Drawing Number 01151-2575, Rev. C), pages
B-11 through B-13.

Index of intrinsically safe barrier systems and entity parameters for the HART Communicator SMART FAMILY Interface (Drawing Number 00268-0031, Rev M), pages B-14 through B-20.

Index of intrinsically safe barrier systems and entity parameters for the HART Communicator (Drawing Number 00275-0081, Rev B), pages B-21 through B-26.

Index of intrinsically safe C.S.A. barrier systems for the HART Communicator (Drawing Number 00275-0082, Rev A), page B-27.

Index of intrinsically safe barrier systems and entity parameters for the HART Communicator (Drawing Number 00375-1130, Rev B), page B-27 through page B-31.

Figure B-1.

REVISIONS					
LTR	DESCRIPTION	ECO NO	REV BY	APPR	DATE
P	Change entity parameters (Fm on re-exam) correct 444 CI	637376	[illegible]	[illegible]	9/28/90
R	Add 1151 Low Power Barrier System, Model 751 LI to 0	638105		MCR	4/27/90
T	1135, 1144, 1151 Li TO Ø	639039	SVC	MCR	1/23/91
U	1151 Li TO 20; Ci .01 AND .034	651426	SVC	[illegible]	12/11/92
V	751 Li TO Ø	662242		[illegible]	11/17/94

CONTENTS	
ENTITY APPROVALS	SHEETS 2 THRU 4
APPROVED PARAMETERS	SHEETS 2 THRU 3
CONNECTION DIAGRAMS	SHEET 4

MASTER

APPROVED SOURCES OF SUPPLY	
MFG	MFG PART NO

Material purchased to this Rosemount Specification Control Drawing shall be required to meet all the specifications of this drawing. Any mention of manufacturer's part number within this drawing is for reference only. This is necessary to ensure design control of Rosemount's end product. It is Rosemount's intent to purchase your standard material whenever possible.

SPECIFICATION CONTROL DRAWING

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES.

TOLERANCES:

DECIMALS: .X ± .1, .XX ± .02, .XXX ± .010
FRACTIONS: ±1/32
ANGLES: ±2°

PREPARED BY: Nancy Nix	DATE 9/28/90	
CHECKED BY: MCR		
APPROVED BY Q.C.		
APPROVED BY ENG. MC Kamut	4/27/90	
APPROVED BY PURCH.		
FINAL APPROVAL ES		

ROSEMOUNT® Measurement Control Analytical Valves

TITLE
INDEX OF INTRINSICALLY SAFE BARRIER SYSTEMS & ENTITY PARAMETERS FOR 444, 1135, 1144, 1151, & 2051TRANSMITTERS AND 751 FIELD INDICATORS

SIZE	CODE IDENT NO	DRAWING NO
A	04274	01151-0214

SCALE None | U/M: Each | SHEET 1 OF 2

ENTITY CONCEPT APPROVALS

The entity concept allows interconnection of intrinsically safe apparatus to associated apparatus not specifically examined in combination as a system. The approved values of maximum open circuit voltage (V_{OC} or V_T) and maximum short circuit current (I_{SC} or I_T) for the associated apparatus must be less than or equal to the maximum safe input voltage (V_{MAX}) and input current (I_{MAX}) of the intrinsically safe apparatus. In addition, the approved maximum allowable connected capacitance (C_A) and inductance (L_A) of the associated apparatus must be greater than the maximum unprotected internal capacitance (C_I) and inductance (L_I) of the intrinsically safe apparatus. The approved entity concept parameters are as follows:

Model 444

Class I, Div. 1, Groups A and B

V_{MAX} = 40V	V_{OC} or V_T is less than or equal to 40V
I_{MAX} = 165 mA	I_{SC} or I_T is less than or equal to 165 mA
C_I = 0.044μF	C_A is greater than 0.044μF
L_I = 0	L_A is greater than 0

Class I, Div. 1, Groups C and D

V_{MAX} = 40V	V_{OC} or V_T is less than or equal to 40V
I_{MAX} = 225 mA	I_{SC} or I_T is less than or equal to 225 mA
C_I = 0.044μF	C_A is greater than 0.044μF
L_I = 0	L_A is greater than 0

Model 751

Class I, Div. 1, Groups A and B

V_{MAX} = 40V	V_{OC} or V_T is less than or equal to 40V
I_{MAX} = 165 mA	I_{SC} or I_T is less than or equal to 165 mA
C_I = 0	C_A is greater than 0
L_I = 0	L_A is greater than 0

Class I, Div. 1, Groups C and D

V_{MAX} = 40V	V_{OC} or V_T is less than or equal to 40V
I_{MAX} = 225 mA	I_{SC} or I_T is less than or equal to 225 mA
C_I = 0	C_A is greater than 0
L_I = 0	L_A is greater than 0



Rosemount Inc. MINNEAPOLIS, MINNESOTA		SIZE A	FSCM. NO.	DRAWING NO. 01151-0214
DR.				
ISSUE		SCALE: NONE	WT.	SHEET 2 OF 6

MASTER

Model and 1151

Class I, Div. 1, Groups A and B

V_{MAX} = 40V	V_{OC} or V_T is less than or equal to 40V
I_{MAX} = 165 mA	I_{SC} or I_T is less than or equal to 165 mA
C_I(1151 Std) = 0	C_A is greater than 0
C_I(Smart 1151) = 0.024μF	C_A is greater than 0.024μF
C_I(1151 Std w/R Option) = 0.010μF	C_A is greater than 0.010μF
C_I(1151 Smart w/R_Option) = 0.034μF	C_A is greater than 0.034μF
L_I(1151 Std) = 0	L_A is greater than 0
L_I(1151 w/R_ Option) = 20μH	L_A is greater than 20 μH

Class I, Div. 1, Groups C and D

V_{MAX} = 40V	V_{OC} or V_T is less than or equal to 40V
I_{MAX} = 225 mA	I_{SC} or I_T is less than or equal to 225 mA
C_I(1151 Std) = 0	C_A is greater than 0
C_I(Smart 1151) = 0.024μF	C_A is greater than 0.024μF
C_I(1151 Std w/R Option) = 0.010μF	C_A is greater than 0.010μF
C_I(1151 Smart w/R_Option) = 0.034μF	C_A is greater than 0.034μF
L_I(1151 Std) = 0	L_A is greater than 0
L_I(1151 w/R_ Option) = 20μH	L_A is greater than 20 μH

Model 2051

Class I, Div. 1, Groups A and B

V_{MAX} = 40V	V_{OC} or V_T is less than or equal to 40V
I_{MAX} = 165 mA	I_{SC} or I_T is less than or equal to 165 mA
C_I = 0.012μF	C_A is greater than 0.012lF
L_I = 480μH	L_A is greater than 480lH

Class I, Div. 1, Groups C and D

V_{MAX} = 40V	V_{OC} or V_T is less than or equal to 40V
I_{MAX} = 225 mA	I_{SC} or I_T is less than or equal to 225 mA
C_I = 0.012μF	C_A is greater than 0.012lF
L_I = 480μH	L_A is greater than 480lH

Rosemount Inc. MINNEAPOLIS, MINNESOTA				
DR.		SIZE A	FSCM. NO.	DRAWING NO. 01151-0214
ISSUE		SCALE: NONE	WT.	SHEET 3 OF 6

Model 1135

Class I, Div. 1, Groups A and B

V_{MAX} = 40V	V_{OC} or V_T is less than or equal to 40V
I_{MAX} = 165 mA	I_{SC} or I_T is less than or equal to 165 mA
C_I = 0.008&μF	C_A is greater than 0.008lF
L_I = 0	L_A is greater than 0

Class I, Div. 1, Groups C and D

V_{MAX} = 40V	V_{OC} or V_T is less than or equal to 40V
I_{MAX} = 225 mA	I_{SC} or I_T is less than or equal to 225 mA
C_I = 0.008&μF	C_A is greater than 0.008lF
L_I = 0	L_A is greater than 0

Model 1144

Class I, Div. 1, Groups A and B

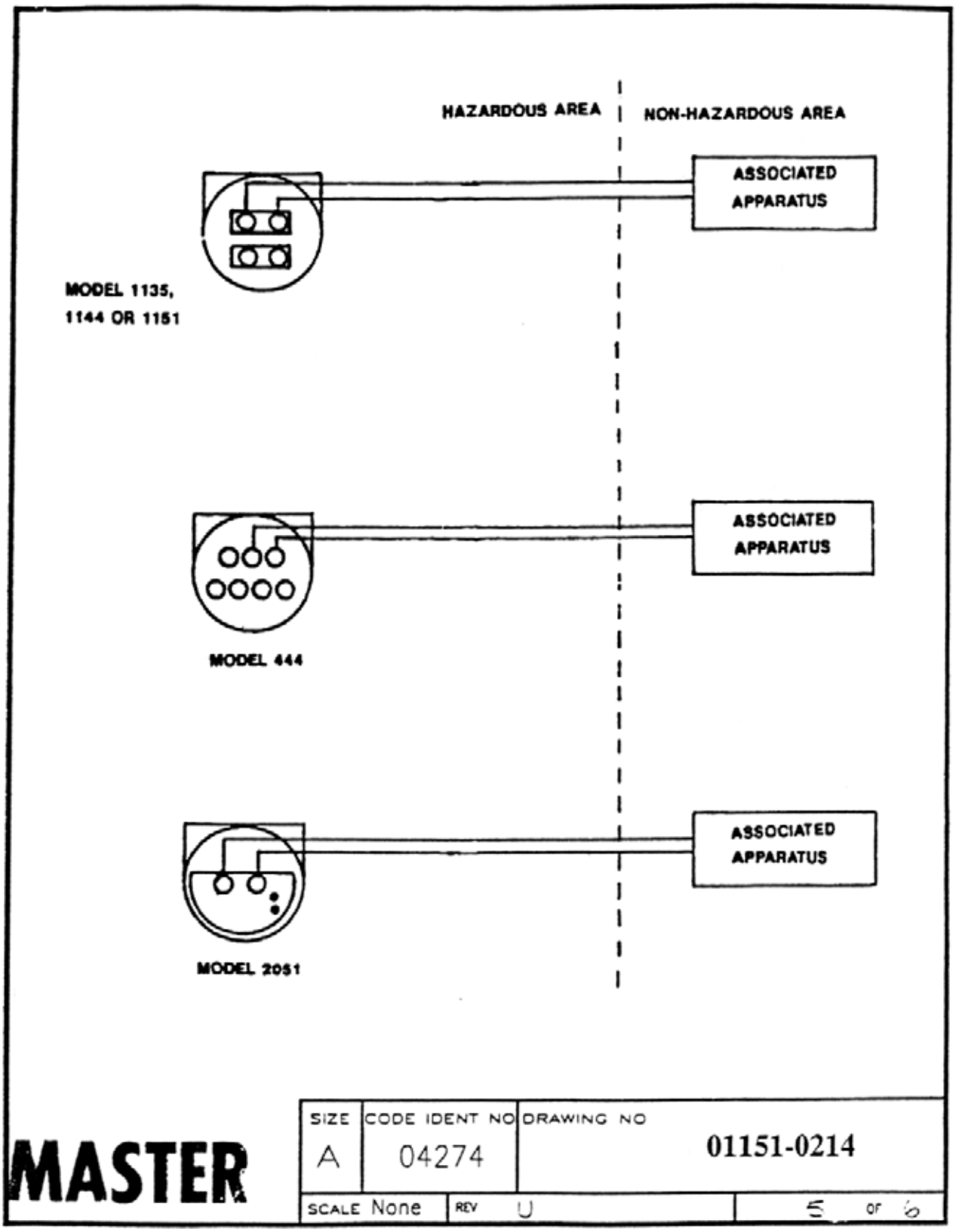
V_{MAX} = 40V	V_{OC} or V_T is less than or equal to 40V
I_{MAX} = 165 mA	I_{SC} or I_T is less than or equal to 165 mA
C_I = 0	C_A is greater than 0
L_I = 0	L_A is greater than 0

Class I, Div. 1, Groups C and D

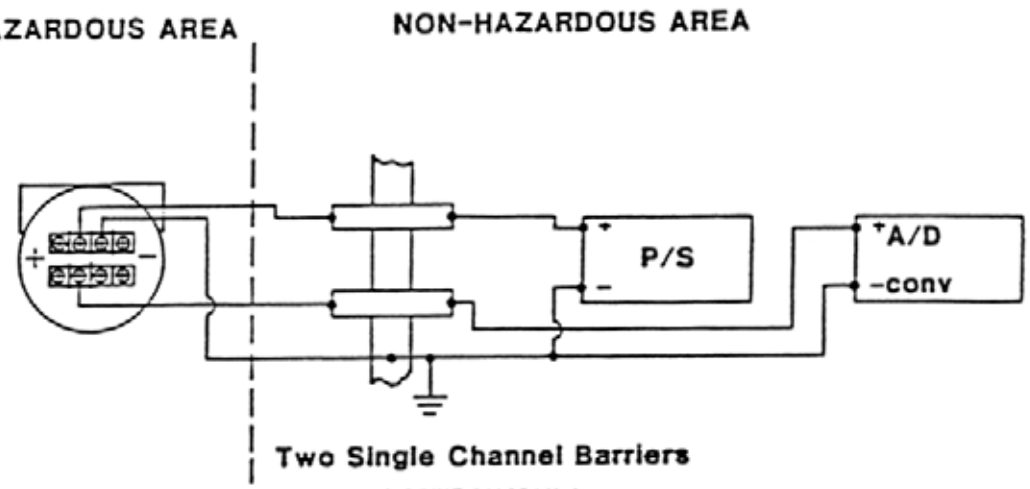
V_{MAX} = 40V	V_{OC} or V_T is less than or equal to 40V
I_{MAX} = 225 mA	I_{SC} or I_T is less than or equal to 225 mA
C_I = 0	C_A is greater than 0
L_I = 0	L_A is greater than 0

MASTER

Rosemount Inc. MINNEAPOLIS, MINNESOTA				
DR.		SIZE A	FSCM. NO.	DRAWING NO. 01151-0214
ISSUE		SCALE: NONE	WT.	SHEET 4 OF 6


HAZARDOUS AREA
NON-HAZARDOUS AREA
ASSOCIATED APPARATUS
MODEL 1135, 1144 OR 1151
ASSOCIATED APPARATUS
MODEL 444
ASSOCIATED APPARATUS
MODEL 2051
MASTER
SIZE
A
CODE IDENT NO
04274
DRAWING NO
01151-0214
SCALE None
REV
U
5 of 6

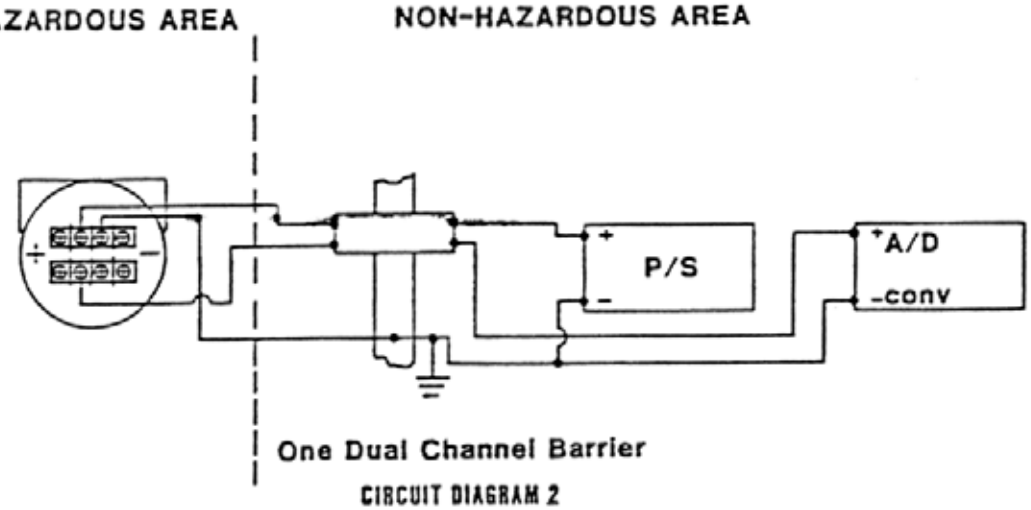
1151 --- L & M CIRCUIT CONNECTION WITH INTRINSIC SAFETY BARRIERS



Two Single Channel Barriers

CIRCUIT DIAGRAM 1

(ONLY FOR USE WITH BARRIERS APPROVED IN THIS CONFIGURATION)



One Dual Channel Barrier

CIRCUIT DIAGRAM 2

MASTER

SIZE	CODE IDENT NO	DRAWING NO
A	04274	01151-0214
SCALE NONE	REV U	c OF 6

Figure B-2.

PROPRIETARY INFORMATION IS CONTAINED HEREIN AND MUST BE HANDLED ACCORDINGLY
BY _____ DATE _____

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
A	NEW RELEASE	646666	W.C.R.	04/01/92
B	150 ohms was 120 ohms	650816	J.J.B.	11/13/92
C	150 ohms was 120 ohms (SHT 3)	652195	J.J.B.	1/29/93

CSA INTRINSICALLY SAFE APPROVAL

Exia
Intrinsically Safe /Securite Intrinseque

THE ROSEMOUNT MODEL 1151 PRESSURE TRANSMITTER IS APPROVED BY CSA AS INTRINSICALLY SAFE FOR THE CLASS I, DIVISION 1 GROUPS AS INDICATED WHEN USED WITH THE BARRIERS AND CONVERTERS LISTED BELOW AND CONNECTED AS SHOWN IN THE ACCOMPANYING DIAGRAMS.

DEVICE	PARAMETERS	APPROVED FOR CLASS I, DIV. 1
CSA Approved Safety Barrier	30 V or less 330 ohms or more 28 V or less 300 ohms or more 22 V or less 180 ohms or more	Groups A, B, C, D
Foxboro Converter 2AS-I3I-CGB, 3AD-I3IA CS-E /CGB-A, 2AI-I3V-CGB, 3A2-I3D CS-E /CGB-A, 2AI-12V-CGB, 3A2-I2D CS-E /CGB-A, 2AS-I2I-CGB, 3A4-I2DA CS-E /CGB-A, 3F4-I2DA1 CS-E /CGB-A		Groups B, C, D
CSA Approved Safety Barrier	30 V or less 150 ohms or more	Groups C, D

THIS DRAWING WAS CREATED ON CAD. DRAWING IS ARCHIVED ON MAGNETIC TAPE FOR ECO CHANGES.

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES. REMOVE ALL BURRS AND SHARP EDGES. MACHINE SURFACE FINISH 125

- TOLERANCES -

DECIMALS .X±.1 .XX±.Ø2 .XXX±.Ø1Ø
FRACTIONS ±1/32
ANGLES ±2°

DO NOT SCALE PRINT

CONTRACT NO.

DR. S.CAPAUL Ø3/18/92
CHK'D W.C.RAUTH Ø4/01/92
APP'D. W.C.RAUTH Ø4/01/92

APP'D. GOVT.

ROSEMOUNT® Measurement Control Analytical Valves

Rosemount Inc.
12ØØ1 Technology Drive
Eden Prairie, MN 55344 USA

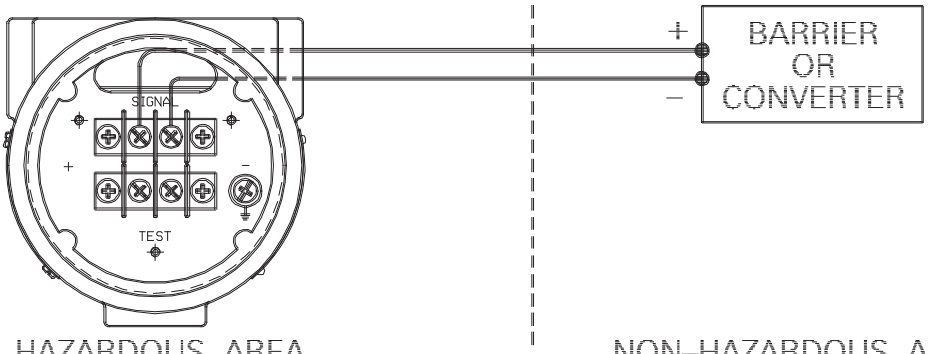
TITLE INDEX OF CSA INTRINSICALLY SAFE BARRIER SYSTEMS FOR MODEL 1151 TRANSMITTERS

SIZE A | FSCM NO | DWG NO. Ø1151-2575

SCALE N/A | WT. _____ | SHEET 1 OF 3

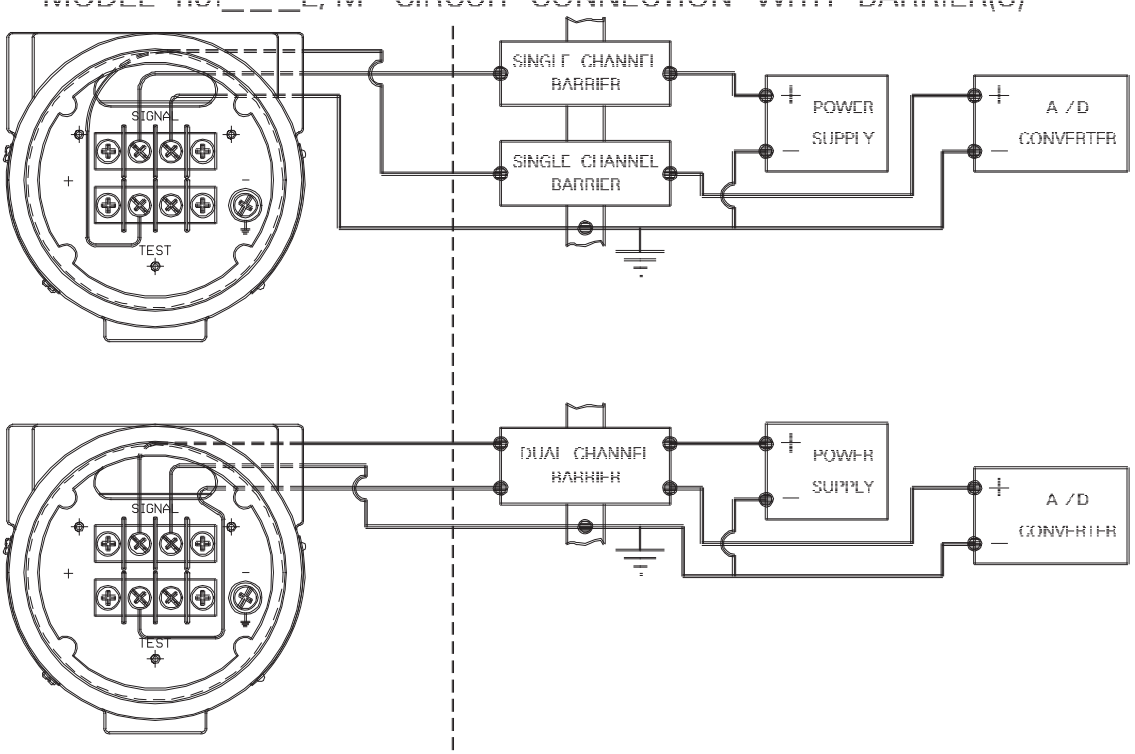
REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
C		652195		

MODEL 1151 CIRCUIT CONNECTION WITH BARRIER OR CONVERTER



HAZARDOUS AREA NON-HAZARDOUS AREA

MODEL 1151___L, M CIRCUIT CONNECTION WITH BARRIER(S)



HAZARDOUS AREA NON-HAZARDOUS AREA

Rosemount Inc. 12001 Technology Drive Eden Prairie, MN 55344 USA	THIS DRAWING WAS CREATED ON CAD. DRAWING IS ARCHIVED ON MAGNETIC TAPE FOR ECO CHANGES.		
DR. S.CAPAUL 03/18/92	SIZE A	FSCM NO	DWG NO. 01151-2575
ISSUED	SCALE NONE	WT.	SHEET 2 OF 3

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
C		652195		

MODEL 1151___L, M CIRCUIT CONNECTION WITH BARRIER(S) (CONTINUED)

APPROVED FOR CLASS I, DIVISION 1, GROUPS A, B, C, D WHEN USED IN CIRCUIT WITH TWO CSA APPROVED SINGLE CHANNEL SAFETY BARRIERS; ONE WITH APPROVED SAFETY PARAMETERS OF 28 VOLTS OR LESS AND 300 OHMS OR MORE IN +POWER LINE, AND THE OTHER WITH APPROVED SAFETY PARAMETERS OF 10 VOLTS OR LESS AND 47 OHMS OR MORE IN +OUTPUT LINE.

–OR–

ONE CSA APPROVED DUAL CHANNEL SAFETY BARRIER WITH IDENTICAL APPROVED SAFETY PARAMETERS CONNECTED IN LIKE MANNER.

APPROVED FOR CLASS I, DIVISION 1, GROUPS C, D WHEN USED IN CIRCUIT WITH TWO CSA APPROVED SINGLE CHANNEL SAFETY BARRIERS; ONE WITH APPROVED SAFETY PARAMETERS OF 30 VOLTS OR LESS AND 150 OHMS OR MORE IN +POWER LINE AND THE OTHER WITH APPROVED SAFETY PARAMETERS OF 10 VOLTS OR LESS AND 47 OHMS OR MORE IN +OUTPUT LINE.

Rosemount Inc. 12001 Technology Drive Eden Prairie, MN 55344 USA	THIS DRAWING WAS CREATED ON CAD. DRAWING IS ARCHIVED ON MAGNETIC TAPE FOR ECO CHANGES.		
DR. S.CAPAUL 03/30/92	SIZE A	FSCM NO	DWG NO. Ø1151-2575
ISSUED	SCALE N/A	WT.	SHEET 3 OF 3

Figure B-3.

PROPRIETARY INFORMATION IS CONTAINED HEREIN AND MUST BE HANDLED ACCORDINGLY
BY _____ DATE _____

REVISIONS

REV	DESCRIPTION	CHG. NO.	APP'D	DATE
G	ADD SHT 4&5, DELETE CLASS II &III.	636328	B.S.J.	08/01/90
H	ADD 3051 P/L/H, 3001C CL /CH	636904	K.D.V.	09/06/90
J	ADD SHT. 6, FIX TBL. 1.	638723	B.S.J.	01/02/91
K	ADD 3044C	641710	W.R.K.	06/13/91
L	ADD 3001S & SHT 7 FOR 3051C-LP	642380	G.E.M.	8/13/91
M	ADD 3095	653145	K.D.V.	4/8/93

THE ROSEMOUNT MODEL 268 SMART FAMILY INTERFACE IS APPROVED BY FACTORY MUTUAL AS INTRINSICALLY SAFE FOR THE CLASS I, DIVISION 1 GROUPS INDICATED WHEN USED IN CIRCUIT WITH THE BARRIERS AND CONVERTERS LISTED BELOW AND THE ROSE-MOUNT SMART FAMILY TRANSMITTERS DEPICTED IN THE ACCOMPANYING CIRCUIT DIAGRAMS.

BARRIER MANUFACTURER	MODEL	APPROVED FOR CLASS I DIVISION 1, GROUPS
FOXBORO	2AI-I2V-FGB 2AI-I3V-FGB 2AS-I3I-FGB 3A2-I2D-CS-E/FGB-A 3A2-I3D-CS-E/FGB-A	A,B,C,D
HONEYWELL	38545-000-0110-113-F5B5 38545-000-0110-111/112-F5B5	C,D
MTL	115 122 322 715 722	A,B,C,D
R. STAHL	8901/31-199/100/7 8901/30-199/100/7 8901/31-280/165/7 8901/30-280/165/7	C,D C,D
	8903/51-200/050/7 8901/31-086/150/7	A,B,C,D A,B,C,D
	8901/31-280/165/7 8901/31-086/150/7	C,D C,D
	9005/01-245/060 9005/01-252/100	A,B,C,D A,B,C,D
TAYLOR	5850FL81200 5851FL81200 1130FF21000 1130FF22000 1135FF21000 1135FF22000	C,D

THIS DRAWING WAS CREATED ON CAD. DRAWING IS ARCHIVED ON MAGNETIC TAPE FOR ECO CHANGES.

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES. REMOVE ALL BURRS AND SHARP EDGES. MACHINE SURFACE FINISH 125

- TOLERANCES -

DECIMALS .X±.1 .XX±.02 .XXX±.010
FRACTIONS ±1/32
ANGLES ±2°

DO NOT SCALE PRINT

CONTRACT NO.

DR. MIKE DOBE 2/7/90

CHK'D

APP'D. K.CARLSON 03/13/90

APP'D. GOVT.

ROSEMOUNT® Measurement Control Analytical Valves

Rosemount Inc.
12001 Technology Drive
Eden Prairie, MN 55344 USA

TITLE INDEX OF I.S. BARRIER SYSTEMS FOR MOD. 268 SMART FAMILY INTERFACE

SIZE A | FSCM NO | DWG NO. 00268-0031

SCALE | WT. _____ | SHEET 1 OF 7

FORM NO. 60651A-1 REV. C

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
M		653145		

ENTITY CONCEPT APPROVALS

THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN COMBINATION AS A SYSTEM. THE APPROVED VALUES OF MAXIMUM OPEN CIRCUIT VOLTAGE (V_T OR V_{OC}) AND MAXIMUM SHORT CIRCUIT CURRENT (I_T OR I_{SC}) AND MAXIMUM OUTPUT POWER ($\frac{V_{OC} \times I_{SC}}{4}$ OR $\frac{V_T \times I_T}{4}$), FOR THE ASSOCIATED APPARATUS MUST BE LESS THAN OR EQUAL TO THE MAXIMUM SAFE INPUT VOLTAGE (V_{MAX}), MAXIMUM SAFE INPUT CURRENT (I_{MAX}) AND MAXIMUM SAFE INPUT POWER (P_{MAX}) OF THE INTRINSICALLY SAFE APPARATUS, IN ADDITION, THE APPROVED MAXIMUM ALLOWABLE CONNECTED CAPACITANCE (C_A) AND INDUCTANCE (L_A) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE MAXIMUM UNPROTECTED INTERNAL CAPACITANCE (C_I) AND INDUCTANCE (L_I) OF THE INTRINSICALLY SAFE APPARATUS. THE APPROVED ENTITY CONCEPT PARAMETERS ARE AS FOLLOWS: ARE AS FOLLOWS:

NOTE: ENTITY PARAMETERS LISTED APPLY ONLY TO ASSOCIATED APPARATUS WITH LINEAR OUTPUT.

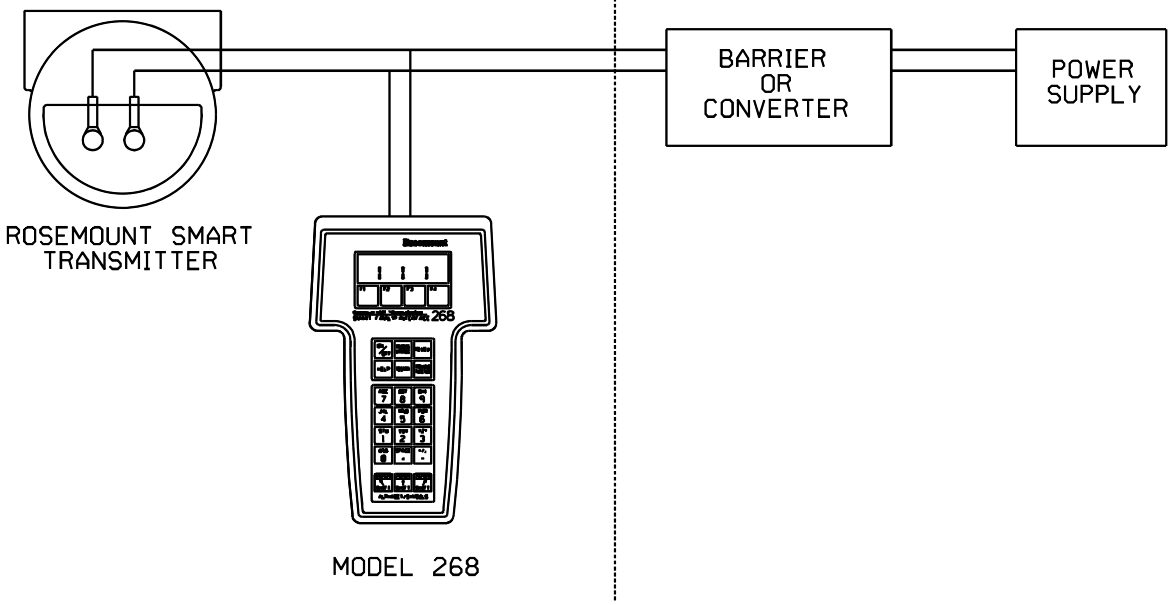
INPUT PARAMETERS (CLASS I, DIV. 1, GROUPS A, B, C, D)				
Vmax = 32 Vdc				V_T or Voc of barrier must be $\leq$ 32 Vdc
Imax = 186 mA				I_T or Isc of barrier must be $\leq$ 186 mA
C_i = 0.01 µF				C_A of barrier must be $\geq$ 0.01 µF
L_i = 1.1 mH				L_A of barrier must be $\geq$ 1.1 mH
Pmax:	1.1W	0.8W	0.6W	$\frac{Voc \times Isc}{4}$ of barrier must be $\leq$ specified value.
Temp code	T4A	T5	T6	

OUTPUT PARAMETERS
Voc = 1.5 Vd.c.
Isc = 27 mA
C_A = 10,000 µF
L_A = 46 mH

Rosemount Inc. 12001 Technology Drive Eden Prairie, MN 55344 USA	THIS DRAWING WAS CREATED ON CAD. DRAWING IS ARCHIVED ON MAGNETIC TAPE FOR ECO CHANGES.			
DR. D.PEARSON	SIZE A	FSCM NO	DWG NO. 00268-0031	
ISSUED	SCALE N/A	WT. ———	SHEET 2 OF 7	

FORM NO. 60651A-1 REV. C

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
M		653145		



ROSEMOUNT SMART TRANSMITTERS

MODEL	1151 SMART
MODEL	3051
MODEL	3051C, 3051P, 3051L, 3051H, 3051CA
MODEL	3044
MODEL	3044C
MODEL	3001C, 3001CL, 3001CH
MODEL	3311
MODEL	3001S, 3001SL, 3001SH
MODEL	3095

UP TO FOUR MODEL 751 INDICATORS MAY BE WIRED IN SERIES WITH THE TRANSMITTERS SHOWN ABOVE AND MAY BE LOCATED IN EITHER THE HAZARDOUS OR NON-HAZARDOUS AREA

Rosemount Inc.
12001 Technology Drive
Eden Prairie, MN 55344 USA

THIS DRAWING WAS CREATED ON CAD. DRAWING IS ARCHIVED ON MAGNETIC TAPE FOR ECO CHANGES.

DR. D.PEARSON	SIZE A	FSCM NO	DWG NO. 00268-0031
ISSUED	SCALE N/A	WT. ———	SHEET 3 OF 7

FORM NO. 60651A-1 REV. C

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
M		653145		

THE MAXIUM ALLOWABLE CONNECTED INDUCTANCE (La) OF THE ASSOCIATED APPARATUS IS DETERMINED BY ADDING 27 mA TO THE Isc OF THE BARRIER (Im=Isc + 27mA AND ENTERING TABLE 1 (SHT 5) AT THE RESULTING VALUE, Im, OR THE NEXT HIGHER VALUE OF Im, TO DETERMINE THE La, (THE La MUST INCLUDE THE L_1 OF THE MODEL 268, WHICH IS 1.1mH).

EXAMPLE #1: Isc OF BARRIER = 100mA.

Im = 100mA + 27mA = 127mA

ENTER TABLE AT Im = 130mA; La = 2.0mH

--WARNING-- BEFORE CONNECTING THE MODEL 268 INTO THE LOOP, DETERMINE THE CONNECTED INDUCTANCE OF THE SYSTEM BY ADDING THE L_1 OF THE TRANSMITTER, CABLE, AND MODEL 268. THE SUM MUST BE LESS THAN THE La DETERMINED FROM THE TABLE IN ORDER FOR THE MODEL 268 TO BE CONNECTED INTO THE LOOP. IF THE CONNECTED INDUCTANCE IS GREATER THAN THE VALUE DETERMINED FROM THE TABLE, A BARRIER WITH A LOWER Isc MUST BE CHOSEN.

EXAMPLE #2: BARRIER ISC = 41.8mA; BARRIER LA = 20.0mH

IM = 41.8mA + 27mA = 68.8mA;

ENTER TABLE AT 70mA AND READ La = 7.5mH

ADD CONNECTED INDUCTANCE OF SYSTEM:

MODEL 268	L_1 = 1.1mH
MODEL 3051 TRANSMITTER	L_1 = 0.48mH
INDUCTANCE OF LOOP WIRING	1.0mH
TOTAL CONNECTED INDUCTANCE	= 2.58mH

TOTAL CONNECTED INDUCTANCE IS LESS THAN La = 7.5 mH AS DETERMINED ABOVE AND IS ALSO LESS THAN THE BARRIER La. THE MODEL 268 MAY SAFELY BE CONNECTED INTO THE LOOP. IF THE MODEL 751 INDICATORS ARE USED, THEIR TOTAL INDUCTANCE (LABEL VALUE * NUMBER OF INDICATORS) MUST ALSO BE INCLUDED.

S.BARDUSON 30JUL90

SIZE	FSCM NO	DWG NO.
A		00268-0031
SCALE N/A	WT. ———	SHEET 4 OF 7

FORM NO. 60651A-1 REV. C

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
M		653145		

Im (mA)	La ()mH)
150	1.3
145	1.5
140	1.6
130	2.0
120	2.5
110	3.0
100	4.0
90	5.0
85	5.5
80	6.0
75	6.7
70	7.5
65	8.8
62	9.5
60	10.0
57	11.0
55	12.0
50	15.0
45	19.0
40	23.0
35	31.0

TABLE 1

Rosemount Inc.
12001 Technology Drive
Eden Prairie, MN 55344 USA

THIS DRAWING WAS CREATED ON CAD. DRAWING IS ARCHIVED ON MAGNETIC TAPE FOR ECO CHANGES.

DR. S.BARDUSON 30JUL90

ISSUED

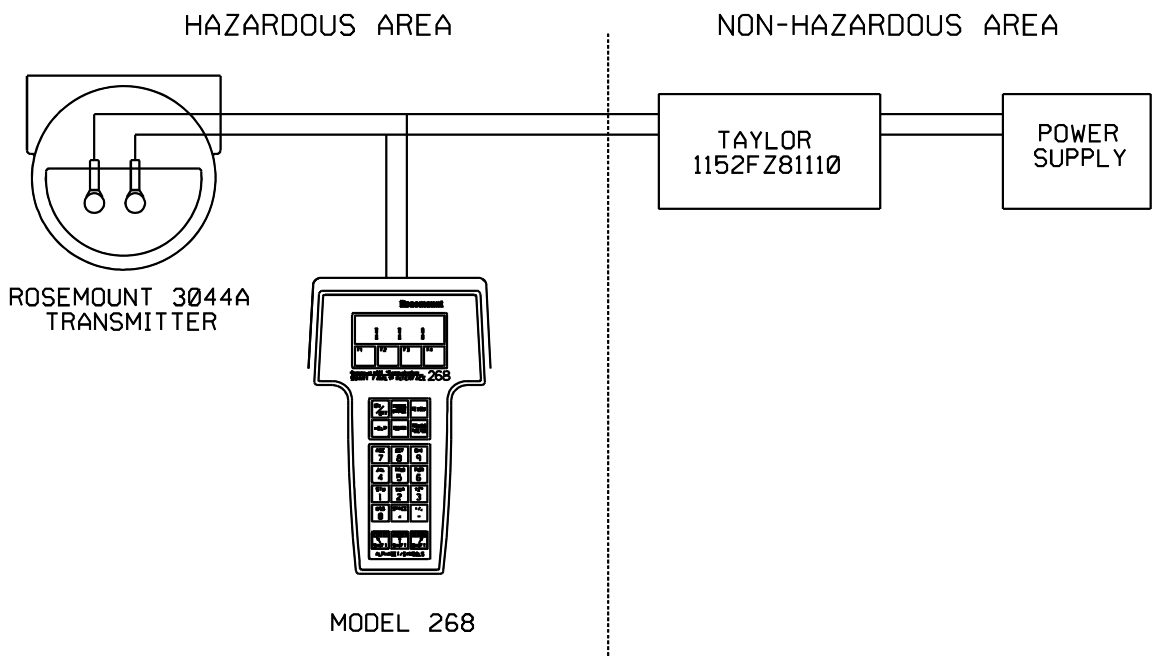
SIZE A | FSCM NO | DWG NO. 00268-0031

SCALE N/A | WT. ——— | SHEET 5 OF 7

FORM NO. 60651A-1 REV. C

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE

TAYLOR 1152FZ81110 SYSTEM



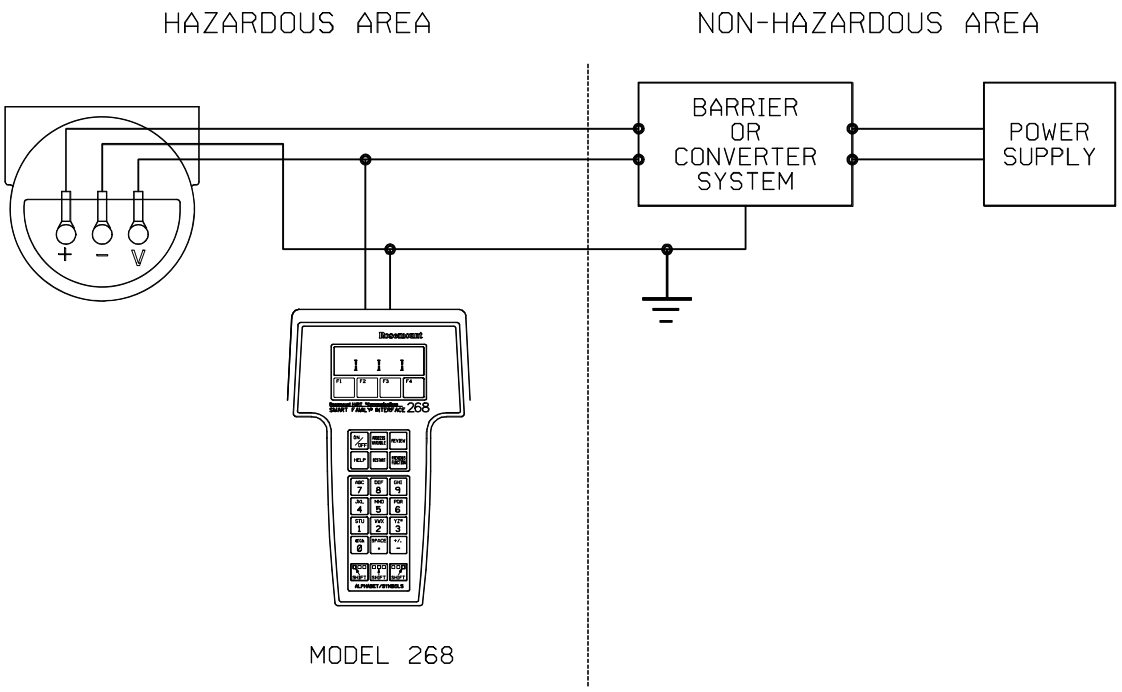
ROSEMOUNT 3044A SMART TRANSMITTERS MAY BE PLACED IN A CLASS I, DIVISION I, GROUP A, B, C, D HAZARDOUS LOCATION AS SHOWN ABOVE. THE LOOP POWER IS LIMITED BY A TAYLOR 1152FZ81110 INTRINSIC SAFETY BARRIER. THE ROSEMOUNT 268 MAY ALSO BE CONNECTED IN THE LOOP AS SHOWN. FOR CABLE WITH CAPACITANCE OF 60 pF/ft OR LESS AND INDUCTANCE OF .2 uH/ft OR LESS; CABLE LENGTHS OF UP TO 1600 FEET ARE ALLOWED.

TRANSMITTER: ROSEMOUNT 3044A
BARRIER: TAYLOR 1152FZ81110
COMMUNICATOR: ROSEMOUNT 268
CABLE: Cmax = 60 pF/ft
Lmax = .2 uH/ft
MAX. LENGTH = 1600 ft

Rosemount Inc. 12001 Technology Drive Eden Prairie, MN 55344 USA	THIS DRAWING WAS CREATED ON CAD. DRAWING IS ARCHIVED ON MAGNETIC TAPE FOR ECO CHANGES.		
DR. C. SCRIBNER 12/21/90	SIZE A	FSCM NO	DWG NO. 00268-0031
ISSUED	SCALE N/A	WT. ———	SHEET 6 OF 7

FORM NO. 60651A-1 REV. C

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
M		653145		



MODEL 268

CONNECTION FOR LOW POWER VERSIONS
OF THE FOLLOWING
ROSEMOUNT SMART TRANSMITTERS

MODEL 3051C, 3051P, 3051L, 3051H, 3051CA
MODEL 3001C, 3001CL, 3001CH
MODEL 3001S, 3001SL, 3001SH

Rosemount Inc. 12001 Technology Drive Eden Prairie, MN 55344 USA	THIS DRAWING WAS CREATED ON CAD. DRAWING IS ARCHIVED ON MAGNETIC TAPE FOR ECO CHANGES.		
DR. SANDI MANSON 8/8/91	SIZE A	FSCM NO	DWG NO. 00268-0031
ISSUED	SCALE N/A	WT. ———	SHEET 7 OF 7

FORM NO. 60651A-1 REV. C

Figure B-4.

PROPRIETARY INFORMATION IS CONTAINED HEREIN AND MUST BE HANDLED ACCORDINGLY
BY _____ DATE _____

REVISIONS

REV	DESCRIPTION	CHG. NO.	APP'D	DATE
A	NEW RELEASE	654533	B.S.J.	8/30/93
B	CHG Vmax & C_1	657178	B.S.J.	12/13/93

THIS DRAWING WAS CREATED ON CAD. DRAWING IS ARCHIVED ON MAGNETIC TAPE FOR ECO CHANGES.

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES. REMOVE ALL BURRS AND SHARP EDGES. MACHINE SURFACE FINISH 125

- TOLERANCES -

DECIMALS
.X±.1
.XX±.02
.XXX±.010

FRACTIONS
±1/32

ANGLES
±2°

DO NOT SCALE PRINT

CONTRACT NO.

DR. C.SCRIBNER 6/2/93

CHK'D

APP'D. B.S. JUNK 8/30/93

APP'D. GOVT.

ROSEMOUNT® Measurement Control Analytical Valves

Rosemount Inc.
12001 Technology Drive
Eden Prairie, MN 55344 USA

TITLE INDEX OF I.S. BARRIER SYSTEMS FOR MOD. 275 HART® COMMUNICATOR

SIZE A | FSCM NO | DWG NO. 00275-0081

SCALE | WT. _____ | SHEET 1 OF 6

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
B		657178		

FM ENTITY CONCEPT APPROVALS

THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPRATUS NOT SPECIFICALLY EXAMINED IN COMBINATION AS A SYSTEM. THE APPROVED VALUES OF MAXIMUM OPEN CIRCUIT VOLTAGE (V_T OR V_{OC}) AND MAXIMUM SHORT CIRCUIT CURRENT (I_T OR I_{SC}) FOR THE ASSOCIATED APPARATUS MUST BE LESS THAN OR EQUAL TO THE MAXIMUM SAFE INPUT VOLTAGE (V_{MAX}) AND MAXIMUM SAFE INPUT CURRENT (I_{MAX}) OF THE INTRINSICALLY SAFE APPARATUS, IN ADDITION, THE APPROVED MAXIMUM ALLOWABLE CONNECTED CAPACITANCE (C_A) AND INDUCTANCE (L_A) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE MAXIMUM UNPROTECTED INTERNAL CAPACITANCE (C_I) AND INDUCTANCE (L_I) OF THE INTRINSICALLY SAFE APPARATUS. THE APPROVED ENTITY CONCEPT PARAMETERS ARE AS FOLLOWS:

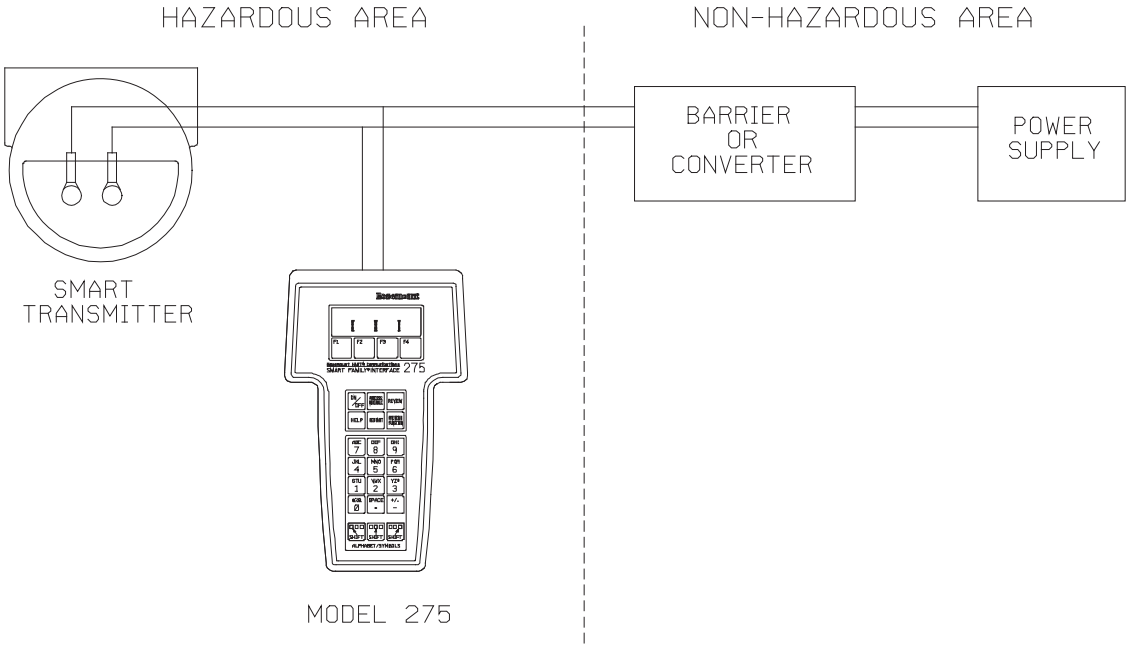
NOTE: ENTITY PARAMETERS LISTED APPLY ONLY TO ASSOCIATED APPARATUS WITH LINEAR OUTPUT.

INPUT PARAMETERS (CLASS I, DIV. 1, GROUPS A, B, C, D)	
Vmax = 30 Vdc	V_T or Voc of barrier must be $\leq$ 30 Vdc
Imax = 300 mA	I_T or Isc of barrier must be $\leq$ 300 mA
C_1 = 0.07μF	C_A of barrier must be $\geq$ 0.07 μF
L_1 = 0 mH	L_A of barrier must be $\geq$ 0 mH

OUTPUT PARAMETERS
Voc = 1.7 Vd.c.
Isc = 32 mA

Rosemount Inc. 12001 Technology Drive Eden Prairie, MN 55344 USA	THIS DRAWING WAS CREATED ON CAD. DRAWING IS ARCHIVED ON MAGNETIC TAPE FOR ECO CHANGES.		
DR. C.SCRIBNER	SIZE A	FSCM NO	DWG NO. 00275-0081
ISSUED	SCALE N/A	WT. ———	SHEET 2 OF 6

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
B		657178		



Rosemount Inc. 12001 Technology Drive Eden Prairie, MN 55344 USA	THIS DRAWING WAS CREATED ON CAD. DRAWING IS ARCHIVED ON MAGNETIC TAPE FOR ECO CHANGES.		
DR. C.SCRIBNER	SIZE A	FSCM NO	DWG NO. 00275-0081
ISSUED	SCALE N/A	WT. ———	SHEET 3 OF 6

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
B		657178		

THE MAXIMUM ALLOWABLE CONNECTED INDUCTANCE (La) OF THE ASSOCIATED APPARATUS IS DETERMINED BY ADDING 32 mA TO THE Isc OF THE BARRIER (Im=Isc + 32mA) AND ENTERING TABLE 1 (SHT 5) AT THE RESULTING VALUE, Im, OR THE NEXT HIGHER VALUE OF Im, TO DETERMINE THE La.

EXAMPLE #1: Isc OF BARRIER = 100mA. (GROUP A)

Im = 100mA + 32mA = 132mA

ENTER TABLE AT Im = 140mA; La = 1.60mH

--WARNING-- BEFORE CONNECTING THE MODEL 275 INTO THE LOOP, DETERMINE THE CONNECTED INDUCTANCE OF THE SYSTEM BY ADDING THE L_1 OF THE TRANSMITTER AND CABLE. THE SUM MUST BE LESS THAN THE La DETERMINED FROM THE TABLE IN ORDER FOR THE MODEL 275 TO BE CONNECTED INTO THE LOOP. IF THE CONNECTED INDUCTANCE IS GREATER THAN THE VALUE DETERMINED FROM THE TABLE, A BARRIER WITH A LOWER Isc MUST BE CHOSEN.

EXAMPLE #2: BARRIER ISC = 41.8mA; BARRIER LA = 20.0mH

IM = 41.8mA + 32mA = 73.8mA;

ENTER TABLE AT 80mA AND READ La = 6.0mH

ADD CONNECTED INDUCTANCE OF SYSTEM:

MODEL 3051 TRANSMITTER	L_1 = 0.48mH
INDUCTANCE OF LOOP WIRING	1.0mH
TOTAL CONNECTED INDUCTANCE	= 1.48mH

TOTAL CONNECTED INDUCTANCE IS LESS THAN La = 6.0 mH AS DETERMINED ABOVE AND IS ALSO LESS THAN THE BARRIER La. THE MODEL 275 MAY SAFELY BE CONNECTED INTO THE LOOP. IF THE MODEL 751 INDICATORS ARE USED, THEIR TOTAL INDUCTANCE (LABEL VALUE * NUMBER OF INDICATORS) MUST ALSO BE INCLUDED.

Rosemount Inc. 12001 Technology Drive Eden Prairie, MN 55344 USA	THIS DRAWING WAS CREATED ON CAD. DRAWING IS ARCHIVED ON MAGNETIC TAPE FOR ECO CHANGES.		
DR. C.SCRIBNER 6/2/93	SIZE A	FSCM NO	DWG NO. 00275-0081
ISSUED	SCALE N/A	WT.	SHEET 4 OF 6

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
B		657178		

Im	La (mH)		
(mA)	GROUPS A & B	GROUP C	GROUP D
300	0.20	1.80	3.20
280	0.21	2.00	3.70
270	0.23	2.20	3.90
260	0.25	2.50	4.30
250	0.27	2.70	4.60
240	0.30	3.00	5.00
220	0.40	3.20	5.90
200	0.50	4.00	7.20
180	0.60	5.00	8.80
170	0.80	5.50	9.90
160	1.00	6.20	11.20
150	1.30	7.00	12.70
140	1.60	8.00	14.60
130	2.00	9.00	16.90
120	2.50	10.00	19.80
110	3.00	12.00	23.60
100	4.00	15.00	28.50
90	5.00	18.00	35.10
85	5.50	20.00	39.30
80	6.00	22.00	44.40
75	6.70	25.00	50.50
70	7.50	28.00	57.90
65	8.80	34.00	67.10
62	9.50	37.00	73.70
60	10.00	40.00	78.70
57	11.00	43.00	87.10
55	12.00	48.00	93.50
50	15.00	56.00	113.10
45	19.00	70.00	139.40
40	23.00	87.00	176.30
35	31.00	110.00	229.90
32	36.00	135.00	274.80
30	40.00	150.00	312.40
28	46.00	170.00	358.40
25	58.00	210.00	449.00
23	68.00	250.00	530.10
21	82.00	300.00	635.30
20	90.00	330.00	700.00

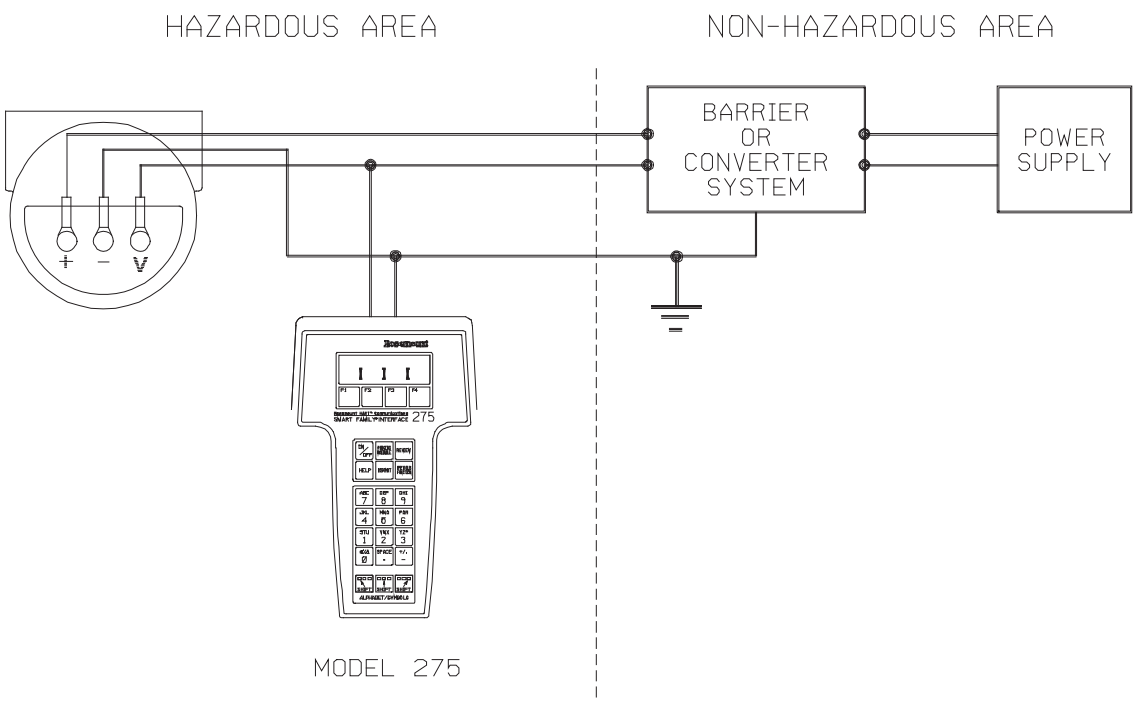
TABLE 1

Rosemount Inc.
12001 Technology Drive
Eden Prairie, MN 55344 USA

THIS DRAWING WAS CREATED ON CAD. DRAWING IS ARCHIVED ON MAGNETIC TAPE FOR ECO CHANGES.

DR. C.SCRIBNER 6/2/93	SIZE A	FSCM NO	DWG NO. 00275-0081
ISSUED	SCALE N/A	WT.	SHEET 5 OF 6

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
B		657178		



Rosemount Inc. 12001 Technology Drive Eden Prairie, MN 55344 USA	THIS DRAWING WAS CREATED ON CAD. DRAWING IS ARCHIVED ON MAGNETIC TAPE FOR ECO CHANGES.		
DR. C. SCRIBNER 6/2/93	SIZE A	FSCM NO	DWG NO. 00275-0081
ISSUED	SCALE N/A	WT.	SHEET 6 OF 6

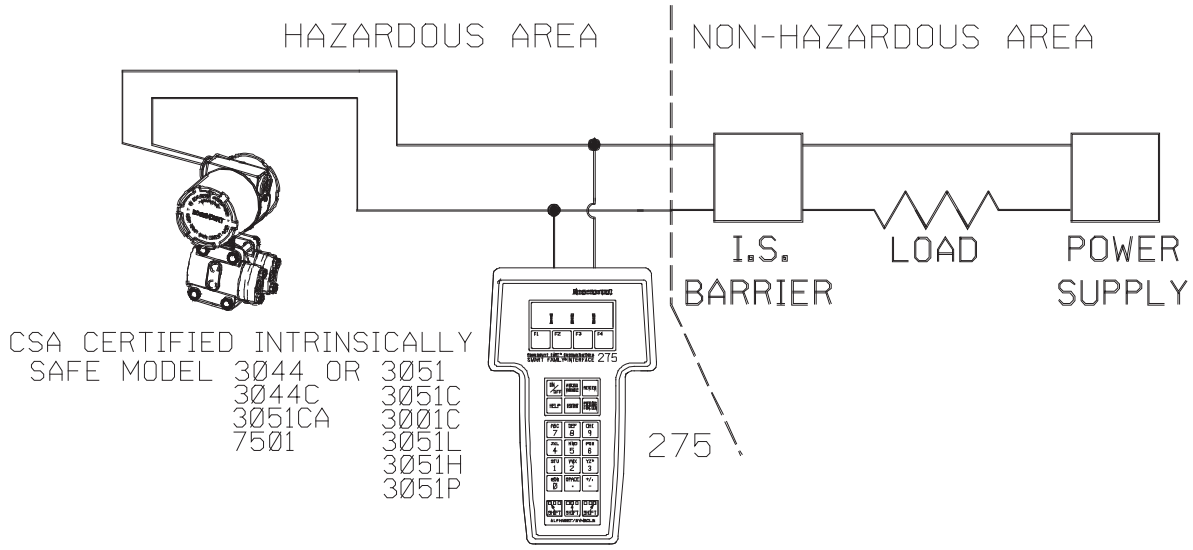
Figure B-5.

PROPRIETARY INFORMATION IS CONTAINED HEREIN AND MUST BE HANDLED ACCORDINGLY
BY _____ DATE _____

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
A	NEW RELEASE	654533		

CSA INTRINSIC SAFETY APPROVALS
MODEL 275 CIRCUIT CONNECTION WITH INTRINSIC SAFETY BARRIERS

"Exia"
INTRINSICALLY SAFE/SECURITE INTRINSEQUE



CSA CERTIFIED INTRINSICALLY SAFE MODEL 3044 OR 3051
3044C 3051C
3051CA 3001C
7501 3051L
3051H
3051P

INTRINSICALLY SAFE FOR USE IN CLASS 1, DIVISON 1, GROUPS A,B,C AND D HAZARDOUS LOCATIONS WHEN CONNECTED TO CSA CERTIFIED INTRINSIC SAFETY BARRIERS AS INDICATED IN THE ABOVE CONNECTION DIAGRAM. CERTIFIED INTRINSIC SAFETY BARRIERS ARE LISTED BELOW.

30V MAX, 330 OHMS MIN
28V MAX, 300 OHMS MIN
22V MAX, 180 OHMS MIN

THIS DRAWING WAS CREATED ON CAD. DRAWING IS ARCHIVED ON MAGNETIC TAPE FOR ECO CHANGES.

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES. REMOVE ALL BURRS AND SHARP EDGES. MACHINE SURFACE FINISH 125
- TOLERANCES -
DECIMALS .X±.1 .XX±.02 .XXX±.010
FRACTIONS ±1/32
ANGLES ±2°
DO NOT SCALE PRINT

CONTRACT NO.
DR. C. SCRIBNER 6/2/93
CHK'D
APP'D.
APP'D. GOVT.

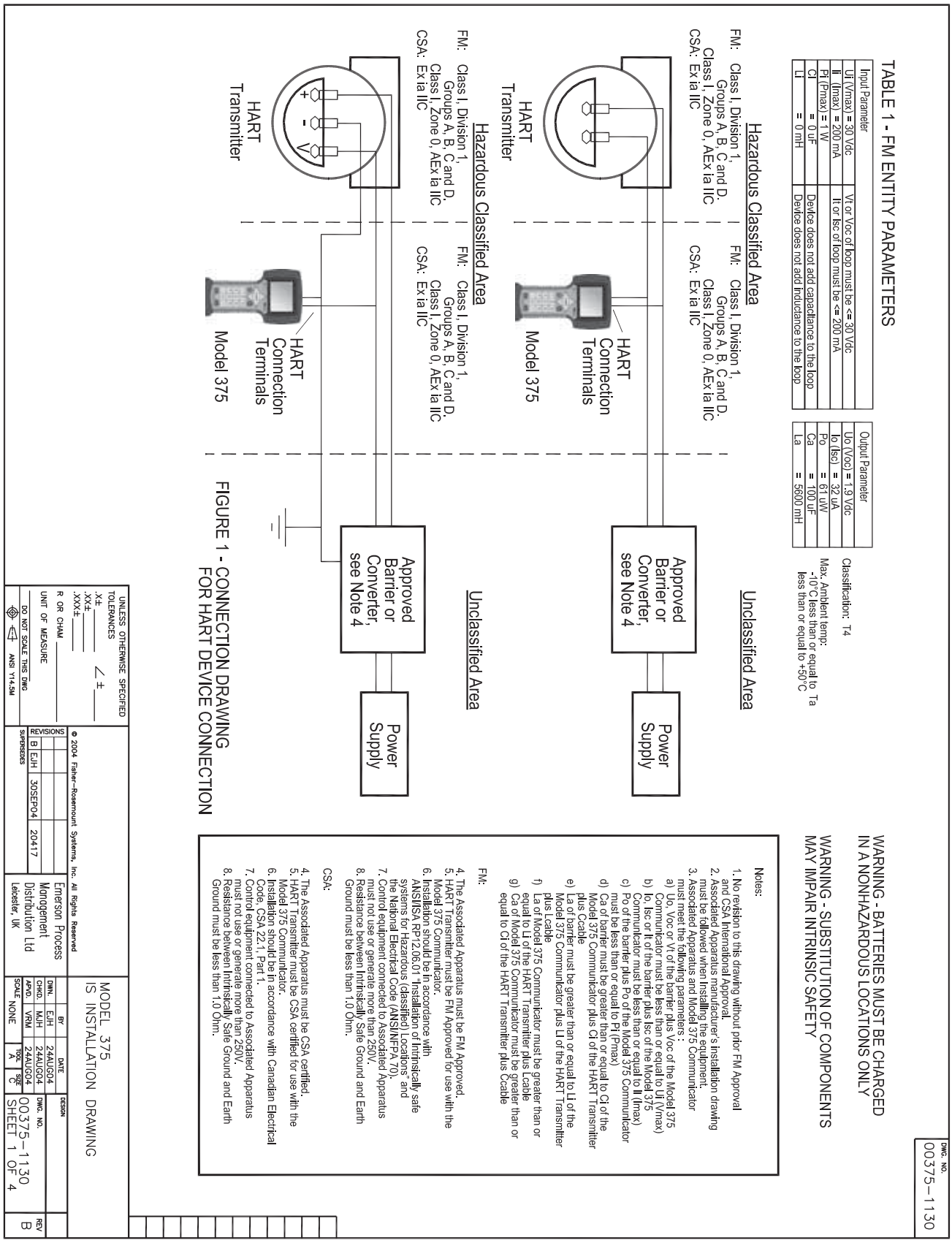
ROSEMOUNT® Measurement Control Analytical Valves

Rosemount Inc.
12001 Technology Drive
Eden Prairie, MN 55344 USA

TITLE
275 CSA INTRINSICALLY SAFE CONFIGURATION

SIZE	FSCM NO	DWG NO.	
A		00275-0082	
SCALE NONE	WT. _____	SHEET 1 OF 1	

Figure B-6.


TABLE 1 - FM ENTITY PARAMETERS
Input Parameter
Ui (Vmax) = 30 Vdc
Ii (Imax) = 200 mA
Pi (Pmax) = 1 W
Ci = 0 uF
Li = 0 mH
Vt or Voc of loop must be <= 30 Vdc
It or Isc of loop must be <= 200 mA
Device does not add capacitance to the loop
Device does not add inductance to the loop
Output Parameter
Uo (Voc) = 1.9 Vdc
Io (Isc) = 32 uA
Po = 61 uW
Ca = 100 uF
La = 5600 mH
Classification: T4
Max. Ambient temp: -10°C less than or equal to Ta less than or equal to +50°C
WARNING - BATTERIES MUST BE CHARGED IN A NONHAZARDOUS LOCATIONS ONLY
WARNING - SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY
DWG. NO. 00375-1130
Hazardous Classified Area
FM: Class I, Division 1, Groups A, B, C and D.
CSA: Class I, Zone 0, AEx ia IIC
HART Transmitter
HART Connection Terminals
Model 375
Unclassified Area
Approved Barrier or Converter, see Note 4
Power Supply
Notes:
1. No revision to this drawing without prior FM Approval and CSA International Approval.
2. Associated Apparatus manufacturer's installation drawing must be followed when installing the equipment.
3. Associated Apparatus and Model 375 Communicator must meet the following parameters :
a) Uo, Voc or Vt of the barrier plus Voc of the Model 375 Communicator must be less than or equal to Ui (Vmax)
b) Io, Isc or It of the barrier plus Isc of the Model 375 Communicator must be less than or equal to Ii (Imax)
c) Po of the barrier plus Po of the Model 375 Communicator must be less than or equal to Pi (Pmax)
d) Ca of barrier must be greater than or equal to Ci of the Model 375 Communicator plus Ci of the HART Transmitter plus Ccable
e) La of barrier must be greater than or equal to Li of the Model 375 Communicator plus Li of the HART Transmitter plus Lcable
f) La of Model 375 Communicator must be greater than or equal to Li of the HART Transmitter plus Lcable
g) Ca of Model 375 Communicator must be greater than or equal to Ci of the HART Transmitter plus Ccable
FM:
4. The Associated Apparatus must be FM Approved.
5. HART Transmitter must be FM Approved for use with the Model 375 Communicator.
6. Installation should be in accordance with ANSI/ISA RP12.06.01 "Installation of Intrinsically safe systems for Hazardous (classified) Locations" and the National Electrical Code (ANSI/NFPA 70).
7. Control equipment connected to Associated Apparatus must not use or generate more than 250V.
8. Resistance between Intrinsically Safe Ground and Earth Ground must be less than 1.0 Ohm.
CSA:
4. The Associated Apparatus must be CSA certified.
5. HART Transmitter must be CSA certified for use with the Model 375 Communicator.
6. Installation should be in accordance with Canadian Electrical Code, CSA 22.1, Part 1.
7. Control equipment connected to Associated Apparatus must not use or generate more than 250V.
8. Resistance between Intrinsically Safe Ground and Earth Ground must be less than 1.0 Ohm.
FIGURE 1 - CONNECTION DRAWING FOR HART DEVICE CONNECTION
UNLESS OTHERWISE SPECIFIED
TOLERANCES
X± .XX± .XXX± ∠ ±
R OR CHAM
UNIT OF MEASURE
DO NOT SCALE THIS DWG
ANSI Y14.5M
REVISIONS
B EJH 30SEP04 20417
SUPERSEDES
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Emerson Process Management Distribution Ltd
Leicester, UK
MODEL 375 IS INSTALLATION DRAWING
DWN. EJH 24AUG04
CHKD. MJH 24AUG04
APVD. VRM 24AUG04
SCALE NONE
TOOL A
SIZE C
DWG. NO. 00375-1130
SHEET 1 OF 4
REV B

DWG. NO. 00375–1130

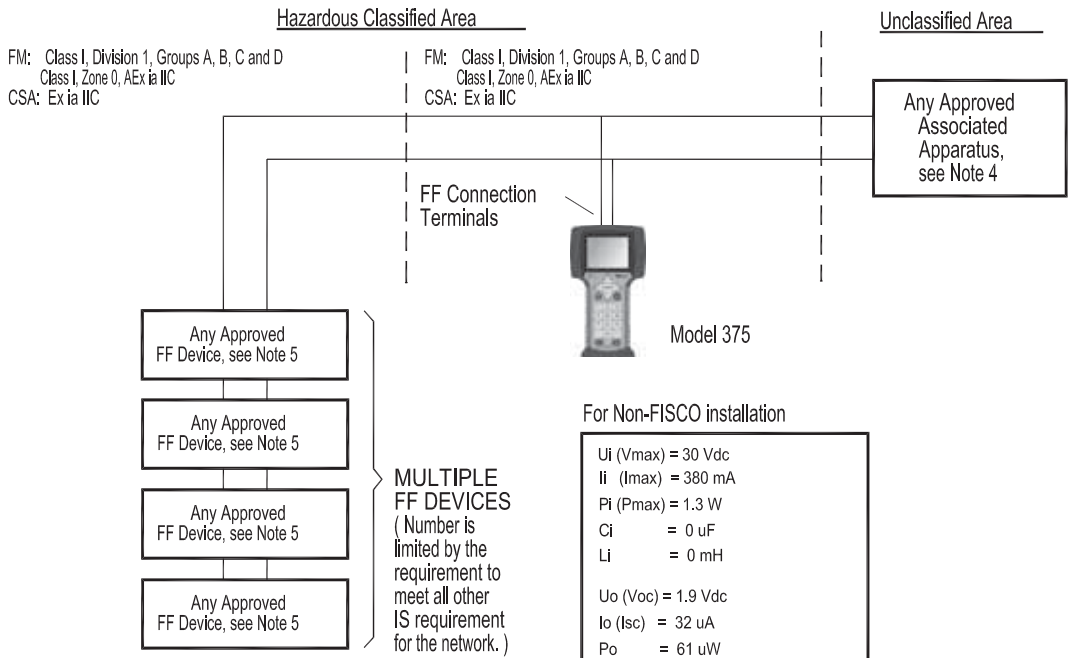


FIGURE 2 - CONNECTION DRAWING FOR FF Non-FISCO DEVICE CONNECTION

For Non-FISCO installation

Ui (Vmax) = 30 Vdc
Ii (Imax) = 380 mA
Pi (Pmax) = 1.3 W
Ci = 0 uF
Li = 0 mH

Uo (Voc) = 1.9 Vdc
Io (Isc) = 32 uA
Po = 61 uW
Ca = 100 uF
La = 5600 mH

Leakage current:
less than or equal to 50 uA

Classification: T4

Max. Ambient temp:
-10°C less than or equal to Ta
less than or equal to +50°C

WARNING - BATTERIES MUST BE CHARGED IN A NONHAZARDOUS LOCATIONS ONLY

WARNING - SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY

Notes:

1. No revision to this drawing without prior FM Approval and CSA International Approval.
2. Associated Apparatus manufacturer's installation drawing must be followed when installing the equipment.
3. Associated Apparatus and Model 375 Communicator must meet the following parameters :
   a) Uo, Voc or Vt of the barrier plus Voc of the Model 375 Communicator must be less than or equal to Ui (Vmax)
   b) Io, Isc or It of the barrier plus Isc of the Model 375 Communicator must be less than or equal to Ii (Imax)
   c) Po of the barrier plus Po of the Model 375 Communicator must be less than or equal to Pi (Pmax)
   d) Ca of barrier must be greater than or equal to Ci of the Model 375 Communicator plus Ci of the HART Transmitter plus Ccable
   e) La of barrier must be greater than or equal to Li of the Model 375 Communicator plus LI of the HART Transmitter plus Lcable
   f) La of Model 375 Communicator must be greater than or equal to Li of the HART Transmitter plus Lcable
   g) Ca of Model 375 Communicator must be greater than or equal to Ci of the HART Transmitter plus Ccable

FM:

4. The Associated Apparatus must be FM Approved.
5. FF Device must be FM Approved for use with the Model 375 Communicator.
6. Installation should be in accordance with ANSI/ISA RP12.06.01 "Installation of Intrinsically safe systems for Hazardous (classified) Locations" and the National Electrical Code (ANSI/NFPA 70).
7. Control equipment connected to Associated Apparatus must not use or generate more than 250V.
8. Resistance between Intrinsically Safe Ground and Earth Ground must be less than 1.0 Ohm.

CSA:

4. The Associated Apparatus must be CSA certified.
5. FF Device must be CSA certified for use with the Model 375 Communicator.
6. Installation should be in accordance with Canadian Electrical Code, CSA 22.1, Part 1.
7. Control equipment connected to Associated Apparatus must not use or generate more than 250V.
8. Resistance between Intrinsically Safe Ground and Earth Ground must be less than 1.0 Ohm.

UNLESS OTHERWISE SPECIFIED
TOLERANCES
.X± _____ ∠ ±_____
.XX±_____
.XXX±_____
R OR CHAM _____
UNIT OF MEASURE
_____
DO NOT SCALE THIS DWG
ANSI Y14.5M

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REVISIONS				
B	EJH	30SEP04	20417	

SUPERSEDES

Emerson Process Management
Distribution Ltd
Leicester, UK

MODEL 375
IS INSTALLATION DRAWING

	BY	DATE
DWN.	EJH	24AUG04
CHKD.	MJH	24AUG04
APVD.	VRM	24AUG04

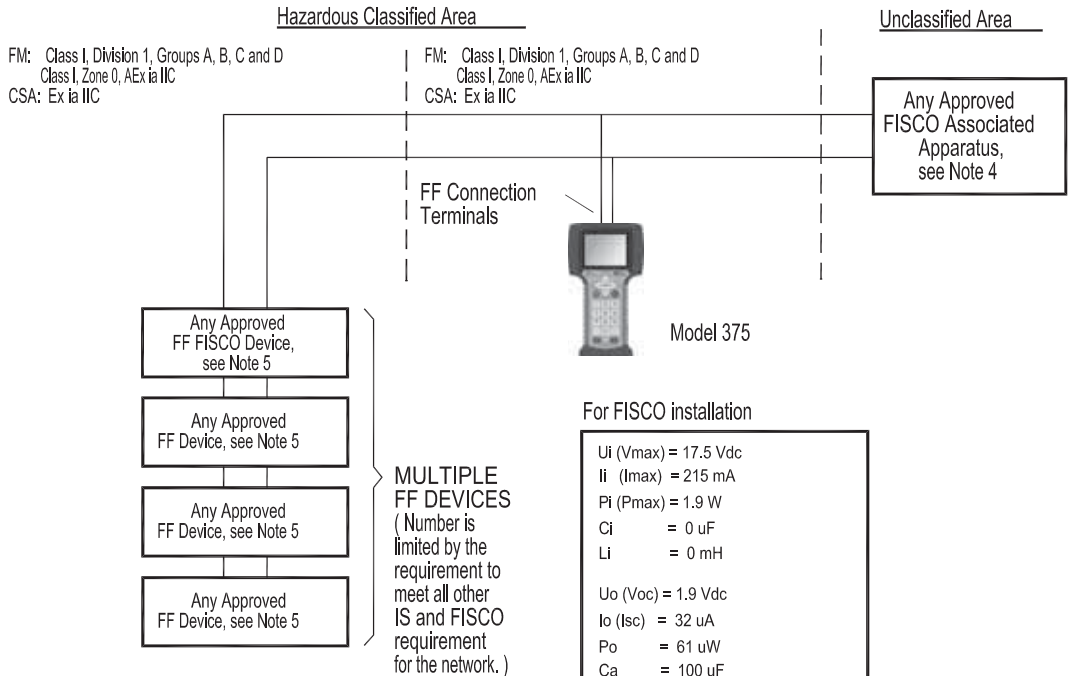
SCALE NONE | TOOL A | SIZE C

DESIGN

DWG. NO. 00375–1130 SHEET 2 OF 4

REV B

DWG. NO.
00375–1130



For FISCO installation

Ui (Vmax) = 17.5 Vdc
Ii (Imax) = 215 mA
Pi (Pmax) = 1.9 W
Ci = 0 uF
Li = 0 mH

Uo (Voc) = 1.9 Vdc
Io (Isc) = 32 uA
Po = 61 uW
Ca = 100 uF
La = 5600 mH

Leakage current:
less than or equal to 50 uA

Classification: T4

Max. Ambient temp:
-10°C less than or equal to Ta
less than or equal to +50°C

FIGURE 3 - CONNECTION DRAWING FOR FF FISCO DEVICE CONNECTION

WARNING - BATTERIES MUST BE CHARGED IN A NONHAZARDOUS LOCATIONS ONLY

WARNING - SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY

Notes:

1. No revision to this drawing without prior FM Approval and CSA International Approval.
2. Associated Apparatus manufacturer's installation drawing must be followed when installing the equipment.

3. Associated Apparatus and Model 375 Communicator must meet the conditions of the

"FISCO CONCEPT"

see notes on Page 4

FM:

4. The Associated Apparatus must be FM Approved.
5. FF Device must be FM Approved for use with the Model 375 Communicator.
6. Installation should be in accordance with ANSI/ISA RP12.06.01 "Installation of Intrinsically safe systems for Hazardous (classified) Locations" and the National Electrical Code (ANSI/NFPA 70).
7. Control equipment connected to Associated Apparatus must not use or generate more than 250V.
8. Resistance between Intrinsically Safe Ground and Earth Ground must be less than 1.0 Ohm.

CSA:

4. The Associated Apparatus must be CSA certified.
5. FF Device must be CSA certified for use with the Model 375 Communicator.
6. Installation should be in accordance with Canadian Electrical Code, CSA 22.1, Part 1.
7. Control equipment connected to Associated Apparatus must not use or generate more than 250V.
8. Resistance between Intrinsically Safe Ground and Earth Ground must be less than 1.0 Ohm.

UNLESS OTHERWISE SPECIFIED
TOLERANCES
.X± _____ ∠ ±_____
.XX± _____
.XXX± _____
R OR CHAM _____
UNIT OF MEASURE _____
DO NOT SCALE THIS DWG
ANSI Y14.5M

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REVISIONS				
B	EJH	30SEP04	20417	

SUPERSEDES

Emerson Process Management
Distribution Ltd
Leicester, UK

MODEL 375
IS INSTALLATION DRAWING

	BY	DATE
DWN.	EJH	24AUG04
CHKD.	MJH	24AUG04
APVD.	VRM	24AUG04

SCALE NONE | TOOL A | SIZE C

DESIGN

DWG. NO. 00375–1130
SHEET 3 OF 4

REV B

DWG. NO. 00375–1130

FISCO CONCEPT

THE FISCO CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIALLY EXAMINED IN SUCH COMBINATION. THE CRITERIA FOR INTERCONNECTION IS THAT THE VOLTAGE (Ui OR Vmax), THE CURRENT (Ii OR Imax) AND THE POWER (Pi OR Pmax) WHICH AN INTRINSICALLY SAFE APPARATUS CAN RECEIVE AND REMAIN INTRINSICALLY SAFE CONSIDERING FAULTS, MUST BE EQUAL OR GREATER THAN VOLTAGE (Uo, Voc OR Vt), THE CURRENT (Io, Isc OR It) AND THE POWER (Po OR Pmax) LEVELS WHICH CAN BE DELIVERED BY THE ASSOCIATED APPARATUS, CONSIDERING FAULTS AND APPLICABLE FACTORS. IN ADDITION, THE MAXIMUM UNPROTECTED CAPACITANCE (Ci) AND THE INDUCTANCE (Li) OF EACH APPARATUS (OTHER THAN THE TERMINATION) CONNECTED TO THE FIELDBUS MUST BE LESS THAN OR EQUAL TO 5 nF and 10 uH RESPECTIVELY.

IN EACH SEGMENT ONLY ONE ACTIVE DEVICE, NORMALLY THE ASSOCIATED APPARATUS, IS ALLOWED TO PROVIDE THE NECESSARY ENERGY FOR THE FIELDBUS SYSTEM. THE VOLTAGE Uo (OR Voc OR Vt) OF THE ASSOCIATED APPARATUS IS LIMITED TO A RANGE OF 14 V TO 24 Vdc ALL OTHER EQUIPMENT CONNECTED TO THE BUS CABLE HAS TO BE PASSIVE, MEANING THAT THEY ARE NOT ALLOWED TO PROVIDE ENERGY TO THE SYSTEM, EXCEPT A LEAKAGE CURRENT OF 50uA FOR EACH CONNECTED DEVICE. SEPARATELY POWERED EQUIPMENT NEEDS GALVANIC ISOLATION TO ASSURE THAT THE INTRINSICALLY SAFE FIELDBUS CIRCUIT REMAINS PASSIVE.

THE CABLE USED TO INTERCONNECT DEVICES NEEDS TO HAVE THE PARAMETERS IN THE FOLLOWING RANGE:

Loop Resistance R:	15.....150 Ohm/km
Inductance per unit length L:	0.4.....1 mH/km
Capacitance per unit length C:	80.....200 nF

C = C line/line + 0.5C line/screen, if both lines are floating, or
C = C line/line + C line/screen, if the screen is connected to one line

Length of trunk cable:	less than or equal to 1000m
Length of spur cable:	less than or equal to 30m
Length of spur splice:	less than or equal to 1m

AT EACH END OF THE TRUNK CABLE AN APPROVED INFALLIBLE LINE TERMINATION WITH THE FOLLOWING PARAMETERS IS SUITABLE:

R = 90.....100 Ohm C = 0.....2.2 uF

ONE OF THE ALLOWED TERMINATIONS MIGHT ALREADY BE INTEGRATED IN THE ASSOCIATED APPARATUS. THE NUMBER OF PASSIVE APPARATUS CONNECTED TO THE BUS SEGMENT IS NOT LIMITED DUE TO I.S. REASONS. IF THE ABOVE RULES ARE RESPECTED, UP TO A TOTAL LENGTH OF 1000 m (SUM OF TRUNK AND ALL SPUR CABLES) OF CABLE IS PERMITED. THE INDUCTANCE AND THE CAPACITANCE OF THE CABLE WILL NOT IMPAIR THE INTRINSIC SAFETY OF THE INSTALLATION.

UNLESS OTHERWISE SPECIFIED TOLERANCES
.X± _____ ∠ ±_____
.XX± _____
.XXX± _____
R OR CHAM _____
UNIT OF MEASURE _____
DO NOT SCALE THIS DWG
ANSI Y14.5M

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REVISIONS				
B	EJH	30SEP04	20417	

SUPERSEDES

Emerson Process Management Distribution Ltd Leicester, UK

MODEL 375
IS INSTALLATION DRAWING

	BY	DATE
DWN.	EJH	24AUG04
CHKD.	MJH	24AUG04
APVD.	VRM	24AUG04

SCALE NONE | TOOL A | SIZE C

DESIGN

DWG. NO. 00375–1130 SHEET 4 OF 4

REV B

Appendix C Glossary

Some of the terms used in this manual relate specifically to the operation of Rosemount transmitters, hand-held communicators, and other Rosemount products. The following list provides brief definitions.
See the sections listed for additional information.

Analog Output Trim
Digital trim operation that allows adjustment of the output electronics to conform to the plant standard of current. Three types of analog output trim are available: 4–20 mA output trim, 4–20 mA other scale, and low power.

Cloning
Off-line operation that uses a HART-based communicator to copy configuration data from one transmitter to one or more other transmitters that require the same data.

Commissioning
Functions performed with the HART-based communicator and the transmitter that test the transmitter and test the loop, and verify transmitter configuration data.

Configuration
Process of setting parameters that determine how the transmitter operates.

Damping
Output function that increases the response time of the transmitter to smooth the output when there are rapid input variations.

Descriptor
Sixteen-character field for additional identification of the transmitter, its use, or location. The descriptor is stored in the transmitter and can be changed using the HART-based communicator.

Digital Trim
Format function that allows you to adjust the transmitter characterization for purposes of digital calibration to plant standards. Digital trim includes two separate operations: sensor trim and analog output trim.

Failure Mode Alarm
Transmitter function that drives the analog output to a jumper-selectable high or low value in the event of an electronics failure.

Factory Characterization
Factory process during which each sensor module is subjected to pressures and temperatures covering the full operating range.
The sensor module memory stores data generated from this process for use by the microprocessor in correcting the transmitter output during operation.

HART (Highway Addressable Remote Transducer) Protocol
Communications standard that provides simultaneous analog and digital signal transmission between control rooms and field devices such as transmitters. All Rosemount SMART FAMILY products communicate using the HART protocol.

Lower Range Limit (LRL) Lowest value of the measured variable that the transmitter can be configured to measure.

Lower Range Value (LRV) Lowest value of the measured variable that the analog output of the transmitter is currently configured to measure.

Multidropping The connection of several transmitters to a single communications transmission line. Communication between the host and the transmitters takes place digitally with the analog output of the transmitters deactivated.

Reranging Configuration function that changes the transmitter 4 and 20 mA settings.

Send Data HART-based communicator command that transfers configuration data from the hand-held communicator's memory to the transmitter memory.

Sensor Trim Sensor trim function in which two accurate, end-point pressures are applied and all output is linearized between them. The selected end points should always be equal to or outside the LRV and URV. This is also known as a Full Trim.

Smart Term used to describe instruments that are microprocessor-based and feature advanced communications capabilities.

SMART FAMILY Rosemount pressure, temperature, level, and flow instruments with microprocessor-based digital electronics.

Span Algebraic difference between the upper and lower range values.

Tag Eight-character field for identifying the transmitter. The tag is stored in the transmitter and can be changed using the HART Communicator and the transmitter information function.

Transmitter Address Unique number (1-15) used to identify a multidropped transmitter. Transmitters that are not multidropped have 0 as an address.

Transmitter Security Jumper-selectable feature that prevents accidental or deliberate changes to configuration data.

Upper Range Limit (URL) Highest value of the measured variable that the transmitter can be configured to measure.

Upper Range Value (URV) Highest value of the measured variable that the analog output of the transmitter is currently configured to measure.

Zero Trim A zero-based, one-point adjustment used in differential pressure applications to compensate for mounting position effects or zero shifts caused by static pressure.

Index

A
Access Requirements
Circuit Side of Electronics Housing 2-5
Exterior of Electronics Housing 2-5
Process Flange Orientation 2-4
Terminal Side of Electronics Housing 2-4
Adjustment
Damping Adjustment . . . 4-15
Linearity Adjustment . . . 4-15
Amplifier Board Standoffs 6-5
Analog Electronics (Figure 12-1) 6-3
Analog Electronics Assembly . 6-2

B
Backup Ring Installation 5-16
Board Spacers 6-10
Brackets
Mounting Options 2-11
Bubbler Liquid Level Measurement 2-20
Bubbler System in Open Vessel 2-20
Liquid Level Measurement 2-20

C
Calibrate the Sensor 3-12
Calibration
Damping Adjustment . . . 4-15
Data Flow 4-11
Elevated or Suppressed Zeros 4-14
Linearity Adjustment . . . 4-15
Span Adjustment Range 4-11
Static Pressure Span Correction Factor 4-16
Zero Adjustment Range . 4-11
Zero and Span Adjustment 4-13
Characterization
Before Characterizing the Transmitter . . . 6-13
Characterizing with a Model 275 Communicator . 6-14
Circuit Side of Electronics Housing 2-5
Closed Vessels
Dry Leg Condition 2-18
Liquid Level Measurement 2-17
Wet Leg Condition 2-18
Commissioning the 1151 with a HART-Based Communicator . . 3-3
Commissioning the Transmitter on the Bench 3-1
Configuration
LCD Meter 2-21
Connecting the Electrical Housing to the Sensor 5-16
Connections
Electrical Housing to the Sensor 5-7
Header Board (Figure 9-4) 5-9

D
Damping Adjustment 4-15
Data Flow with Calibration Options 4-11
Digital Trim (Analog Output Trim and Sensor Trim) 4-4
Disassembly
Transmitter Disassembly 5-12
Drain/Vent Valves 2-8
Dry Leg Condition
Liquid Level Measurement 2-18

E
Electrical Housing 5-6, 5-7
Electrical Installation Considerations 2-13
Grounding 2-14
Power Supply 2-13
Signal and Test Terminals 2-14
Wiring 2-14
Elevated or Suppressed Zeros 4-14
Elevation and Suppression Jumper Settings 4-13
Environmental Considerations 2-17
Environmental Requirements
Mounting Requirements . . 2-8
Exterior of Electronics Housing 2-5

F
Filter Terminal Blocks
Installation 2-25

G
Gas
Mounting Requirements . . 2-8
Grounding 2-14
Effects on Accuracy for Fast Sample Computers 2-16
Transmitter Case 2-15

H
Hazardous Locations 2-17
Header Board Connections (Figure 9-4)
Housing
Electrical 5-6, 5-7
Connecting Sensor . . 5-7
Sensor Removal 5-6
Electronic
Circuit Side 2-5
Exterior 2-5
Terminal Side 2-4
Rotation 2-4

I
Impulse Piping 2-9
Installation Diagrams 2-9
Installation 2-25
Board Spacers 6-10
Electrical Considerations . 2-13
Environmental Considerations . 2-17
General Considerations . . 2-4
Hazardous Locations . . . 2-17
Mounting Bracket Options 2-11
Mounting Considerations 2-11
Power Supply Load Limitations 2-13
Process Considerations . 2-10
Signal Wiring Grounding . 2-15
Smart Retrofit Kit 6-10
Installation Diagrams
Impulse Piping 2-9
Integral Span and Zero Buttons 3-9, 3-10
Introduction 1-1

L
LCD Meter 2-21
Assembly 2-23
Configuration 2-21
Linearity Adjustment 4-15
Liquid
Mounting Requirements . . 2-8
Liquid Level Measurement
Bubbler System in Open Vessel . . . 2-20
Closed Vessels 2-17
Dry Leg Condition 2-18
Open Vessels 2-17
Wet Leg Condition 2-18

M
Maintenance
Reassembly Procedure . . . 5-7
Sensor Module Checkout . 5-9
Troubleshooting Symptoms and Corrective Action (Table 9-2) 5-3

Maintenance and Troubleshooting
Reassembly Procedure . 5-15
Return of Material 5-18
Transmitter Disassembly 5-12
Manual
Use of 1-1
Menu Tree 3-5
Meters
Optional Plug-in Meters . 5-18
Model 1151 Analog Electronics (Figure 12-1) 6-3
Mounting Bracket Options (Figure 4-2) 2-11
Mounting Considerations . . . 2-11
Mounting Requirements 2-8
Drain/Vent Valves 2-8
Impulse Piping 2-9
Taps 2-8

O

On-line Configuration
Transmitter Security 3-2
Open Vessels
Liquid Level Measurement 2-17
Optional Plug-in Meter 5-9
Optional Plug-in Meters 5-18
Options
LCD Meter 2-21
O-ring Installation 5-16

P

Piping
Impulse Piping 2-9
Power Supply 2-13
Load Limitations 2-13
Preliminary Precaution 5-15
Process Considerations 2-10
Process Flange Orientation . . . 2-4
Process Sensor Body . . . 5-6, 5-7
Process Sensor Body Removal 5-13
Sensor Module Checkout 5-14

Q

Quick Calibration
Transmitter Data Flow . . 4-11

R

Rangeability A-3
Reassembly Procedure 5-7, 5-15
Backup Ring and O-ring Installation 5-16
Connecting the Electrical Housing to the Sensor 5-7, 5-16
Electrical Housing 5-7
Optional Plug-in Meter . . . 5-9
Optional Plug-in Meters . 5-18
Preliminary Precaution . . 5-15
Process Sensor Body . . . 5-7
Removing Power 6-3
Removing the Amplifier Board Standoffs 6-5
Removing the Analog Electronics Assembly 6-2
Removing the Sensor from the Electrical Housing 5-6, 5-14
Reranging the Transmitter
Using the Integral Span and Zero Buttons . . . 3-9, 3-10
Retrofit Kit 6-10
Retrofitting the Model 1151 Transmitter
Installing the Board Spacers 6-10
Installing the Smart Retrofit Kit 6-10
Model 1151 Analog Electronics (Figure 12-1) . . . 6-3
Removing Power 6-3
Removing the Analog Electronics Assembly 6-2
Return of Material 5-18
Rotating Housing 2-4

S

Sensor
Connecting to the Electrical Housing 5-7
Removal from Electrical Housing 5-6
Sensor Body Removal . . 5-13
Sensor Module Checkout 5-14
Sensor Removal 5-14
Sensor Module Checkout 5-9
Header Board Connections (Figure 9-4) 5-9
Sensor Trim 4-4
Setting Output Units 4-2
Setting the Loop to Manual . . . 3-7
Signal Terminals 2-14
Signal Wiring Grounding . . . 2-15
Smart Retrofit Kit 6-10
Span Adjustment Range . . . 4-11
Specifications and Reference Data
Model 1151 Transmitter Range Availability A-3
Rangeability (Table 10-1) . A-3
Startup
Testing Equipment and Loop 3-6
Static Pressure Span Correction Factor 4-16
Steam
Mounting Requirements . . 2-8
Suppressed Zeros
Elevated Zeros 4-14
Systematic Error Correction . 5-10

T

Taps 2-8
Terminal Side of Electronics Housing 2-4
Terminals 2-14
Signal 2-14
Test 2-14
Test Terminals 2-14
Transient Protection
Installation 2-25
Transmitter
Data Flow 4-11
Disassembly 5-12
Electrical Housing 5-6
Process Sensor Body .5-6
Removing the Sensor from the Electrical Housing 5-6
Exploded View 5-13
Range Availability (1151) A-3
Security 3-2
Transmitter Case 2-15
Transmitter Disassembly
Process Sensor Body Removal .5-13
Removing the Sensor from the Electrical Housing 5-14
Sensor Module Checkout 5-14
Transmitter Reassembly 5-15
Backup Ring and O-ring Installation 5-16
Connecting the Electrical Housing to the Sensor . .5-16
Optional Plug-in Meters .5-18
Preliminary Precaution . .5-15
Troubleshooting Symptoms and Corrective Action (Table 9-2) . .5-3

V

Vent/Drain Valves 2-8
Vessels
Open/Closed 2-17

W

Wet Leg Condition
Example (Figure 4-6) . . .2-19
Liquid Level Measurement 2-18
Wiring 2-14
Signal Terminals 2-14
Test Terminals 2-14

Z

Zero Adjustment Range 4-11
Elevation and Suppression Jumper Settings 4-13
Zero and Integral Span Buttons 3-9, 3-10
Zero and Span Adjustment . .4-13

Reference Manual
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Rosemount 1151

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EMERSON™
Process Management

CALGON CARBON CORPORATION

Specification No. VS23

For

Vessel Lining Application Specification
Using Carboline / Plasite 4006 Vinyl Ester
For Immersion Service

TABLE OF CONTENTS

1. QUALITY REQUIREMENTS 1
2. SCOPE OF WORK 2
3. REFERENCE DOCUMENTS 2
4. SERVICE CONDITIONS 5
5. MATERIALS 6
6. DELIVERY, STORAGE AND HANDLING 6
7. APPLICATION 7
8. INSPECTION AND TESTING 13
9. SPECIAL REQUIREMENTS FOR NSF-61 (WHEN SPECIFIED) 15
10. APPENDIX A-INSPECTION PROCEDURE 17
11. APPENDIX B- PLASITE 4006 PRODUCT DATA 33

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1. QUALITY REQUIREMENTS

1.1. Calgon Carbon Corporation relies on the joint effort between supplier and buyer to emphasize conformance to specification. If conflict exists between this specification, drawings, purchase orders, data sheets or appendix documents, it is the responsibility of the supplier to bring such conflict to the attention of Calgon Carbon Corporation for resolution.

1.2. All vendors are expected to supply products and services with zero defects. Vendors are encouraged to use error prevention processes in their manufacturing procedures to obtain this goal. Calgon Carbon Corporation prefers to address quality issues prior to, and during the lining process rather than at the end. Where the vendor does not fully meet the requirements of this specification, implementation of a corrective action plan to address any deficiencies will be required in writing and subject to Calgon Carbon Corporation approval.

1.3. The vendor agrees to retain objective evidence, including written records of the inspections, measurements and tests performed in the course of blasting, lining, testing, and inspecting. These records shall be made available to the Calgon Carbon Corporation's Quality Inspector for review upon request. Calgon Carbon Corporation may at its discretion use a third party quality inspector for auditing purposes. The vendor's quality department will be notified if this is the course of inspection. Calgon Carbon Corporation requires third party inspectors to perform inspections using the coating manufacture's standards, calibrations and methodologies. All inspectors are to identify themselves at the vendor's facility, inform the vendor of the purpose and scope of the inspection and to conduct themselves in a professional non-confrontational manner.

1.4. The vendor shall submit their corporate QA/QC program, QC personnel with contact info and responsibilities. Inspection, testing procedures and documents are to be submitted to Calgon Carbon Corporation for approval. Please send to the attention of Quality Inspector, Equipment and Assembly Plant, at 4301 Grand Ave, Neville Island, PA 15225.

1.5. In the event of failure of the lining to withstand the service conditions set forth in Article 4.0, of this specification, the Vendor shall, at his expense, replace the

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defective materials and workmanship to Calgon Carbon Corporation's satisfaction.

2. SCOPE OF WORK

2.1. This specification covers materials, surface preparation, application and testing of protective coatings for internal lining of carbon steel vessels.

2.2. The scope of work includes all labor, materials, equipment and services required for surface preparation, lining and testing the vessels indicated on the drawings.

2.3. The entire internal surface of the designated vessels including all nozzles and man ways shall be lined.

2.4. The lining must completely protect the internal metal surfaces from corrosion.

3. REFERENCE DOCUMENTS

3.1. Carboline Plasite 4006 Technical Bulletin, Carboline Company's most current version.

3.2. When needed use Carboline Plasite PA-3 Specification.

3.3. SSPC, "Pictorial Surface Preparation Standards."

3.4. SSPC, "Profile Comparative Panels."

3.5. NACE Publication RP0288-94, "Recommended Practices for Inspection of Linings on Steel and Concrete."

3.6. NACE Publication 6F-166, "Recommended Practices for Inspection of Linings on Steel and Concrete."

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3.7. D.M. Berger and S.E. Mrox, “Instruments for Inspection of Coatings,” ASTM, Journal of Testing & Evaluation, Vol. 4, No.1, 1969.

3.8. NACE Publication 6J-162, “Guide to the Preparation of Contracts and Specifications for the Application of Protective Coatings.”

3.9. NACE Standard RP-01-78, “Design, Fabrication and Surface Finish of Metal Tanks and Vessels to be lined for Chemical Immersion Service.”

3.10. Ferrous Metals-Preparation Methods

3.10.1 Solvent Cleaning (SSPC-SP1): Solvents such as water, mineral spirits, xylol, toluol, ect., are used to remove solvent-soluble foreign matter from the surface of ferrous metal. Rags and solvents must be replenished frequently to avoid spreading the contaminant rather than removing it. Low-pressure (1500-4000 psi) high volume (3-5) gal./min.) water washing with appropriate cleaning chemicals is a recognized “solvent cleaning” method. All surfaces should be cleaned per this specification prior to using hand tools or blast equipment.

3.10.2 Hand Tool Cleaning (SSPC-SP2) (SSI-St2): A mechanical method of surface preparation involving wire brushing, scraping, chipping and sanding. Not the most desirable method of surface preparation, but can be used for mild exposure conditions. Optimum performances of protective coatings systems should not be expected when hand tool cleaning is employed.

3.10.3 Power Tool Cleaning (SSPC-SP3) (SSI-St3): A mechanical method of surface preparation widely used in industry and involving the use of power sanders or wire brushes, power chipping hammers, abrasive grinding wheels, needle guns, ect. Although usually more effective than hand tool cleaning, it is not considered adequate for use under severe exposure conditions or for immersion applications.

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3.10.4 Power Tool Cleaning to Bare Metal (SSPC-SP11): Utilizing same equipment as Power Tool Cleaning to remove all visible coatings and contaminants to bare metal substrate.

3.10.5 White Metal Blasting (SSPC-SP5), (SSI-Sa3), or (NACE #1): The removal of all visible rust, mill scale, paint, and contaminants, leaving the metal uniformly whit or gray in appearance. This is the ultimate in blast cleaning. Use where maximum performance of protective coatings is necessary due to exceptionally severe conditions such as constant immersion in water or liquid chemicals.

3.10.6 Near White Blast (SSPC-SP10), (SSI-Sa2½), or (NACE #2): In this method all oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint, or other foreign matter have been completely removed from the surface by abrasive blasting, except for very light shadows, very slight streaks or slight discolorations caused by rust stain, mill scale oxides or slight, tight residues of paint of coating. At least 95% of each square inch of surface areas shall be free of all visible residues, and the remainder shall be limited to the light discoloration mentioned above. From a practical standpoint, this is probably the best quality surface preparation that can be expected today for existing plant facility maintenance work.

3.10.7 Commercial Blast (SSPC-SP6), (SSI-Sa2), or (NACE #3): All oil, grease, dirt, rust scale and foreign matter are completely removed from the surface and all rust, mill scale and old paint are completely removed by abrasive blasting except for slight shadows, streaks, or discolorations caused by rust stain, mill scale oxides or slight, tight residues of paint of coating that may remain. If the surface is pitted, slight residues of rust or paint may be found in the bottom of pits: at least two-thirds of each square inch of surface area shall be free of all visible residues and the remainder shall be limited to the light residues mentioned above.

3.10.8 Brush Off Blast (SSPC-SP7), (SSI-Sa1), or (NACE #4): A method in which all oil, grease, dirt, rust scale, loose mill scale, loose rust,

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and loose paint or coatings are removed completely. Tight mill scale and tightly-adhered rust, paint and coatings are permitted to remain. However, all mill scale and rust must have been exposed to the abrasive blast pattern sufficiently to expose numerous flecks of the underlying metal fairly uniformly distributed over the entire surface.

3.10.9 High and Ultra-High Pressure Water Jet Cleaning (SSPC-SP12), or (NACE #5): As part of the surface preparation, deposits of oil, grease, and foreign matter must be removed by ultra-high pressure water jetting, by steam cleaning with detergent, or by methods in accordance with SSPC-SP1. The difference in the degrees of surface cleanliness is defined by the amount of pressure as follows:

Low Pressure Water Cleaning (LP WC)	34 MPa	(5 000 psi)
High Pressure Water Cleaning (HP WC)	34 to 70 MPa	(5,000 to 10,000 psi)
High Pressure Water Jetting (HP WJ)	70 to 170 MPa	(10,000 to 25,000 psi)
Ultra-High Pressure Water Jetting (UHP WJ)	Above 170 MPa	(25,000 psi)

4. SERVICE CONDITIONS

4.1. The lining will be exposed to static and moving water slurries of granular activated carbon, resin and other abrasive media's.

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4.2. The characteristics of the slurries will be as follows:

4.2.1	Media in Water		
4.2.2	Temperature	-	35-100F
4.2.3	pH -	-	5.0 to 9.0
4.2.4	Density	-	26 lbs./cu.ft. up to 36 lbs.cu.ft., Dry
4.2.5	Abrasive	-	Yes

5. MATERIALS

5.1. The lining shall be Plasite 4006 coating material as supplied by Carboline Company. Products from other suppliers or manufacturers are not approved.

6. DELIVERY, STORAGE AND HANDLING

6.1. Product Delivery: Lining material shall be delivered to the site in sealed, original, labeled containers with the Plasite name, product number, batch number, color designation, and instructions for mixing and thinning.

6.2. Storage: Vendor shall be responsible for the proper storage of all coating materials. Damaged, leaking, or unlabeled containers shall be disposed of daily.

6.3. Storage Location: Lining materials shall be stored in a place specifically assigned for that purpose which is dry and out of direct sunlight and stored in a manner so as not to exceed the manufacturer's temperature limitations. In all cases, the storage and handling of lining material shall conform to the requirements of the manufacturer and the applicable safety regulatory agencies.

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7. APPLICATION

7.1. Surface Preparation

7.1.1 The lining vendor shall install and maintain protective coverings on any surface not to be lined to protect the surface during surface preparation and lining application.

7.1.2 Grease, Oil & Interference Material: Surface contamination on bare steel such as grease, oil, tape tags, markings, etc. shall be removed by the vendor by solvent cleaning per SSPC-SPI, SSPC-SP12, or NACE #5 prior to blast cleaning.

7.1.3 Surface Irregularities: Prior to blast cleaning, all surfaces shall be inspected for weld spatter, weld flux, or any other surface irregularities. When discovered, they will be removed by grinding.

7.1.4 Edges: All sharp edges will be ground to a smooth 1/8 inch radius. Areas inside the vessel that are not expected to be in direct contact with media are not required to be chamfered unless noted on the specific detail. (A specific example: the holes in the internal cone design. They do not require a radius or chamfer on their edge since filter nozzles must fit snugly into these holes for proper service.)

7.1.5 Ambient Conditions: Final blast cleaning shall not be performed when the surface temperature is less than 5^0F greater than the dew point temperature of the surrounding air, nor when the relative humidity is greater than 90%.

7.1.6 Compressed Air Cleanliness: The air supply used for blast cleaning shall be free from moisture and oil contamination. The air cleanliness shall be verified at least once per shift for each compressor used. The test involves directing the air stream onto a piece of white paper held not more than 18-inches away from

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the air outlet. The test shall be run downstream of moisture and oil separators for a period of not less than two-minutes. Sufficient freedom from oil and water is confirmed if no soiling or discoloration is visible on the paper. If air contamination is evidenced, the filters shall be changed or cleaned, traps emptied, after-coolers, moisture separators or filters added, the equipment maintained, or such adjustments made as may be otherwise required to achieve clean, dry air for all blast cleaning, coating application, blow-down, or any other quality operations involving compressed air. Verification of this activity will by required by Calgon Carbon Corporation's inspector.

7.1.7 Abrasive/Profile: The abrasive selected shall be identified by the vendor prior to use. The abrasive shall have a sharp, hard cutting surface and shall be dry and free of oil or soluble salt contaminants. Copper slag shall not be used. The abrasive shall provide an anchor pattern of at least 4.0 mils in depth. The surface profile shall be measured using the WPCC 4000 Series Anchor Profile Comparator or Testex replica tape and measuring the results with a calibrated micrometer.

7.1.8 Abrasive Blasting of Carbon Steel: The preparation of all carbon steel shall be by abrasive blast cleaning to remove all mill scale, rust and coatings.

7.1.9 Dry abrasive blast all interior steel surfaces in accordance with SSPC-SP5 or NACE #1, "White Metal Blast Cleaning."

7.2. Coating Application Equipment: Reference Source: Carboline Pa-3 Specification

7.2.1 CONVENTIONAL AIR SPRAY GUNS: The following chart indicates the standard types of conventional air spray guns, nozzles and air caps recommended for the best atomization, material break-up and high production rates. Use of a pot with an agitator is preferred.

Gun Fluid Air

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Binks #2001 66-SS 63-PB

DeVilbiss JGA-510 E 797

Graco P-800 04-02
Note: The same guns may be used with a stainless needle and tip. GUN FLUID AIR Binks #2001 59ASS 251 with a 559SS needle.

7.2.2 Airless Spray Equipment: The airless pump shall be of sufficient size to properly atomize the coating with the spray tip selected. The orifice size required will range between .013" to .035" varying with the viscosity of the coating. In selecting a spray tip, a suitable fan width for the configuration of the substrate shall be of major consideration. The amount of thinner required will vary up to approximately 20% depending on temperature, substrate size and individual technique.

GUN TIP Graco Bulldog (or equivalent) .013"-.035"

The high build vinyl ester coatings require a large capacity pump with a capability of 3 gpm, a minimum tip size of .025" with a 12" spray width recommended. The liquid pressure shall be in the range of 1800 to 2200 psi. Airless spray is not recommended for abrasion resistant formulations because of the extreme wear on the tips and lower units of the pump unless the airless unit is designed for abrasive type of materials.

7.2.3 Airless Spray Advantages and Disadvantages:

Advantages: No problem with contaminated air. Overspray is kept to a minimum and the production rate is high. Thick films may be obtained without runs or sags under some conditions.

Disadvantages: The large output of the gun makes it difficult to handle in small tanks where working conditions are crowded or cramped causing runs or sags.

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Due to the large amount of liquid handled and the easy build properties of this equipment, it is possible, with improper thinning and improper technique, to apply the coating material at too high a rate per pass. The end result usually being solvent entrapment and porous film, runs and sags.

7.2.4 Equipment Manufacturers:

Supplier Name Supplier Address Product or Service

Binks Manufacturing Co.
9201 W. Belmont Avenue
Franklin Park, IL 60131
Air Atomizing & Airless Spray Equipment

DeVilbiss Ransburg
1724 Indian Wood Circle, Ste. F
Maumee, OH 43537
Air Atomizing & Airless Spray Equipment

Graco, Inc.
P.O. Drawer 1441
Minneapolis, MN 55440
Airless Spray Equipment
Nordson Corporation 555 Jackson Street
Amherst, OH 44001
Airless Spray Equipment

7.3. Coating Application

7.3.1 All coatings must be applied in a controlled environment.

7.3.2 Surface Cleanliness: The surface of the prepared steel shall be blown down (clean, dry, compressed air), vacuumed prior to coating application to remove spent abrasive, dust and other interference material. If grease or oil is deposited on the surface, they shall be removed by solvent cleaning (SSPC-SP1) prior to

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coating application. Any rust which has formed shall be removed to the specified degree of cleanliness prior to lining, which may require reblasting.

7.3.3 Ambient Conditions: Coatings shall be applied only when the interior surface and air temperatures are between 60^0F and 100^0F, the relative humidity in the tank is less than 90%, and the temperature of the surface to be painted is at least 5^0F above the dew point temperature of the air in the tank. Metal temperature shall be recorded on the form EAP-2A provided before application of coating under application data, under ST designation, see Appendix A.

7.3.4 Mixing: Lining's to be mixed shall have been delivered to the jobsite and stored in accordance with Section 6 of this specification and shall not have exceeded its shelf life. Mixing shall conform to the requirements of the coating manufacturer.

Mix Part A into Part B using a high-speed mechanical air or an explosion proof motor agitator with mixing blades fitting close to sides of container, making sure all of Part A is completely mixed with Part B for approximately 15 to 30 minutes to be properly blended. Mix Part D (the promoter) into Part A & B until obtaining a smooth liquid free of any streaking from Part D is complete. Part C (the catalyst) can then be mixed into Part A, Part B & Part D blend.

Note: Splitting of kits must not be done.
Caution: The promoter (Part D) and the catalyst (Part C) must be separately mixed into Part A/Part B blend. Any contact of Unmixed Part D with Part C may lead to a fire or explosion.

Caution: Avoid breathing dust.

Only complete kits shall be mixed. Lining which has skinned, gelled, separated, or otherwise deteriorated during storage to the extent that it cannot be remixed to a homogeneous film of the intended viscosity, uniformity and

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consistency shall not be used. Mixed coatings shall not be used beyond their pot life.

7.3.5 Thinning: Only Plasite 20 Thinner shall be used for thinning. The amount of thinning will be limited (except for stripe coat). Thinners, as specified, shall be used to adjust coating for various application conditions. A ratio of 5-20% shall be used depending on ambient conditions and metal temperatures. At 75°F, a suggested thinning ratio is 5-10%; the amount of thinner may be increased at a ratio of approximately 5% per 5°. At higher temperatures, a slower evaporating solvent must be utilized. Thinner should be added if surface temperatures are lower than ambient. A faster evaporating solvent must be utilized in this case.

7.3.6 Methods: Coatings shall be applied by conventional or airless spray equipment. Coating applications shall be in accordance with the requirements of Calgon Carbon Corporation VS-7 Spec, SSPC-PA1 and the Carboline Plasite 4006 Technical Bulletin. In the event of a conflict, the requirements of this specification, manufacturer's instructions and SSPC-PA1l shall prevail in that order. If NSF 61 is specified on the drawing, follow Plasite instructions for compliance to this standard.

7.3.7 Stripe Coat: A stripe coat of Plasite 4006 thinned 50% with Plasite Thinner 20 shall be applied to all edges, corners, welds, crevices and irregularities prior to each full coat application. Such striping shall extend a minimum of 3-inches beyond the edge or irregularity.

7.3.8 Brush Application: Brush application is not allowed except for touch-up repairs, inaccessible areas and stripe coating. Those areas for which the contractor desires to use brush application shall be carefully defined prior to the start of all work.

7.3.9 Agitation: Lining must be kept agitated in conventional spray pots or containers during lining application.

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7.3.10 Coating Thickness: The coating shall be applied in a minimum of two coats. Each coat shall have a dry film thickness of between 13 and 16 mils, with a total system thickness of between 25 and 35 mils. Dry Film Thickness readings need to be taken after each coating of lining. The area then needs to be mapped to recognize the high and low areas. This must be done to avoid too little or too much mileage on the interior of the vessel. High mileage is not an acceptable condition, in most cases the coating will need to be removed to the 25 to 35 mils and the surface condition back to a smooth streamline surface. This is a very expensive process and should be avoided at all cost.

7.3.11 Coating Continuity: All coats shall have smooth, streamline surfaces free of dry spray, over spray, orange peel, fish eyes, craters, bubbles and other significant defects. Shadow-through, honey-comb spray, skips and misses are not acceptable. Runs or sags can be brushed out while the material remains wet. Areas where blast products or other debris have become embedded in the paint film shall be prepared by removing these products and touching up the area. In addition, the final coat shall be tested for discontinuities by performing high-voltage holiday testing at 3,500 volts to obtain a pinhole-free film. Holiday testing shall be performed only after a minimum cure time of 48-hours at 70^0F with ventilation has elapsed after application of the final coat.

7.3.12 Re-coat Time and Cleanliness: Subsequent coats shall be applied only after the previously-applied coat has been allowed to dry as required by the Plasite 4006 Technical Bulletin, but as soon as possible in order to minimize exposure to inter-coat contamination. Any such surface contamination which is present shall be removed prior to the application of subsequent coats.

8. INSPECTION AND TESTING

8.1. Inspection

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8.1.1 The lining vendor shall be responsible for inspecting all phases of the surface preparation and lining application in accordance with Calgon Carbon Corporation's and/or the coating manufacturer's inspection procedures.

8.1.2 Calgon Carbon Corporation reserves the right to inspect all phases of the lining operation to assure compliance with specification requirements. The vendor shall repair/correct any and all deficiencies at his own expense. The vendor shall provide accessibility and lighting for any inspections. It is not intended, however, that the presence or activity of such inspection shall in any way whatsoever relieve the vendor of his obligation to provide inspection of his own to assure compliance with this specification. In all cases, Calgon Carbon Corporation or its approved agent will perform final inspection before acceptance.

8.1.3 Calgon Carbon Corporation reserves the right to stop any and all work at any time for non-compliance with the requirements of this specification.

8.2. Testing

8.2.1 Use a properly calibrated non-destructive Type II dry film thickness gage:

- Positector: Measures non-magnetic coating thickness over ferrous substrates with an accuracy of ±3%. Digital reading remains until next measurement taken.
- MikroTest Thickness Gauge: A highly accurate hand gauge which operates on the attraction power of a permanent magnet through a non-magnetic coating to the base steel with an accuracy of ±5%.

Frequency and method of calibration shall be in accordance with the SSPC-PA-2.

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8.2.2 Determine the average dry film thickness of the lining. All areas with less than 30 mil DFT must have additional lining sprayed on before spark test. High or low areas that require remedial action will be marked so on the lining with chalk. When work is completed, all chalk markings shall be removed. Run thickness test prior to spark test.

8.2.3 One (1) reading shall be taken every 10-ft² and any reading outside of the manufacturer's acceptable range, either higher or lower, will require four (4) additional readings 1-ft in each direction from the suspect reading. Any average of the five (5) readings will be figured and must fall within the manufacturer's acceptable range. If not, mark the area to be corrected with chalk.

8.2.4 After all the readings are taken, they are to be averaged in three (3) sections: top head, shell, and the bottom head or cone. These three averages, along with all the readings taken, shall be recorded on a Calgon Carbon Lining Inspection Report (Appendix A).

8.2.5 For method and frequency of calibration for the dry-film thickness gauge, see the calibration section of the Manufacturer's information. Any areas not in compliance shall be marked for remedial action with chalk by the inspector.

8.2.6 Spark test for pinholes with a 4500 VDC detector on all coated surfaces. A Tinker and Rasor Model AP-W, or equivalent device, is required for this operation; 3500-volt maximum, minimum 48-hours at 70°F cure before spark test is run.

9. SPECIAL REQUIREMENTS FOR NSF-61 (WHEN SPECIFIED)

9.1. When the end-use application requires compliance with NSF-61, Carboline Plasite must be applied in accordance with specific instructions found in the product bulletin. Applicator must follow these specific instructions.

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9.2. Calgon Carbon Corporation will notify lining vendor that this section (9.0) applies by signifying such in the purchase order and/or drawings.

9.3. Force curing may follow the date of application but must be completed prior to the disinfection of the vessel at customer site.

9.4. The NSF criteria specified by Carboline Plasite cannot be altered.

9.5. Force curing must be conducted in a controlled manner. Heat rise shall be not greater than 1 degree per minute, up to the maximum temperature needed to achieve a 200 F minimal surface temperature. This is critical to avoid blistering or post-cure holidays.

9.6. Heat should be applied at top or bottom head to allow equal flow of hot air. If heating in the shell, there should be an internal attachment to allow heat to distribute equally so there is not a section of lining that heats faster than the rest. See appendix for recommended flow distribution according to Plasite's guide.

9.7. A strip recorder with multiple thermocouples (or other similar device) shall be used to record the temperature during the force cure process. Records shall be forwarded to Calgon Carbon Corporation for retention. Please send to the attention of Quality Inspector, Equipment and Assembly Plant, at 4301 Grand Ave, Neville Island, PA 15225.

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10. APPENDIX A- INSPECTION PROCEDURE

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APPENDIX A-INSPECTION PROCEDURE

SECTION ONE-SURFACE PREPARATION Job Number:_____ Vessel Number:_____
Final Inspection:_____

	Acceptable
1. Verify prior to blast cleaning that sharp edges, weld spatter, slivers, laminations, scabs or any other surface irregularities have been adequately removed to provide a surface suitable for coating application.	Yes ☐ No ☐ **Verified By:**_____ **Date:**_____
2. Verify prior to blast cleaning that heavy deposits of oil and/or grease have been adequately removed in accordance with "Solvent Cleaning" (SSPC-SPI).	Yes ☐ No ☐ **Verified By:**_____ **Date:**_____
3. Prior to blast cleaning operations, perform compressed air cleanliness test at least once per eight-hour shift. Insert a clean, white blotter or clean, white paper into the air stream no more than 18-inches from air source downstream of moisture and oil separators for approximately two minutes. Examine the blotter or paper for signs of moisture and/or oil contamination. Blast cleaning should not begin unless air is free of detrimental amounts of oil and/or water.	Yes ☐ No ☐ **Verified By:**_____ **Date:**_____

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APPENDIX A-INSPECTION PROCEDURE

SECTION ONE-SURFACE PREPARATION (Continued)

Job Number:_____ Vessel Number:_____
Final Inspection:_____

	Acceptable
4. Verify that only clean and dry abrasives will be used. If bulk abrasive is to be used, verify that the abrasive is properly protected from rain, moisture and oil.	Yes ☐ No ☐ **Verified By:**_____ **Date:**_____
5. If abrasives are recycled, test for the presence of abrasive contamination. Add approximately one ounce of recycled abrasive to several ounces of clean water. Shake contents vigorously and visually examine the water level for signs of oil contamination.	Yes ☐ No ☐ **Verified By:**_____ **Date:**_____
6. Angular abrasive that will provide an anchor profile depth minimum equal to the SPCC 4000 Series Blast Comparator will be used.	Yes ☐ No ☐ **Verified By:**_____ **Date:**_____
7. Verify that required protective coverings are intact to assure that previously-coated surfaces will not be damaged during blast cleaning operations.	Yes ☐ No ☐ **Verified By:**_____ **Date:**_____

APPENDIX A-INSPECTION PROCEDURE

SECTION ONE-SURFACE PREPARATION Job Number:_____ Vessel Number:_____

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(Continued) Final Inspection:_____

8. Monitor and record ambient conditions and surface temperatures during blast cleaning operations using a psychrometer, surface temperature thermometer and U.S. Weather Bureau Tables. Yes ☐ No ☐ **Verified By:**_____ **Date:**_____

9. "Final blast cleaning" shall not be performed unless the surface temperature is at least 50°F higher than the dew point. "Rough blasting" may be performed regardless of ambient conditions, but must be "final blast cleaned" when conditions become favorable. Yes ☐ No ☐ **Verified By:**_____ **Date:**_____

10. Verify that blast cleaned surfaces have been prepared in accordance with SSPC-SP5, SSI-Sa3, or NACE#1, "White Metal Blast Cleaning". SSPC-VIS-1 may be used as a visual reference. Mark all non-conforming areas with chalk or spray paint for rework. Yes ☐ No ☐ **Verified By:**_____ **Date:**_____

APPENDIX A-INSPECTION PROCEDURE

SECTION ONE-SURFACE PREPARATION Job Number:_____ Vessel Number:_____
(Continued) Final Inspection:_____

11. Verify the profile (4 mils minimum) has been achieved using the WPCC 4000 Series Blast Comparator. Yes ☐ No ☐ **Verified By:**_____ **Date:**_____

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12. Using a dry film thickness gage, determine the magnetic base reading and record. Yes ☐ No ☐ **Verified By:**_____ **Date:**_____

SECTION TWO- LINING MATERIAL PREPARATION

1. Verify that all containers are sealed, intact and properly labeled. Yes ☐ No ☐ **Verified By:**_____ **Date:**_____

2. Verify that all coating material temperatures are at least 60°F before mixing by the use of a stem thermometer. Yes ☐ No ☐ **Verified By:**_____ **Date:**_____

3. Verify type of coating mixed, record and retain batch numbers of all components, type of thinner and batch number, thinning ratios, time of mix, maximum pot life, etc. Yes ☐ No ☐ **Verified By:**_____ **Date:**_____

APPENDIX A-INSPECTION PROCEDURE

SECTION TWO- LINING MATERIAL PREPARATION (Continued)

Job Number:_____ Vessel Number:_____
Final Inspection:_____

4. Verify that all three components are combined and thoroughly mixed in the proper proportions to obtain a uniform color, free of lumps. Yes ☐ No ☐ **Verified By:**_____ **Date:**_____

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5. Verify that only the recommended thinner is used. Yes ☐ No ☐ **Verified By:**_____ **Date:**_____

6. Verify that the pot life is observed. Yes ☐ No ☐ **Verified By:**_____ **Date:**_____

APPENDIX A-INSPECTION PROCEDURE

SECTION THREE- APPLICATION LINING

Job Number:_____ Vessel Number:_____
Final Inspection:_____

1. Monitor and record ambient conditions and surface temperatures every three to four hours during lining application using a psychrometer, surface temperature thermometer and U.S. Weather Bureau Tables. Coating application shall not be permitted when the surface temperature is less than 50°F above the dew point. No coatings shall be applied when the surface and/or material temperatures are less than 70°F. No coating shall be applied when the surface temperature is expected to drop below 60°F before it has dried. Coating application shall not be permitted when the relative humidity is greater than 90%. Yes ☐ No ☐ **Verified By:**_____ **Date:**_____

2. Verify compressed air cleanliness and test for conventional spray application and blow down operations (see Section 9.1.3). Plasite 4006 must be applied using an agitated conventional pressure pot using continuous agitation during application. Yes ☐ No ☐ **Verified By:**_____ **Date:**_____

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APPENDIX A-INSPECTION PROCEDURE

SECTION THREE- APPLICATION LINING (Continued)

Job Number:_____ Vessel Number:_____
Final Inspection:_____

3. Verify that protective coverings previously established are intact. Yes ☐ No ☐ **Verified By:**_____ **Date:**_____

4. Verify that surrounding air is free of airborne contaminants prior to the application of coatings. Yes ☐ No ☐ **Verified By:**_____ **Date:**_____

5. Verify intercoat cleanliness and that blast-cleaned surfaces have been cleaned to assure that coatings will not be applied over oil, grease, dirt, dust, spent abrasive, etc. Yes ☐ No ☐ **Verified By:**_____ **Date:**_____

SECTION FOUR- APPLICATION OF FIRST COAT

1. Verify that Plasite 4006 has been applied to all surfaces prepared that day before visual oxidation takes place. Any surfaces not primed the same day shall be reblasted prior to primer application. Yes ☐ No ☐ **Verified By:**_____ **Date:**_____

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APPENDIX A-INSPECTION PROCEDURE

SECTION FOUR- APPLICATION OF FIRST COAT (Continued)

Job Number:_____ Vessel Number:_____
Final Inspection:_____

2. Verify that weld seams have been brush-coated at least 3-inches on each side of seam prior to spray application.

Yes ☐ No ☐ **Verified By:**_____ **Date:**_____

3. Verify that the first coat has been applied to a dry film thickness of 13-16 mils. Perform dry film thickness tests in accordance with SSPC-PA2.
(Deduct magnetic base reading.)

Yes ☐ No ☐ **Verified By:**_____ **Date:**_____

SECTION FIVE- APPLICATION OF FINAL COAT

1. Verify that previously-coated surfaces have dried at least eight hours at 70°F with ventilation prior to application of second coat.

Yes ☐ No ☐ **Verified By:**_____ **Date:**_____

2. b) Verify that the final coat has been applied to a dry film thickness of 13-16 mils. Perform dry film thickness test in accordance with SSPC-PA2.
(Deduct primer thickness.)

Yes ☐ No ☐ **Verified By:**_____ **Date:**_____

APPENDIX A-INSPECTION PROCEDURE

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SECTION SIX- FINAL INSPECTION OF LINED SURFACES Job Number:_____ Vessel Number:_____
Final Inspection:_____

1. Verify that all surfaces have a smooth and uniform appearance free of any irregularities such as debris inclusions, scuff marks or spatter. Yes ☐ No ☐ **Verified By:**_____ **Date:**_____

2. Verify that the total dry film thickness (minimum two coats) is 25-35 mils. Perform dry film thickness test in accordance with SSPC-PA2. Yes ☐ No ☐ **Verified By:**_____ **Date:**_____

3. Allow 48-hours cure at 70°F before holiday testing. Verify that a void-free, continuous film has been achieved by performing high-voltage holiday detection on 100% of the coated surfaces. The voltage shall be set at 3,500-volts. Mark all discovered holidays and re-test all repairs. Yes ☐ No ☐ **Verified By:**_____ **Date:**_____

4. All repairs shall be made in strict accordance with this specification. Yes ☐ No ☐ **Verified By:**_____ **Date:**_____

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APPENDIX A

VESSEL LINING INSPECTION REPORT
QUALITY CONTROL PROCEDURE EAP-2

PROJECT/STOCK NO._____ N.B. NO._____ DATE_____

COMPANY_____ INSPECTOR_____

TYPE OF LINING_____ D.F.T. REQUIRED_____

TYPE OF PAINT_____ D.F.T. REQUIRED_____

EXTERIOR INSPECTION_____

_____

INTERIOR INSPECTION (VISUAL & UNDER CONE)_____

_____

HIGH D.F.T. READINGS:	TOP_____	BOTTOM_____	SHELL_____
LOW D.F.T. READINGS:	TOP_____	BOTTOM_____	SHELL_____
AVG. D.F.T. READINGS:	TOP_____	BOTTOM_____	SHELL_____

CONTINUITY TEST (VOLTS_____) _____

REPAIRS REQUIRED: NO_____ YES_____

COMMENTS_____

_____

_____

_____

_____

ALL REPAIRS HAVE BEEN MADE/INSPECTED AS DIRECTED ABOVE: DATE_____

BY_____ AUTHORIZED APPROVAL BY_____

(APPLICATOR IS REQUIRED TO COMPLETE FORM AND RETURN WITHIN FIVE (5) WORKING DAYS OF CALGON CARBON'S INSPECTION.)

FAX TO: (412) 264-2060
CALGON CARBON CORPORATION
ATTENTION: Quality Inspector

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APPENDIX A LINING / COATING REPORT
QUALITY CONTROL PROCEDURE EAP-15D
****

PROJECT SHORTNAME_____NAT=L. BOARD NO._____

PRE-SURFACE PREPARATION
RADIUSED EDGES: Y___ N___ WELD SURFACE CONDITION: G___ B___
WELD SPATTER: Y___ N___ STEEL CLEANLINESS: G___ B___

SURFACE PREPARATION

INTERIOR BY _____ REQ=D. SSPC SP_____

REQ=D. ANCHOR PATTERN _____ MILS ACTUAL_____

PROFILE CLEANED: Y___ N___

LAP JOINTS FREE: Y___ N___

EXTERIOR BY_____ REQ=D. SSPC SP_____

SUBSTRATE CLEANED: Y___ N___

AMBIENT CONDITION

DATE	PRES.	W.B.	D.B.	D.P.	R.H.	S.T.

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APPENDIX A ***APPLICATION***

INTERIOR COATING SPEC_____ D.F.T. REQ=D._____

*** FIRST COAT ***

MIXED BY_____ DATE_____ PART 1_____

APPLIED BY_____ DATE_____ PART 2_____

*** SECOND COAT ***

MIXED BY_____ DATE_____ PART 1_____

APPLIED BY_____ DATE_____ PART 2_____

*** THIRD COAT ***

MIXED BY_____ DATE_____ PART 1_____

APPLIED BY_____ DATE_____ PART 2_____

EXTERIOR COATING SPEC_____ D.F.T REQ=D_____

*** FIRST COAT ***

MIXED BY_____ DATE_____ PART 1_____

APPLIED BY_____ DATE_____ PART 2_____

APPENDIX A *** SECOND COAT ***

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MIXED BY_____ DATE_____ PART 1_____

APPLIED BY_____ DATE_____ PART 2_____

*** THIRD COAT ***

MIXED BY_____ DATE_____ PART 1_____

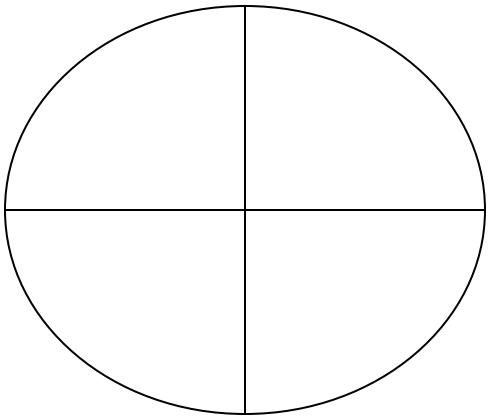
APPLIED BY_____ DATE_____ PART 2_____

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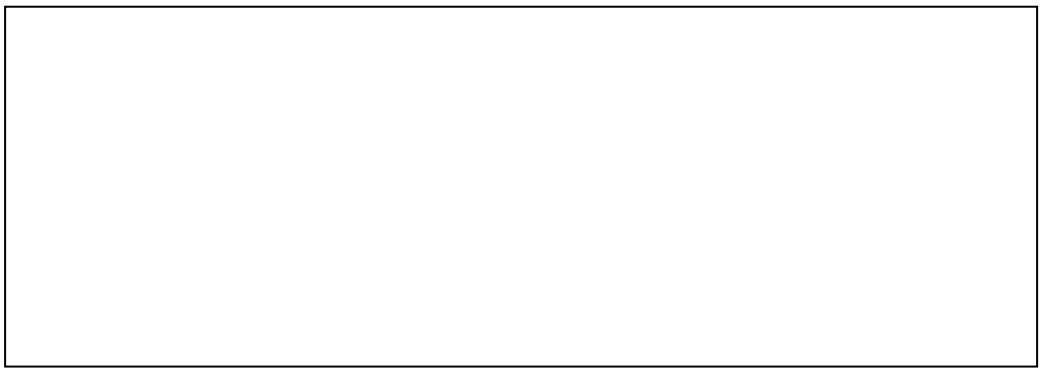
APPENDIX A

Lining:

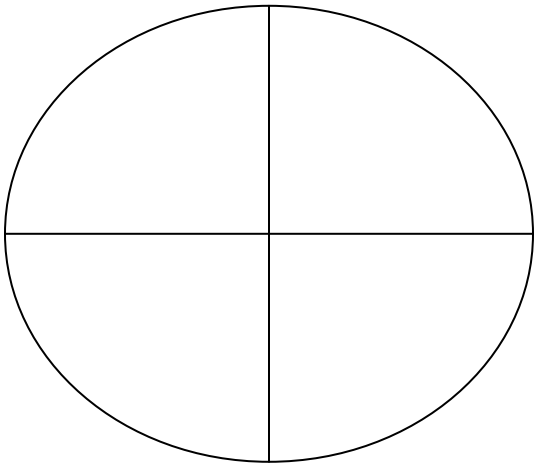
Top Head



Main Body



Bottom Head

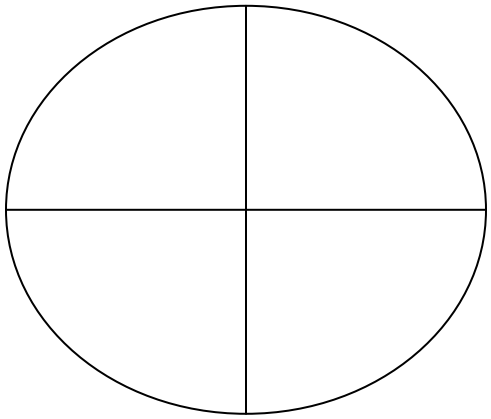


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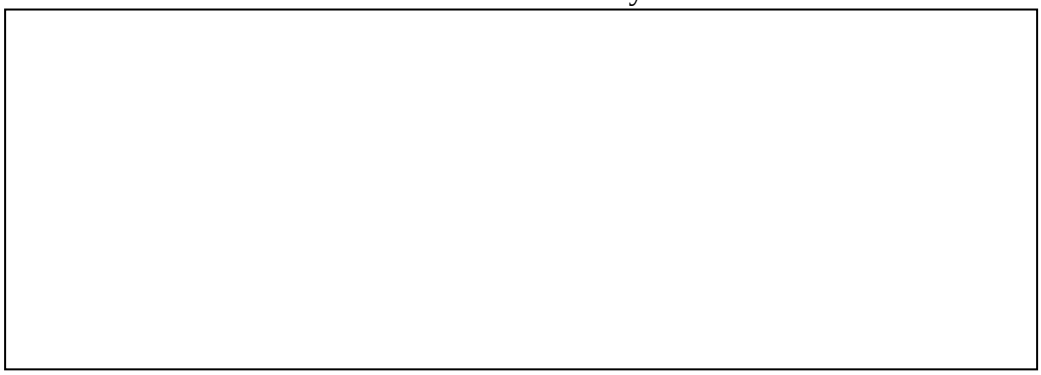
APPENDIX A

Paint:

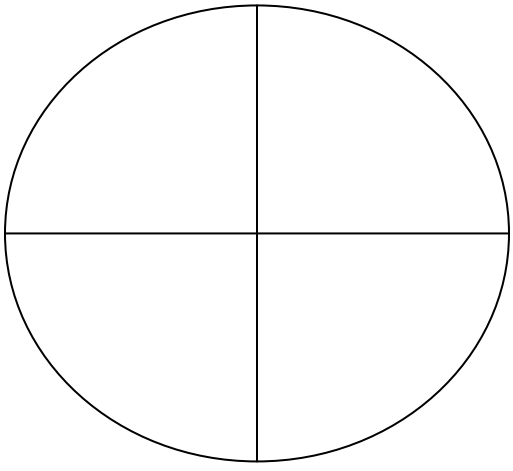
Top Head



Main Body



Bottom Head



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APPENDIX A

Applicator's Report
Quality Control Procedure EAP-2A

Company_____ Nat'L Board No.#_____Model Type_____

**** * Surface Preparation * ****

CONDITION OF INTERIOR FROM FABRICATOR_____

_____

TESTEX TAPE SAMPLE (4-mil Min.)

SIZE/TYPE OF ABRASIVE_____
DATE OF BLAST_____

TOP	SHELL	BOTTOM

**** * APPLICATION DATA * ****

	Date	W.B.	D.B.	% R.H.	D.P.	S.T.	Coating Type Batch No.#
Coat 1							
Coat 2							
Coat 3							
Exterior							
Exterior							

***** APPLICATOR'S INSPECTION *****

VISUAL_____

D.F.T. AVG._____ D.F.T. RANGE_____

CONTINUITY TEST_____

_____

INSPECTED BY _____

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11. Appendix B- Plasite 4006 Product Data

product data

carboline®

PLASITE® 4006

NSF Certified

Includes PLASITE 4006HAR

NSF/ANSI 61

TYPE

PLASITE 4006: A vinyl ester resin combined with pigments to provide a high build coating with excellent chemical resistance. PLASITE 4006HAR: A high build vinyl ester coating specially formulated for excellent abrasion resistance.

INTENDED USE

As a chemical-resistant coating for tank lining service and as a maintenance coating to protect against corrosive conditions encountered in waste treatment, chemical/food processing and carbon filters. When combined with abrasive conditions, use PLASITE 4006HAR.

GOVERNMENT AGENCY ACCEPTANCE

PLASITE 4006 and 4006HAR meet the requirements of the U.S. Food and Drug Administration, 21 CFR 175.300 and 177.2420.

NSF REQUIREMENT GUIDE

PLASITE 4006 (Off White, Gray and Yellow Oxide) and PLASITE 4006HAR (Off White and Gray) are certified to NSF/ANSI Standard 61 for cold potable water when the following requirements are met. The tank is 3,000 gallons/11,350 liters or larger. PLASITE Thinner #20, up to a maximum of 5% by volume, must be used for thinning purposes. The coating must be applied in two to three coats to a maximum thickness of 35 mils/0.88 DFT. Prior to placing the lining in service, it must be force cured at 200°F/93°C metal temperature for four hours.

TEMPERATURE RESISTANCE

Dry film basis is 250-300°F/121-149°C. Immersion temperature or splash and spill limits are determined by chemical exposure - please consult with Carboline Technical Service Department for further information.

VOC CONTENT

	Coating as Supplied (Determined Theoretically)		Thinned 5% by Volume with Plasite Thinner #20 (Determined Theoretically)	
Color	**Lbs./Gal.**	**g/L**	**Lbs./Gal.**	**g/L**
Off White, Gray, Yellow Oxide	0.34 ± 2%	42 ± 2%	0.64 ± 2%	77 ± 2%

COLORS

PLASITE 4006: Off White; Gray; Yellow Oxide.
PLASITE 4006HAR: Off White, Gray.

FILM THICKNESS PER COAT

One multi-pass spray coat will produce approximately 15 mils/380 microns DFT. When PLASITE 4006 (4006HAR) is used as an IMMERSION lining in corrosive services (dilute acids, etc.), use of a 30 mils/750 microns system applied in a minimum of two coats is recommended. CHEMICAL FUMES AND SPILLAGE normally require two coats at 20-30 dry mils/500-750 microns DFT.

PACKAGING

A one-gallon kit consists of:
- One 1-gallon can of Part A
- One small container of Part B
- One small container of catalyst Part C

A five-gallon kit consists of:
- One 5-gallon can of coating Part A
- One small container of promotor Part B
- One small container of catalyst Part C

COVERAGE

28-30 sq. ft./gallon (2.6-2.8 sq. m/gallon) at 30 mils/0.75 mm.

RECOATING TIME

May be recoated after initial hardening or set which will normally occur in 3 to 6 hours at 75°F/24°C. Following coats must be applied within 30 days.

PHYSICAL SPECIFICATIONS

Abrasion Resistance:…….. 87.6 mg
(ASTM D-4060, PLASITE 4006HAR: 37.5 mg, CS-17 wheel)

***Surface Hardness** (ASTM D2240)…….Shore D: 91

Solid:……...72% ± 2% by weight; 55% ± 2% by volume.

Pot Life:……..……1 hour @ 70-80°F

Shelf Life:……..60 days at 70°F

Spray Viscosity:…….…At 70°F/21°C, 17 ± 5 seconds
Ford Cup #4.

Shipping Weight:……..Approximately 13 lbs./gallon.

Thermal Shock:……..Unaffected in 5 cycles,
minus 70°F/21°C to plus 212°F.

Gloss:……Low sheen.

***Note**: Above tests were conducted on film cured at 150°F.

CHEMICAL RESISTANCE

Resistant to chemical effluents, organic and inorganic acids, corrosive liquids, salts, and water. PLASITE 4006HAR also provides protection against abrasion conditions encountered in agitated or flowing solutions.

It is recommended each following coat be diluted approximately 2 to 5% with PLASITE Thinner #20.

Note: Previously applied coating exposed to an accumulation of 24 hours of sunlight or surface temperatures in excess of 130°F/54°C may result in intercoat disbondment. An applied coating film should be topcoated before an accumulation of 24 hours exposure has occurred, or special procedures (such as shading with tarps) should be used. Care must be taken to avoid contamination between coats.

THINNERS

Use PLASITE Thinner #20. 2 to 5% thinning may be required to adjust coating for higher temperatures and various application conditions. Topcoating of previously applied films will require the addition of 2 to 5% thinner. Consult Carboline Technical Service Department for unusual thinning requirements. See RECOATING TIME section.

CLEANUP THINNER: Thinner #71

CURING

Curing time is 7 days at 70°F/21°C or 5 days at 90°F/32°C. Although coating may be applied at substrate temperatures as low as 60°F/16°C, the substrate temperature must be raised to a least 70°F/21°C within 12 hours and held until coating surface is tack free (approximately 10 hours) to avoid possible loss of cure. A minimum of 70°F/21°C surface temperature is required to obtain polymerization of this coating.

Listed below are a few curing schedules that may be used for time and work planning. Prior to raising the metal to the force curing temperature, it is necessary that an air dry time of 2 to 5 hours at temperatures from 70-100°F/21-38°C be allowed. After the air dry time has elapsed, the temperature should be raised in increments of approximately 30°F/17°C every 30 minutes until the desired force curing metal temperatures are reached. Any moisture from condensation of any source will kill the cure on freshly applied coating before it reaches a “non-tacky” stage. In order to assure removal of solvents and odor, force curing is generally recommended when coating is to be used in potable water and food material service. A force cure at 200°F/93°C metal temperature for 4 hours is necessary to comply with NSF Standard 61 requirements.

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PLASITE®4006

NSF Certified

METAL TEMPERATURE	CURING TIME	METAL TEMPERATURE	CURING TIME
110°F/43°C	72 Hrs	160°F/71°C	4 ½ Hrs
120°F/49°C	36 Hrs	170°F/77°C	3 ½ Hrs
130°F/54°C	18 Hrs	180°F/82°C	2 ½ Hrs
140°F/60°C	10 Hrs	190°F/88°C	2 Hrs
150°F/66°C	6 Hrs	200°F/93°C	1 ¾ Hrs

SURFACE PREPARATION

Steel - High Temperature & Immersion Service

All sharp edges shall be ground to produce a radius and correct all imperfections such as skip welds, delaminations, scabs, slivers and slag prior to abrasive blasting. Skip welds shall be welded solid.

Degrease surface prior to sandblasting. Use organic solvents, alkaline solutions, steam, hot water with detergents or other systems that will completely remove dirt, oil, grease, etc. Used tanks may require additional decontamination.

The surface shall be blasted to NACE No. 1 or SSPC-SP5 white metal using a Venturi blast nozzle with 100 psi/7 bars air. Use a properly graded, clean, sharp angular abrasive, similar to Humble Abrasive Flint S7 (6 to 30 mesh), Steel Grit (HG25), or BLACK BEAUTY® (BB10
40) to produce the anchor pattern as required. The degree of profile shall be a minimum of 4 mils/0.1 mm as determined by comparing Carboline's blasted panel, using adequate light and magnification as required. Comparator panel is available to inspectors on a job basis. If clarification is required as to how to develop this anchor pattern, consult Carboline's Technical Service Department or your sales representative.

Remove all traces of grit and dust, as well as embedded abrasives, with a vacuum cleaner and/or by brushing. Care should be taken to avoid contaminating the surface with fingerprints or from detrimental material on the workers' clothes.

The surface temperature shall be maintained at a minimum of 5°F/3°C above the dew point to prevent oxidation of the surface. The coating shall be applied within the same day that the surface has been pre- pared. Visible oxidation or condensation is not allowed.

Steel - Service in Severe Corrosive Environments - Splash & Fume

Surface preparation is the same as above except NACE No. 2 or SSPC-SP10 near white metal blast may be used, provided the anchor pattern as described above is achieved.

Concrete

Immersion Service

All concrete surfaces require whip blasting for immersion service. Fully cured concrete (minimum 28 day cure) must be blasted to provide a hard, firm, clean and neutral surface for coating. All concrete surfaces must be filled and sealed with the appropriate Carboline filler sealer, applied in accordance with the corresponding Carboline product data sheet. All surface imperfections, "bug holes," etc. must be completely repaired before application of PLASITE 4006.

Strong Fumes and Splash Spill

Severity of expected service will dictate proper concrete surface preparation. Contact the Carboline Technical Service Department for surfaces other than steel and concrete.

APPLICATION

Mixing

The promotor (Part B) and catalyst (Part C) are supplied in separate containers and are premeasured for the coating unit supplied. Thoroughly mix the coating (Part A). After the pigments and liquid are thoroughly mixed, add the entire amount of the measured liquid promotor (Part B). MIX COM-PLETELY! NO COLOR STREAKING OR RESIDUE OF PART B SHOULD REMAIN ON CONTAINER SIDEWALLS. Add the catalyst (Part C) and mix completely with the coating.

Warning! The promotor (Part B) and the catalyst (Part C) must be separately mixed into the coating (Part A). Any contact of unmixed Part B with Part C may lead to a fire or explosion!

Atomizing Spray Equipment

Conventional atomizing spray system shall be equal to: Binks Model 2001 gun with 59ASS fluid nozzle, 251 air cap and 559SS needle. A heavy-duty trigger spring is recommended with a pot pressure of approximately 50 psi/3.5 bars and atomizing pressure of approximately 60 psi/4.1 bars. Use standard production type pressure pot with air motor drive agitator.

Airless Spray Equipment

Airless spray system requires a large capacity pump with a capacity of 3 g.p.m./11 l.p.m. similar or equal to Graco Bulldog with 0.025 in./0.63 mm or larger fluid nozzle. A 12 in. minimum spray width is recommended. Use liquid pressure of approximately 1600-1800 psi/110-120 bars. All screens should be removed from pump and gun. A 3/8 in. diameter fluid line is recommended. Continuous mixing during use is required.

Note: Airless spray is NOT recommended for PLASITE 4006HAR.

A minimum surface temperature of 70°F/21°C is required to obtain polymerization of the coating system. Coating can be applied at a surface temperature as low as 60°F/16°C but polymerization will not take place. Succeeding coats cannot be applied without damaging the system until the surface temperature rises sufficiently to obtain polymerization. Refer to CURING. When surface temperatures are over 100°F/38°C, consult the laboratory for special thinner and thinning instructions. The mixed coating shall be applied utilizing a multi-pass spray system. Apply horizontal and vertical passes with 50% overlap. Special precautions are required at overlaps and welds to eliminate excessive film build.

Spray gun should be perpendicular to surface at all times, approximately 14 in./36 cm from surface.

Coating may be overcoated after initial "set" which will occur normally in 3 to 6 hours at 70°F/21°C with proper ventilation. Initial "set" time will decrease as surface temperature increases.

Warning! Refer to RECOATING TIME.

When physical contact (foot traffic, scaffolding, etc.) with the previously applied coating is required, a minimum of 10 hours at 70°F/21°C substrate and air temperature with ventilation is normally required before proceeding. Previously applied coats must have reached a "non-tacky" state before being exposed to physical contact. This condition will occur in less time as surface temperature increases. Over coating shall be performed as soon as possible to prevent contamination.

Brush

Brush application is not recommended, but may be used for repairs or touch-up. Continuous mixing during use is required.

LINING REPAIR

Clean damaged area, removing all contaminants and loose coating.

Abrasive blast substrate to original specification where coating has been exposed to environment and where oxidation is evident. Feather the original coating not less than 2 in./5 cm from damaged area.

If new coating is physically damaged and has not been in service, repair as shown above.

For repairing holidays, sand surface and brush apply proper thickness of coating.

Apply coating by brush or spray. Do not apply by brush on areas larger than 1 sq. ft/0.1 sq. m.

Warning: Contamination of previously exposed coating film may be detrimental to adhesion of the repair and may affect service life expectancy.

INSPECTION

Degree of surface preparation shall conform to appropriate specifications as outlined in SURFACE PREPARATION section.

Metal temperature shall be recorded at least every 4 hours and before application of coating. Humidity (wet bulb reading) shall be taken to ensure that metal temperature is at least 5°F/3°C higher than wet bulb temperature. Dry bulb temperatures shall be recorded at the same time to ensure curing.

For immersion service, a pinhole-free film is essential and testing with Tinker & Rasor Model AP-W or Stearns Model 14/20 or equivalent is required on final film. Use 3000 volts at the recommended 30 mils/0.75 mm DFT. Allow a minimum cure of 48 hours at 70°F/21°C or 36 hours at 90°F/32°C before holiday testing.

Dry film thickness shall be determined utilizing a non-destructive, magnetic type, high range gauge. The anticipated film thickness shall be in the middle range of the gauge.

April 2006 replaces September 2004

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Refer to Plasite Bulletin PA-3, Section 3, for inspection requirements.

This data sheet provides standard information on the coating and application procedure. Since varying conditions may not be covered, consult your local sales representative or Carboline Technical Service Department for further information.

SAFETY

READ THIS NOTICE

SAFETY AND MISCELLANEOUS EQUIPMENT

For tank lining work it is recommended that the operator provide himself with clean coveralls and rubber soled shoes and observe good personal hygiene. Certain personnel may be sensitive to various types of resins which may cause dermatitis.

THE SOLVENT IN THIS COATING IS FLAMMABLE AND CARE AS DEMANDED BY GOOD PRACTICE, OSHA, STATE AND LOCAL SAFETY CODES, ETC. MUST BE FOLLOWED CLOSELY. Keep away from heat, sparks, and open flame and use necessary safety equipment such as air mask, explosion-proof electrical equipment, non-sparking tools and ladders, etc. Avoid contact with skin and breathing of vapor or spray mist. When working in tanks, rooms, and other enclosed spaces adequate ventilation must be provided. Refer to Plasite Bulletin PA-3. Keep out of the reach of children.

The catalyst or curing agent is relatively stable at room temperatures but must be protected from contamination, heat and fire and is classified by the Interstate Commerce Commission as an “oxidizing material.” Subsequently, all shipping containers bear a yellow caution label. The catalyst is highly irritating if it gets into the eyes. Immediately rinse eyes thoroughly with water and get medical attention. The catalyst also can be a skin irritant and should be removed with large quantities of soap and water. Since this is an oxidizing material, it should not be allowed to accumulate or remain in soaked rags or clothing.

CAUTION - Read and follow all caution statements on this data sheet, material safety data sheet and container label for this product.

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1.0 SCOPE OF WORK

The Supplier shall furnish and apply all lining materials in accordance with this specification and all referenced documents, standards and codes.

In the event that the equipment described in this specification are beyond the normal scope of the supplier, the supplier shall submit in writing exceptions to such items for approval by CCC.

2.0 DEFINITIONS

2.1 Calgon Carbon Corporation "CCC" shall refer to all staff, subcontractors, and / or subsidiaries of Calgon Carbon Corporation.

2.2 "Supplier" shall refer to the vendor, manufacturer, or supplier of the materials specified.

3.0 WORK INCLUDED

3.1 Procurement, preparation, application, testing, packaging and delivery.

4.0 WORK EXCLUDED

4.1 Receipt, off-loading, and storage of the equipment at the plant site.

4.2 Field assembly and installation of the equipment.

5.0 PREPARATION FOR SHIPMENT

5.1 All equipment shall be cleaned prior to shipment.

5.2 Flange faces and other machined surfaces shall be protected from damage during shipment and handling by plastic/wooden covers, wooden blocks or other suitable means.

5.3 The supplier shall be responsible for all necessary bracing, cradles, blocking, etc. deemed necessary to prevent damage of the equipment during shipment and handling. All temporary bracing shall be clearly marked for easy identification.

5.4 Each item shipped shall be marked with the following information:

- CCC's Purchase order number.
- Description of contents.
- Shipping Weight.

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MATERIAL CLASSIFICATION: **RS100**

SPRAY LINER

1.0 Application Standards

- ANSI / NSF - Standard 61: Drinking Water System Components - Health Effects.
- SSPC-SP NO. 10 / NACE NO. 2 – Near-White Blast Cleaning.

2.0 Epoxy Coating

2.1. Manufacturer: Sherwin Williams Tank Clad HS coating, or equal – NSF/ANSI 61 and AWWA C210 approved material.

3.0 Preparation and Application

3.1. Per manufacturers' recommendation.

3.2. The shop shall observe safe practices and standards when spray coating with material used.

4.0 Quality

4.1 Dry Film Thickness must be in accordance with the manufacturer's recommendation. Depending on the pipe diameter, contractor shall take reasonable random DFT readings to insure minimum thickness has been satisfied.

4.2 Lining is to be commercially continuous, no visible light or missed areas, no sags or runs will be acceptable.

5.0 The following documentation shall be submitted:

- Coating Material Lot numbers and NSF written approval for lining in this application.
- MSDS shall be submitted for record.
- Testing / quality documents as required.

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Industrial & Marine Coatings

Certified to NSF/ANSI 61

TRM 15

TANK CLAD HS

PART A	B62W80	SANITARY WHITE
PART A	B62L80	LIGHT BLUE
PART B	B60V80	STANDARD HARDENER
PART B	B60V85	LOW TEMP HARDENER

PRODUCT INFORMATION

Revised 7/06

PRODUCT DESCRIPTION

TANK CLAD HS is a VOC compliant, 80% solids epoxy coating formulated as an interior lining for pipes and tanks containing potable water, fresh water, salt water, and other commodities. May also be used as part of a system for tank exteriors.

RECOMMENDED USES

Lining system for the interior of steel tanks and concrete reservoirs used for potable water. Meets requirements of AWWA C210 for coating systems for the interior and exterior of steel water pipelines. Meets NSF Standard 61 requirements for use in potable water storage tanks:

- 60,000 gallons and larger tanks with standard hardener
- 1,000 gallons and larger tank with low temp hardener
- 8" or greater pipe with low temp hardener

Acceptable for use with cathodic protection systems.

Conforms to AWWA D102-03 ICS #,1 #2,#3, and #5.***
***Refer to respective System

PRODUCT CHARACTERISTICS

Finish: Semi-gloss

Color: Sanitary White, Light Blue

Volume Solids: 80% ± 2%, mixed

Weight Solids: 90% ± 2%, mixed

VOC (EPA Method 24):
mixed
Unreduced <200 g/L; 1.67 lb/gal
Reduced 10%: <240 g/L; 2.00 lb/gal

Mix Ratio: 2 component, premeasured 4:1

Recommended Spreading Rate per coat:

	Standard	AWWA
Wet mils:	6.0 - 10.0	3.75 -7.5
Dry mils:	5.0 - 8.0*	3.0 - 6.0*
Coverage:	160 - 255 sq ft/gal approximate	213 - 426

NOTE: Brush or roll application may require multiple coats to achieve maximum film thickness and uniformity of appearance.
* See recommended systems on reverse side

Drying Schedule @ 10.0 mils wet @ 50% RH:
Standard Hardener (B60V80)

	@ 55°F	@ 77°F	@ 120°F
To touch:	7 hours	3 hours	1 hour
Tack free:	8 hours	4 hours	2 hours
To recoat:			
minimum:	48 hours	18 hours	4 hours
maximum:	60 days	60 days	60 days
To cure:	14 days	7 days	3 days
Pot Life:	4 hours	2 hours	30 minutes
Sweat-in Time:	30 minutes	15 minutes	Not required

Low Temp Hardener (B60V85)*

	@ 40°F	@ 77°F
To touch:	24 hours	2 hours
Tack free:	48 hours	2-1/2 hours
To recoat:		
minimum:	48 hours	8 hours
maximum:	30 days	14 days
To cure:	10 days	5 days
Pot Life:	2 hours	30 minutes
Sweat-in Time:	10 minutes	None

***Do not use Tank Clad HS Low Temp Hardener above 80°F.**

If maximum recoat time is exceeded, abrade surface before recoating. Drying time is temperature, humidity, and film thickness dependent.

For **Potable Water Service,** allow a minimum cure time of 7 days @ 77°F (5 days with low temp hardener) prior to placing into service, sterilize and thoroughly rinse with potable water. Per AWWA C652.

Shelf Life: 36 months, unopened
Store indoors at 40°F to 100°F

Flash Point: 80°F, PMCC, mixed

Reducer/Clean Up: Xylene, R2K4

PERFORMANCE CHARACTERISTICS

System Tested: (unless otherwise indicated)
Substrate: Steel
Surface Preparation: SSPC-SP10/NACE 2
2 cts. Tank Clad HS @ 6.0 mils dft/ct

Abrasion Resistance:
Method: ASTM D4060, CS17 wheel, 1000 cycles, 1 kg load
Result: 120 mg loss

Adhesion:
Method: ASTM D4541
Result: 1000 psi

Direct Impact Resistance: (on cold rolled steel)
Method: ASTM G14
Result: 30 in. lbs.

Dry Heat Resistance:
Method: ASTM D2485 (discolors)
Result: 200°F

Flexibility: (on cold rolled steel)
Method: ASTM D522, 180° bend, 1" mandrel
Result: Passes

Moisture Condensation Resistance:
Method: ASTM D4585, 100°F, 1000 hours
Result: No blistering, underfilm corrosion, or rust creepage observed

Pencil Hardness:
Method: ASTM D3363
Result: 4H

Salt Fog Resistance:
Method: ASTM B117, 1000 hours
Result: No blistering, underfilm corrosion, or rust creepage observed.

Epoxy coatings may darken or yellow following application and curing.

continued on back

Industrial & Marine Coatings

Certified to NSF/ANSI 61

TRM 15

TANK CLAD HS

PART A	B62W80	SANITARY WHITE
PART A	B62L80	LIGHT BLUE
PART B	B60V80	HARDENER
PART B	B60V85	LOW TEMP HARDENER

PRODUCT INFORMATION

RECOMMENDED SYSTEMS

Immersion, *Steel

***AWWA D102: Inside Coating System No. 1**
(minimum AWWA DFT 8.0 mils)
1 ct. Tank Clad HS @ 3.0 mils dft
1 ct. Tank Clad HS @ 5.0 mils dft

***AWWA D102: Inside Coating System No. 2**
(minimum AWWA DFT 12.0 mils)
1 ct. Tank Clad HS @ 3.0 mils dft
1 ct. Tank Clad HS @ 4.0 mils dft
1 ct. Tank Clad HS @ 5.0 mils dft

***AWWA D102: Inside Coating System No. 3**
(minimum AWWA DFT 10.0 mils)
1 ct. Zinc Clad II LV or Plus @ 2.0 mils dft
1 ct. Tank Clad HS @ 3.0 mils dft
1 ct. Tank Clad HS @ 5.0 mils dft

***AWWA D102: Inside Coating System No. 5**
(minimum AWWA DFT 10.0 mils)
1 ct. Corothane I – Galvapac NSF @ 2.0 mils dft
1 ct. Tank Clad HS @ 4.0 mils dft
1 ct. Tank Clad HS @ 4.0 mils dft

Atmospheric, steel:

***AWWA D102: Outside Coating System No. 5**
(minimum AWWA DFT 6.0 mils)
1 ct. Tank Clad HS @ 2.0 mils dft
1 ct. Tank Clad HS @ 2.0 mils dft
1 ct Acrolon 218HS @ 2.0 mils dft

***AWWA D102: Outside Coating System No. 6**
(minimum AWWA DFT 6.0 mils)
1 ct. Corothane I – Galvapac NSF @ 2.0 mils dft
1 ct. Tank Clad HS @ 2.0 mils dft
1 ct Acrolon 218HS @ 2.0 mils dft

Concrete/ Masonry- Smooth
2 cts. Tank Clad HS @ 5.0 - 8.0 mils dft/ct

The systems listed above are representative of the product's use. Other systems may be appropriate. Also suitable for Ductille Iron, Aluminum, and Galvanized surfaces.

SURFACE PREPARATION

Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, and other foreign material to ensure adequate adhesion.

Refer to product Application Bulletin for detailed surface preparation information.

Minimum recommended surface preparation:
Iron & Steel:
Atmospheric: SSPC-SP6/NACE 3
Immersion: SSPC-SP10/NACE 2, 2-3 mil profile

Concrete & Masonry:
Immersion: SSPC-SP 13/NACS 6-4.3.1 or 4.3.2, or ICRI 03732, CSP 2-3

TINTING

Do not tint.

APPLICATION CONDITIONS

Temperature:	55°F minimum, 120°F maximum (air, surface, and material) At least 5°F above dew point
Relative humidity:	85% maximum

Do not use Low Temp Hardener (B60V85) above 80°F.

Refer to product Application Bulletin for detailed application information.

ORDERING INFORMATION

Packaging:	5 gallons mixed
Part A:	4 gallons in a 5 gallon container
Part B:	1 gallon
Weight per gallon:	14.4 ± 0.2 lb, mixed

SAFETY PRECAUTIONS

Refer to the MSDS sheet before use.

DISCLAIMER

The information and recommendations set forth in this Product Data Sheet are based upon tests conducted by or on behalf of The Sherwin-Williams Company. Such information and recommendations set forth herein are subject to change and pertain to the product offered at the time of publication. Consult your Sherwin-Williams representative to obtain the most recent Product Data Information and Application Bulletin.

WARRANTY

The Sherwin-Williams Company warrants our products to be free of manufacturing defects in accord with applicable Sherwin-Williams quality control procedures. Liability for products proven defective, if any, is limited to replacement of the defective product or the refund of the purchase price paid for the defective product as determined by Sherwin-Williams. NO OTHER WARRANTY OR GUARANTEE OF ANY KIND IS MADE BY SHERWIN-WILLIAMS, EXPRESSED OR IMPLIED, STATUTORY, BY OPERATION OF LAW OR OTHERWISE, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Industrial & Marine Coatings

Certified to NSF/ANSI 61

TRM15A

TANK CLAD HS

PART A	B62W80	SANITARY WHITE
PART A	B62L80	LIGHT BLUE
PART B	B60V80	STANDARD HARDENER
PART B	B60V85	LOW TEMP HARDENER

APPLICATION BULLETIN

Revised 7/06

SURFACE PREPARATION

Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, and other foreign material to ensure adequate adhesion.

Carbon Steel, Immersion Service:
Clean and degrease the surface prior to abrasive blasting per SSPC-SP 1 Solvent Cleaning. Methods described in SSPC-SP 1 include solvents, alkali, detergent/water, emulsions, and steam. The surface shall be abrasive blasted to SSPC-SP10/NACE No. 2 Near-White Blast Cleaning with a 2 - 3 mil profile. The anchor pattern shall be sharp with no evidence of a polished surface. The finished surface shall be free of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products, and other foreign matter with no more than 5% staining. After blasting, all dust and loose residue should be removed from the surface by acceptable means. Coat steel the same day as it is prepared and prior to the formation of rust.

Iron & Steel, Atmospheric Service:
Minimum surface preparation is Hand Tool Clean per SSPC-SP2. Remove all oil and grease from surface by Solvent Cleaning per SSPC-SP1. For better performance, use Commercial Blast Cleaning per SSPC-SP6/NACE 3, blast clean all surfaces using a sharp, angular abrasive for optimum surface profile (2 mils). Prime any bare steel within 8 hours or before flash rusting occurs.

Ductile Iron, Immersion Service:
Refer to National Association of Pipe Fabricators Surface Preparations Standard NAPF 500-03 as follows:

a. NAPF 500-03-01 "Solvent Cleaning"
b. NAPF 500-03-02 "Hand Tool Cleaning"
c. NAPF 500-03-03 "Power Tool Cleaning"
d. NAPF 500-03-04 "Abrasive Blast Cleaning of Ductile Iron Pipe".

Concrete and Masonry, Immersion Service:
Decontamination of the concrete surface requires the removal of oils, grease, wax, fatty acids and other contaminants and may be accomplished by the use of detergent scrubbing with a Sherwin-Williams cleaner and degreaser, low pressure water cleaning (less than 5,000 psi), steam cleaning, or chemical cleaning.The preferred methods for creating a surface profile, including the removal of dirt, dust, laitance and curing compounds, is abrasive blasting or scarifying to achieve an ICRI surface equivalent to CSP1-3. See ICRI Technical Guideline No. 03732 for additional information.

Previously Painted Surfaces:
If in sound condition, clean the surface of all foreign material. Scarify the surface to create the desired surface profile. Apply coatings on a test area, allowing paint to dry one week before testing adhesion. If adhesion is poor, or if this product attacks the previous finish, removal of the previous coating may be necessary.

APPLICATION CONDITIONS

Temperature:	55°F minimum, 120°F maximum (air, surface, and material) At least 5°F above dew point
Relative humidity:	85% maximum

Do not use Low Temp Hardener (B60V85) above 80° F

APPLICATION EQUIPMENT

The following is a guide. Changes in pressures and tip sizes may be needed for proper spray characteristics. Always purge spray equipment before use with listed reducer. Any reduction must be compliant with existing VOC regulations and compatible with the existing environmental and application conditions.

Reducer/Clean up ..... Xylene, R2K4
Use of any other solvent than Xylene, R2K4 may affect the performance or compliance of this product for its intended service.

Airless Spray
Pump ..... 45:1 minimum
Pressure ..... 3600 psi minimum
Hose ..... 3/8" ID
Tip ..... .017" - .019"
Filter ..... 30 mesh
Reduction ..... As needed up to 10% by volume

Brush
Brush ..... Natural Bristle
Reduction ..... Not recommended

Roller
Cover ..... 3/8" - 1/2" woven with phenolic core
Reduction ..... Not recommended

Recommended Spreading Rate per coat:

	Standard	AWWA
Wet mils:	6.0 - 10.0	3.75 -7.5
Dry mils:	5.0 - 8.0*	3.0 - 6.0*
Coverage:	160 - 255	213 - 426
	sq ft/gal approximate	

* See recommended systems on Product Information Page

If specific application equipment is not listed above, equivalent equipment may be substituted.

continued on back

Industrial & Marine Coatings

Certified to NSF/ANSI 61

TRM 15

TANK CLAD HS

Part A	**B62W80**	**Sanitary White**
Part A	**B62L80**	**Light Blue**
Part B	**B60V80**	**Hardener**
Part B	**B60V85**	**Low Temp Hardener**

APPLICATION BULLETIN

Application Procedures

Surface preparation must be completed as indicated.

Mix contents of each component thoroughly with power agitation. Make certain no pigment remains on the bottom of the can. Then combine four parts by volume of Part A with one part by volume of Part B. Thoroughly agitate the mixture with power agitation. Allow the material to sweat-in as indicated. Re-stir before using.

If reducer solvent is used, add only after both components have been thoroughly mixed, after sweat-in.

Apply paint to the recommended film thickness and spreading rate as indicated below:

Recommended Spreading Rate per coat:

	Standard	**AWWA**
Wet mils:	6.0 - 10.0	3.75 -7.5
Dry mils:	5.0 - 8.0*	3.0 - 6.0*
Coverage:	160 - 255 sq ft/gal approximate	213 - 426

NOTE: Brush or roll application may require multiple coats to achieve maximum film thickness and uniformity of appearance.

* See recommended systems on product information page

Drying Schedule @ 10.0 mils wet @ 50% RH:

Standard Hardener (B60V80)

	@ 55°F	**@ 77°F**	**@ 120°F**
To touch:	7 hours	3 hours	1 hour
Tack free:	8 hours	4 hours	2 hours
To recoat:			
minimum:	48 hours	18 hours	4 hours
maximum:	60 days	60 days	60 days
To cure:	14 days	7 days	3 days
Pot Life:	4 hours	2 hours	30 minutes
Sweat-in Time:	30 minutes	15 minutes	Not required

Low Temp Hardener (B60V85)*

	@ 40°F	**@ 77°F**
To touch:	24 hours	2 hours
Tack free:	48 hours	2-1/2 hours
To recoat:		
minimum:	48 hours	8 hours
maximum:	30 days	14 days
To cure:	10 days	5 days
Pot Life:	2 hours	30 minutes
Sweat-in Time:	10 minutes	None

***Do not use Tank Clad HS Low Temp Hardener above 80°F.**

If maximum recoat time is exceeded, abrade surface before recoating. Drying time is temperature, humidity, and film thickness dependent.

For **Potable Water Service,** allow a minimum cure time of 7 days @ 77°F (5 days for low temp hardener) prior to placing into service, sterilize and thoroughly rinse with potable water. See methods outlined in AWWA C652.

Application of coating above maximum or below minimum recommended spreading rate may adversely affect coating performance.

Performance Tips

Stripe coat all crevices, welds, and sharp angles to prevent early failure in these areas.

When using spray application, use a 50% overlap with each pass of the gun to avoid holidays, bare areas, and pinholes. If necessary, cross spray at a right angle

Spreading rates are calculated on volume solids and do not include an application loss factor due to surface profile, roughness or porosity of the surface, skill and technique of the applicator, method of application, various surface irregularities, material lost during mixing, spillage, overthinning, climatic conditions, and excessive film build.

Excessive reduction of material can affect film build, appearance, NSF 61 approval, and may cause lifting of old paint.

Do not apply the material beyond recommended pot life.

Do not mix previously catalyzed material with new.

In order to avoid blockage of spray equipment, clean equipment before use or before periods of extended downtime with Xylene, R2K4.

Holiday Detection: Use a wet sponge-type detector such as KD Bird Dog or equivalent equipment per manufacturer's recommendation. Test only cured coating, as solvent entrapment in fresh films may provide false readings.

Do not use Low Temp Hardener (B60V85) above 80°F.

Refer to Product Information sheet for additional performance characteristics and properties.

Clean Up Instructions

Clean spills and spatters immediately with Xylene, R2K4. Clean tools immediately after use with Xylene, R2K4. Follow manufacturer's safety recommendations when using any solvent.

Safety Precautions

Refer to the MSDS sheet before use.

Disclaimer

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Warranty

The Sherwin-Williams Company warrants our products to be free of manufacturing defects in accord with applicable Sherwin-Williams quality control procedures. Liability for products proven defective, if any, is limited to replacement of the defective product or the refund of the purchase price paid for the defective product as determined by Sherwin-Williams. NO OTHER WARRANTY OR GUARANTEE OF ANY KIND IS MADE BY SHERWIN-WILLIAMS, EXPRESSED OR IMPLIED, STATUTORY, BY OPERATION OF LAW OR OTHERWISE, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

SPECIFICATION NUMBER: RS17 FOR EPOXY PAINTING

1.0 SCOPE

1.1 This specification covers the minimum procedures required for the surface preparation and coating of equipment that has not been previously painted. It also covers equipment that has been previously painted.

1.2 The work to be performed under this specification consists of painting all metal materials including vessels, supports, base plates, skids, pipe, pipe supports, brackets, hanger rods, pipe clamps, and all other metal surfaces, not mentioned in Section 5.0, that are part of the system.

1.3 The "applicator" referred to in this specification could be Calgon Carbon Corporation or a sub-contractor.

1.4 Unless otherwise specified, the applicator shall furnish all paints and solvents, necessary tools, scaffolds, ladders, compressed air, etc.

1.5 The applicator will familiarize himself with rules and regulations as set forth by the Safety Department of the facility where painting is to be conducted and comply with these regulations.

2.0 SURFACE PREPARATION OF PAINTED SURFACES

2.1 ***Previously coated surfaces that are in good condition:***
Maintenance painting will frequently not permit or require complete removal of all old coatings prior to re-painting. However, all surface contamination such as oil, grease, loose paint, mill scale, dirt, foreign matter, rust, mold mildew, mortar, efflorescence and sealers must be removed to assure sound bonding to the tightly adhering old paint.

In addition, glossy surfaces of old paint films must be clean and dull before re-painting. Thorough washing with an abrasive kitchen cleanser will clean and dull in one operation, or wash thoroughly and dull by sanding. Remove all sanding dust.

It is recommended that water blasting be used (NACE Standard RP-01-72) which removes foreign matter by water (with cleanser) at pressures of 2,000-5,000 PSI at a flow of 4-14 gallons per minute.

The applicator shall recognize that any surface preparation short of total removal of the old coatings may compromise the service length of the new coating system. The applicator shall always check for the compatibility of the previously-painted surface with the new coating by applying a test patch of 2-3 square feet. Allow to dry thoroughly; then check adhesion.

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2.2 ***Previously coated surfaces that are not in good condition:***
The applicator will hand-tool clean the surfaces to remove loose rust, loose mill scale and loose paint to the degree specified by SSPC-SP2-63. The applicator shall accomplish this by hand chipping, scraping, sanding, and wire brushing. The applicator shall further prepare the hand-tool cleaned surface per Paragraph 2.1 above.

3.0 SURFACE PREPARATION OF UNPAINTED SURFACES

3.1 The metal surface shall be free of dirt, rust, rust-proofing, drawing oils and compounds, finger prints, mill scale, and other foreign substances both visible and invisible; thereby improving adhesion and reducing the tendency to blister and corrode on exposure.

3.2 The applicator shall use remove all loose rust and mill scale to the degree specified by SSPC-SP3-63 by power-tool chipping, de-scaling, sanding, wire brushing, grinding, or media blasting as a minimum. SSPC-SP7 Brush-off Blast cleaning is preferred.

4.0 PAINT APPLICATION

4.1 The coating shall be applied in accordance with the manufacturer's instructions.

4.2 The system shall consist of at least one (1) coat of epoxy mastic to a total DFT of 6 nominal mils (acceptable range: 5-7 mils).

4.3 All paint shall be within its expiration date and furnished in unopened containers.

4.4 Thinners shall be used only with the permission of Calgon Carbon Corporation.

4.5 Painting will not be allowed when the relative humidity is above 85% or the temperature is below 55°F without special permission from Calgon Carbon Corporation.

4.6 Any surface that develops rust prior to painting shall be re-prepared per Sections 2.0 or 3.0 above.

5.0 AREAS NOT TO BE PAINTED

5.1 Galvanized steel (new) and PVC pipe are not to be painted.

5.2 Inside of pipes shall not be painted.

5.3 Gauge faces, nameplates, plastic or S/S fittings, flange faces, etc. shall be taped to protect against overspray and tape shall be removed prior to shipping.

5.4 Inside of vessel shall be lined by others.

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6.0 MATERIAL SPECIFICATION

6.1 The paint used shall be Sherwin-Williams Macropoxy HS B58 Series (two-part) Epoxy Coating System, or equal. The manufacturer's specifications are attached and shall be followed along with any recommendations and precautions stated on the paint can label.

Accepted substitutes are:

International Protective Coatings -- Interseal 670
ICI Devoe Coatings -- Devran 224 HS

Other manufacturers may be proposed, but are subject to Calgon Carbon approval prior to use.

6.2 The color shall match Sherwin-Williams MC-71 "Slate Gray" or as specified on the project drawings.

* * *REVISIONS* * *

This specification has been revised as indicated below. The new pages added and/or the existing pages revised are attached as replacements for those previously issued.

REVISION	DATE	BY	PAGE	REMARKS
0	9/8/1989	FRF	All	Issued for Construction
1	1/30/1996	JPM	All	All New Pages; Revised Paragraph 4.1
2	4/15/1996	JPM	1-2-3	Revised Paragraphs 1.3, 2.2, 3.2, 4.1 ,5.3, 6.1 and 6.2
3	6/4/2002	JPM	All	Revised 1.2,1.5,3.2,5.3,6.1,6.2
4	6/08/2007	TAB	3	Revised 6.1 and 6.2
5	4/22/2008	RES	All	General Revision

ISSUED: SEPTEMBER 8, 1989

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CALGON CARBON CORPORATION

SECTION 13

SHIPPING SPECIFICATION

SPECIFICATION NUMBER: VS-13

SHIPPING OF STANDARD METAL ADSORBER SYSTEMS

1.0 INTRODUCTION

1.1 The following Calgon Carbon Corporation shipping, and handling instructions are designed to protect the mechanical integrity and the surface finish of the adsorber vessels and/or piping comprising an adsorption system. Proper handling procedures are required to ensure against damage to the new equipment.

1.2 The shipping and handling instructions outlined here are only recommendations and do not relieve any party from full responsibility for proper inspection, handling, shipping preparation, transporting, or unloading of the equipment. Also, the purchaser should be aware that failure to take the precautions outlined here may invalidate the equipment warranty.

2.0 GENERAL HANDLING AND LIFTING INSTRUCTIONS

2.1 Calgon Carbon Corporation equipment is designed with specific locations for lifting and will withstand normal handling procedures. The lifting lugs, shown on the general arrangement installation drawing, are generally located on top of the vessel. Fork tubes are located near the bottom of the equipment.

Refer to the project drawings is required before handling the equipment.

2.2 Normal precautions to follow to prevent equipment damage are as follows:

2.2.1 Operators of hoist equipment must follow proper safety and rigging procedures at all times.

2.2.2 Always lift -- ***NEVER*** roll or slide the vessels or piping.

2.2.3 When moving equipment, do not drop or allow hard impact. Do not allow cables, hooks, or spanner bars to swing against the vessel.

2.2.4 Never allow tools to strike or drop on equipment (especially inside or outside of vessels).

2.2.5 All ladders used inside vessels should have ends protected. They should be wood construction; if not, ladders must have rubber protectors to prevent damaging the lining.

2.2.6 Workmen entering a lined vessel must wear soft-soled shoes, free of grit. Workmen must follow plant and OSHA requirements for confined space entry.

2.2.7 Always make lifting attachments to the lifting lugs when using chains or cables. Never lift from the nozzles.

2.2.8 Never lift a vessel by using any fitting or appurtenance other than the lift lugs. When lift lugs are not provided as part of the equipment, nylon web rigging slings must be used by attachment directly to the corners of the structural frame. It is recommended that the nylon web be protected with rubber pads or sheets to prevent cutting or tearing across the corners.

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3.0 PREPARATION FOR SHIPMENT

3.1 Calgon Carbon Corporation and their representatives are to take reasonable precautions when preparing equipment for shipment. Normally, a flat-bed truck will be used to transport the vessels, pipe rack and piping to the customer. Any hold-down location where a chain or strap contacts a painted surface must be protected with rubber sheeting, carpeting or other similar material.

3.2 Vessel loading will be the responsibility of the fabrication shop. Securing the load on the truck will be the responsibility of the truck driver. Painted surfaces must be protected from damage.

3.3 The pipe rack loading, if supplied, is the responsibility of the fabrication shop. The truck driver is to secure the rack to the truck bed. Points of contact are to be padded to protect the equipment.

3.4 All loose piping is to be loaded in such a manner as to avoid damage to painted surfaces. No chains are to be in direct contact with piping. Padding is to be used. Loading of loose piping will be the responsibility of the fabrication shop. The truck driver is to secure the piping to the truck bed.

4.0 SHIPPING REQUIREMENTS

4.1 Systems are typically shipped on one (1) truck. An additional truck may be required due to specific height or weight restrictions.

4.2 Once the vessels, pipe racks or loose piping are loaded onto a truck, they shall not be unloaded again until they reach their final destination.

4.3 No vessels, pipe racks or loose piping shall be shipped without a complete bill of lading which itemizes all parts. Also, no shipment shall be made without the completed packing list for crated parts which has been initialed by the person who packed and the person doing the checking.

5.0 INSPECTION UPON RECEIPT

5.1 The purchaser should arrange for an inspector or an authorized person at the jobsite to inspect and also supervise the off-loading of the system.

5.2 Check the bill of lading against the equipment received.

5.3 If damage has occurred during transit, it must be noted on the delivery receipt prior to signing acceptance. If damage has occurred, a claim should be filed promptly with the delivery carrier. If excessive damage is found:

- Do not unpack or unload the equipment
- Document the extent of the damage with photographs
- Contact your Calgon Carbon representative

5.4 If no claim is filed, the purchaser accepts all further responsibility for damaged equipment.

5.5 If damage has occurred and is not repaired by Calgon Carbon Corporation prior to the equipment being put into service, the purchaser accepts all future responsibility for the effects of equipment failure resulting from such damage.

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6.0 RECOMMENDED INSPECTION PROCEDURES

The following should be used as a guideline in making an inspection of the equipment prior to unloading.

6.1 The adsorber vessel exterior should be visually examined for damage. Any sign of impacting may result in cracked or flaking of the vessel interior lining. If this damage has occurred, it is required that the manway be opened and the interior lining be visually inspected.

6.2 Check the equipment for any signs of breakage, abrasion, shifting or rotation that may have resulted in damage to the paint on vessels, pipe rack, or loose piping.

6.3 Upon discovering minor or major damage, contact your Calgon Carbon representative to report your findings.

7.0 UNLOADING

7.1 Calgon Carbon Corporation specifically does not assume responsibility for the unloading of vessels, pipe racks or piping. Shipment will be considered complete when the equipment arrives at the jobsite and prior to removal of the equipment from the truck by the purchaser. The presence of Calgon Carbon Corporation representative(s) at the delivery or installation site does not relieve the purchaser of any of his responsibility for proper handling procedures.

7.2 All instructions shown in the Unloading/Foundations Section of the Calgon Carbon Corporation Operation and Maintenance Manual for this equipment shall be followed.

7.3 Vessel and pipe rack unloading shall be accomplished in such a manner as to avoid damage to finished surfaces. Adequate padding may be necessary around the lifting point.

7.4 The use of chains, slings, or a spreader bar is required for hoisting vessels and the pipe rack. The angle between the lifting point and the top of the equipment must always be 60° or greater. Workmen should keep control over the vessel with guidelines.

8.0 INSTALLATION

8.1 All instructions shown in Installation Section of the Calgon Carbon Corporation Operation and Maintenance Manual for this equipment shall be followed.

**** REVISIONS * ****

This specification has been revised as indicated below. The new pages added and/or the existing pages revised are attached as replacements for those previously issued.

REVISION	DATE	BY	PAGE	REMARKS
A	1-15-93	JMcM	All	Issued for Comment
B	5/19/93	JPM	All	Issued for Comment
C	9/1/93	JPM	2-3	Issued for Comment
D	10/12/93	JPM	3	Issued for Comment
E	11/13/07	JSR	All	
F	02/29/2008	RES	All	Modified to include vapor-phase equipment

ISSUED: JANUARY 15, 1993

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Section 14

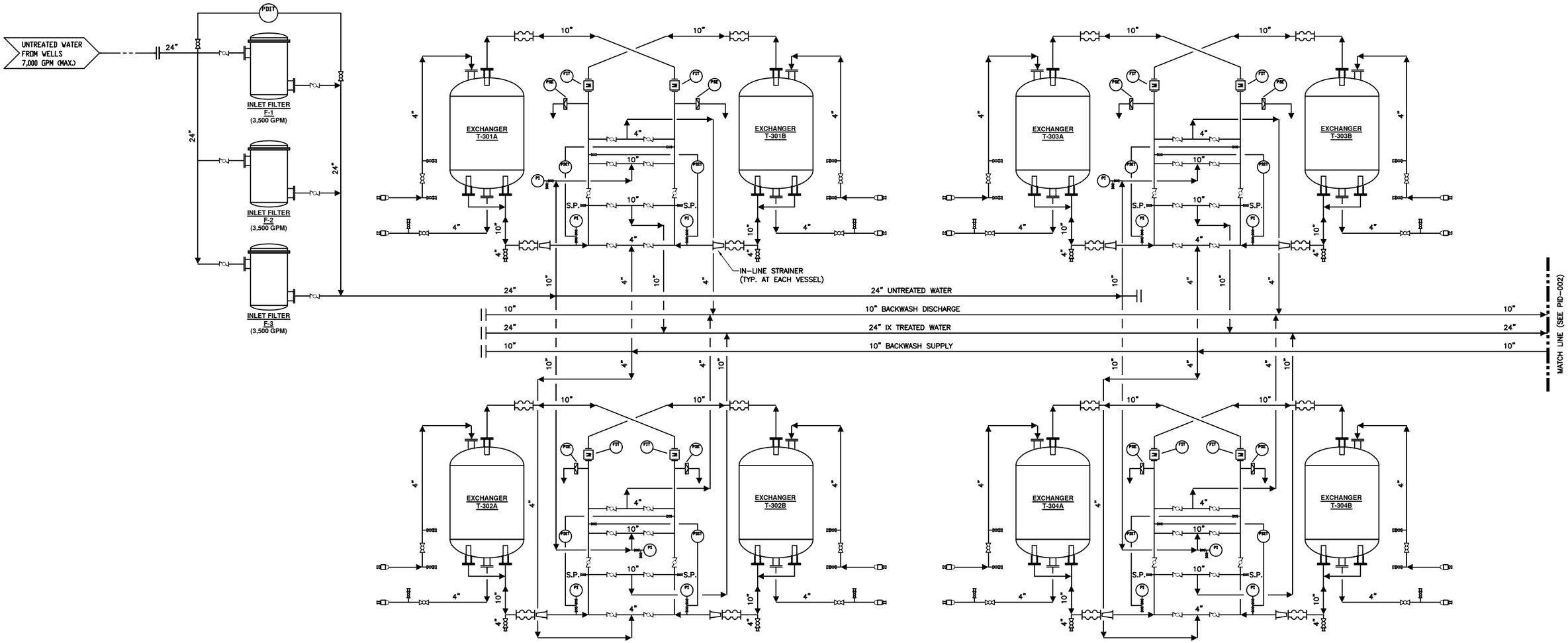
DRAWINGS

SECTION 14

DRAWING INDEX

DRAWING NUMBER	REVISION	TITLE
91075169	D	System Flow Diagram
91075170	B	Resin Systems Flow Diagram
91075171	B	Carbon Systems Flow Diagram
91075162	C	Site Plan
91075161	F	Site General Arrangement
91075163	B	Resin Systems General Arrangement
91075164	B	Carbon Systems General Arrangement
91075172	A	Resin Systems Vessel Arrangement
91075173	A	Carbon Systems Vessel Arrangement
91075174	A	Resin Systems Collection Header
91075175	A	Carbon Systems Collection Header
90060210	0	8” Septa
90060218	0	6” Septa
91085625	A	Control Panel
91085626	A	Junction Box

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NOTES:
1. ALL CARBON STEEL PIPING TO BE LINED PER CCC SPEC. RS-100.

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	NAME	DATE
DRAFTER	RES	02-27-2008
DESIGNER		
CHECKER		
APPROVAL		
PROJECT No.	IX-08089.MHLL	

REV	DESCRIPTION	APP	DATE
D	ISSUED FOR APPROVAL	RES	1/26/09

REVISIONS

TOLERANCES (unless otherwise specified)

ANGULAR	±0°30'	DECIMAL (2 PLACES)	±.010
FRACTIONAL	±1/16"	DECIMAL (3 PLACES)	±.005
DECIMAL (1 PLACE)	±.015	DECIMAL (4 PLACES)	±.0005

CALGON

CALGON CARBON CORPORATION

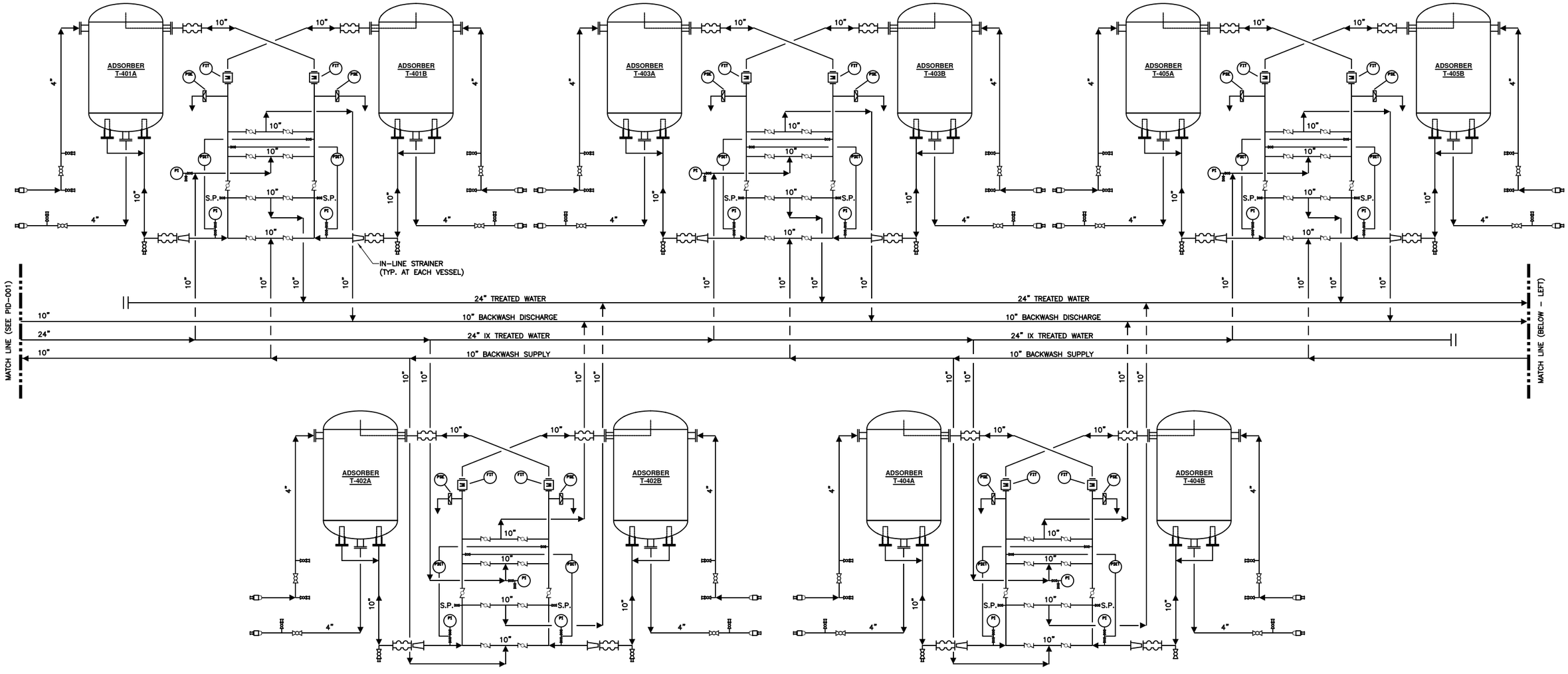
CLIENT: MONK HILLS WELLS PASADENA, CA

TITLE: PERCHLORATE AND VOC REMOVAL GAC AND IX RESIN SYSTEM FLOW DIAGRAM

DWG. Size	SHEET No.	SCALE
D	1 OF 2	NONE

DWG. No. 91075169 REV. D

V:\2008\IX-08089.MHLL\Drawings\Process\91075169 System Flow Diagram.dwg Jan 28, 2009 - 12:59pm



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	NAME	DATE
DRAFTER	RES	02-27-2008
DESIGNER		
CHECKER		
APPROVAL		
PROJECT No.	IX-08089.MHLL	

REV	DESCRIPTION	APP	DA
D	ISSUED FOR APPROVAL	RES	1/26

REVISIONS

TOLERANCES (unless otherwise specified)

ANGULAR	±0°30'	DECIMAL (2 PLACES)	±.010
FRACTIONAL	±1/16"	DECIMAL (3 PLACES)	±.005
DECIMAL (1 PLACE)	±.015	DECIMAL (4 PLACES)	±.0005

CALGON CARBON CORPORATION

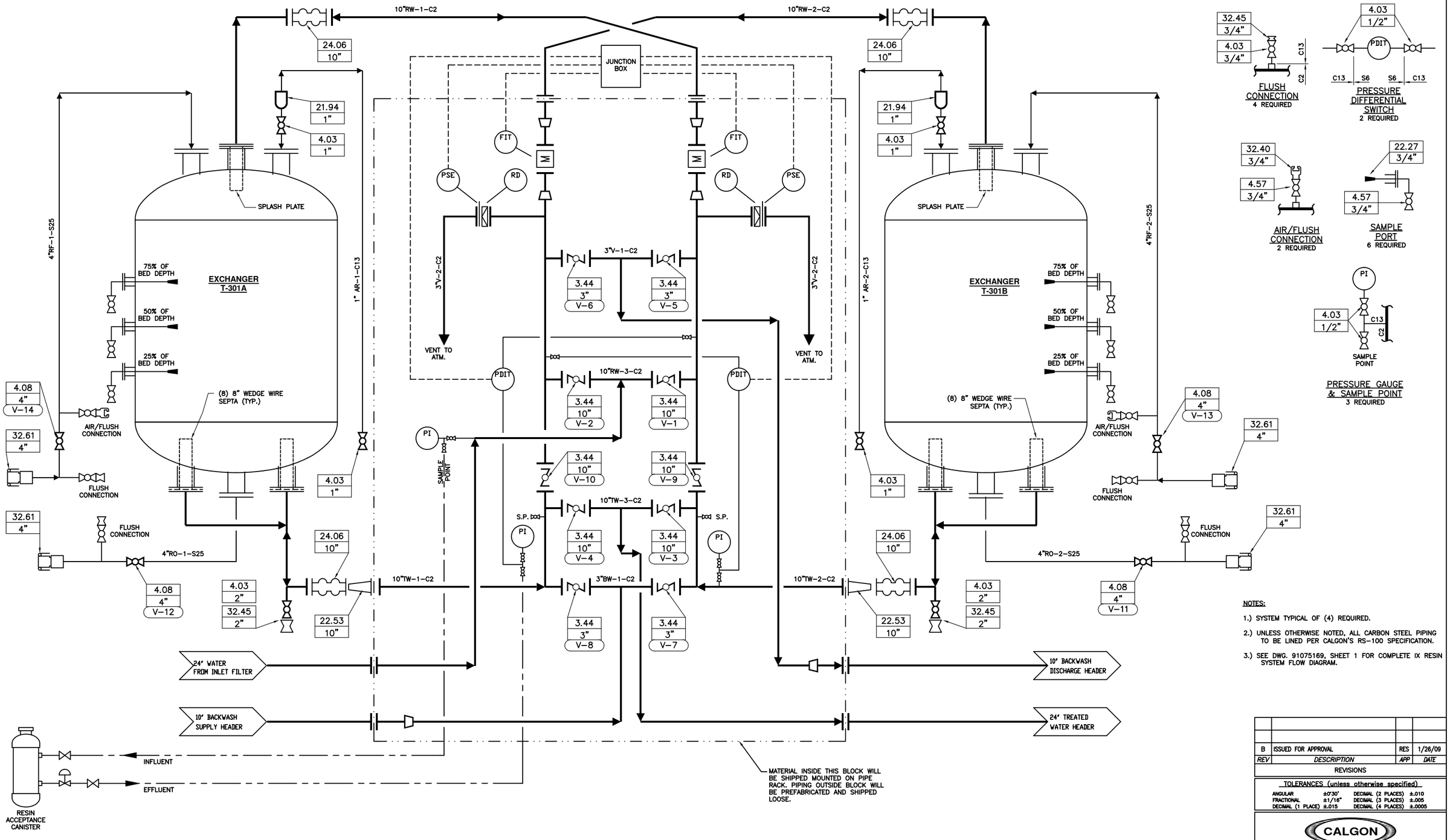
CLIENT: MONK HILLS WELLS
PASADENA, CA

TITLE: PERCHLORATE AND VOC REMOVAL
GAC AND IX RESIN
SYSTEM FLOW DIAGRAM

DWG. Size	SHEET No.	SCALE
D	2 OF 2	NONE

DWG. No. 91075169 REV. D

V:\2008\IX-08089.MHLL\Drawings\Process\91075169 System Flow Diagram.dwg Jan 28, 2009 - 12:59pm



NOTES:

1.) SYSTEM TYPICAL OF (4) REQUIRED.

2.) UNLESS OTHERWISE NOTED, ALL CARBON STEEL PIPING TO BE LINED PER CALGON'S RS-100 SPECIFICATION.

3.) SEE DWG. 91075169, SHEET 1 FOR COMPLETE IX RESIN SYSTEM FLOW DIAGRAM.

MEDIA	INSTRUMENTATION	DESIGN CONDITIONS	LEGEND	ADSORBERS	
MEDIA: CALRES 2109 QUANTITY: 353 CU. FT. PER VESSEL SERVICE: POTABLE	• PI 217 • RD – PSE 577 FOR 125 psig MAX. OPER. PRES. • PSE – BS&B KBA • PDIT – ROSEMOUNT 1151	FLOW RATE – 1750 GPM INFLUENT PRESSURE – 100 PSIG INFLUENT TEMP. – 60° F MAX. BACKFLUSH RATE – 150 GPM MAX.	AR – AIR RELEASE BW – BACKWASH WATER FC – FLUSH CONNECTION RF – RESIN FILL RW – RAW WATER RO – RESIN OUT SP – SAMPLE POINT TW – TREATED WATER V – VENT	12'-0" O.D. x 5'-0" STRAIGHT SIDE ASME 2:1 ELLIPTICAL TOP AND BOTTOM HEADS. CARBON STEEL CONSTRUCTION. ASME SECT. VIII, DIV. 1 W/ PLASITE 4006 LINING FORCE CURED PER NSF 61 CRITERIA 125 PSIG @ 140°F DESIGN.	AIR, CARBON TRANSFER – 100 SCFM @ 30 PSIG MIN. PLANT WATER – 100 GPM @ 30 PSIG MIN. WIRING – MIN. AWG #16 TO PDS 294

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	NAME	DATE
DRAFTER	JGP	07-25-2008
DESIGNER		
CHECKER		
APPROVAL		
PROJECT No.	IX-08089.MHLL	

REV	DESCRIPTION	APP	DATE
B	ISSUED FOR APPROVAL	RES	1/26/09

REVISIONS

TOLERANCES (unless otherwise specified)

ANGULAR	±0°30'	DECIMAL (2 PLACES)	±.010
FRACTIONAL	±1/16"	DECIMAL (3 PLACES)	±.005
DECIMAL (1 PLACE)	±.015	DECIMAL (4 PLACES)	±.0005

CALGON

CALGON CARBON CORPORATION

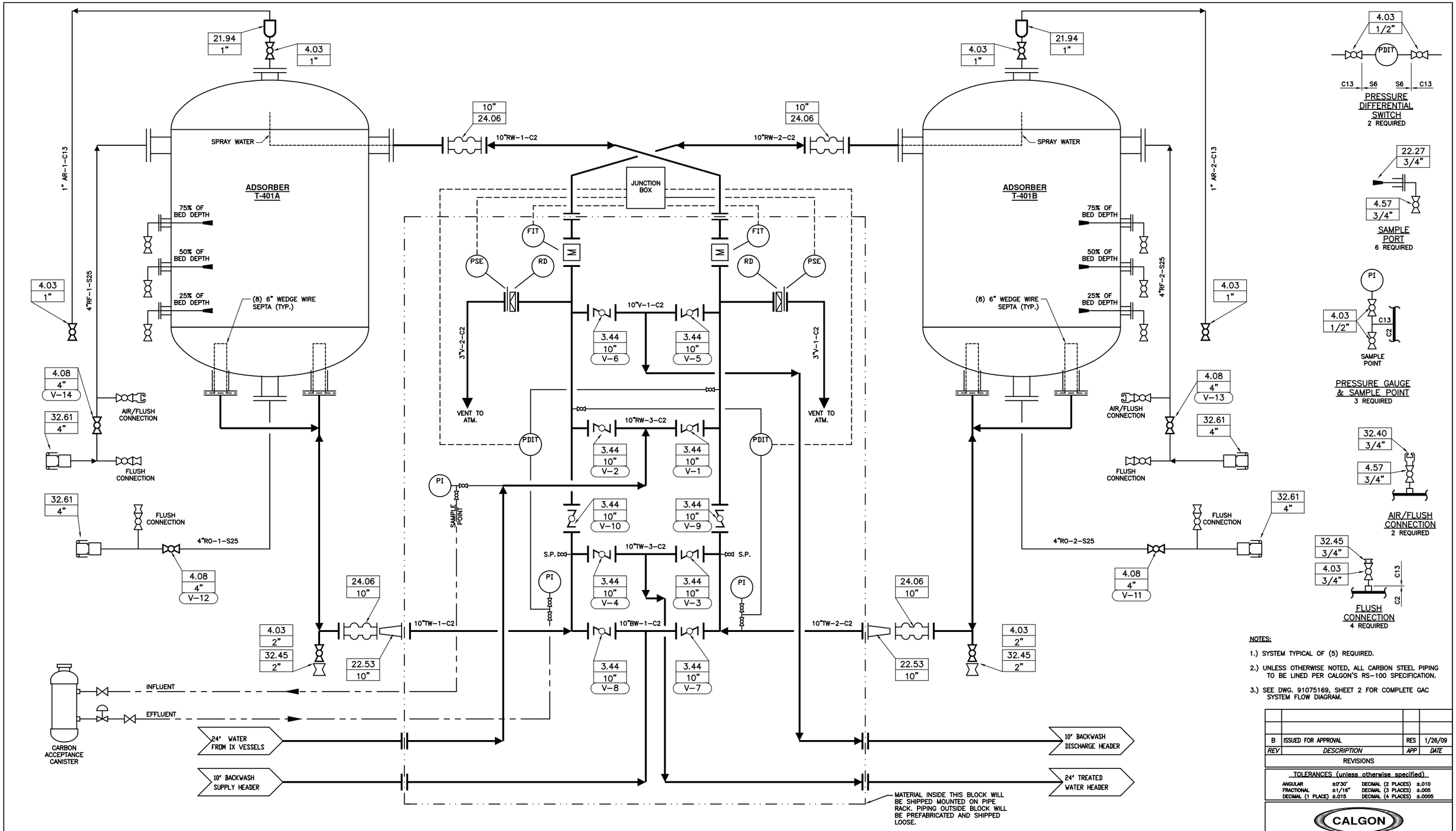
CLIENT: MONK HILLS WELLS PASADENA, CA

TITLE: PERCHLORATE REMOVAL ION EXCHANGE RESIN SYSTEM FLOW DIAGRAM

DWG. Size D | SHEET No. 1 OF 1 | SCALE NONE

DWG. No. 91075170 | REV. B

V:\2008\IX-08089.MHLL\Drawings\Process\91075170 IX System Flow Diagram.dwg Jan 28, 2009 - 2:00pm



NOTES:

1.) SYSTEM TYPICAL OF (5) REQUIRED.

2.) UNLESS OTHERWISE NOTED, ALL CARBON STEEL PIPING TO BE LINED PER CALGON'S RS-100 SPECIFICATION.

3.) SEE DWG. 91075169, SHEET 2 FOR COMPLETE GAC SYSTEM FLOW DIAGRAM.

MEDIA	INSTRUMENTATION	DESIGN CONDITIONS	LEGEND	ADSORBERS	
MEDIA: F-300 QUANTITY: 40,000 LB.S/1,335 CU. FT. PER VESSEL SERVICE: POTABLE	• PI 217 • RD – PSE 577 FOR 125 psig MAX. OPER. PRESS. • PSE – BS&B KBA • PDIT – ROSEMOUNT 1151	FLOW RATE – 1400 GPM INFLUENT PRESSURE – PSIG INFLUENT TEMP. – 60° F MAX. BACKFLUSH RATE – 1700 GPM MAX.	AR – AIR RELEASE BW – BACKWASH WATER FC – FLUSH CONNECTION RF – RESIN FILL RW – RAW WATER RO – RESIN OUT SP – SAMPLE POINT TW – TREATED WATER V – VENT	12'-0" O.D. x 14'-0" STRAIGHT SIDE ASME 2:1 ELLIPTICAL TOP AND BOTTOM HEADS. CARBON STEEL CONSTRUCTION. ASME SECT. VIII, DIV. 1 W/ PLASITE 4006 LINING FORCED CURED PER NSF 61 CRITERIA 125 PSIG @ 140°F DESIGN.	AIR, CARBON TRANSFER – 100 SCFM @ 30 PSIG MIN. PLANT WATER – 100 GPM @ 30 PSIG MIN. WIRING – MIN. AWG #16 TO PDS 294

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REV	DESCRIPTION	APP	DATE
B	ISSUED FOR APPROVAL	RES	1/26/09

REVISIONS

TOLERANCES (unless otherwise specified)

ANGULAR	±0°30'	DECIMAL (2 PLACES)	±.010
FRACTIONAL	±1/16"	DECIMAL (3 PLACES)	±.005
DECIMAL (1 PLACE)	±.015	DECIMAL (4 PLACES)	±.0005

	NAME	DATE
DRAFTER	JGP	07-25-2008
DESIGNER		
CHECKER		
APPROVAL		
PROJECT No.	IX-08089.MHLL	

CALGON

CALGON CARBON CORPORATION

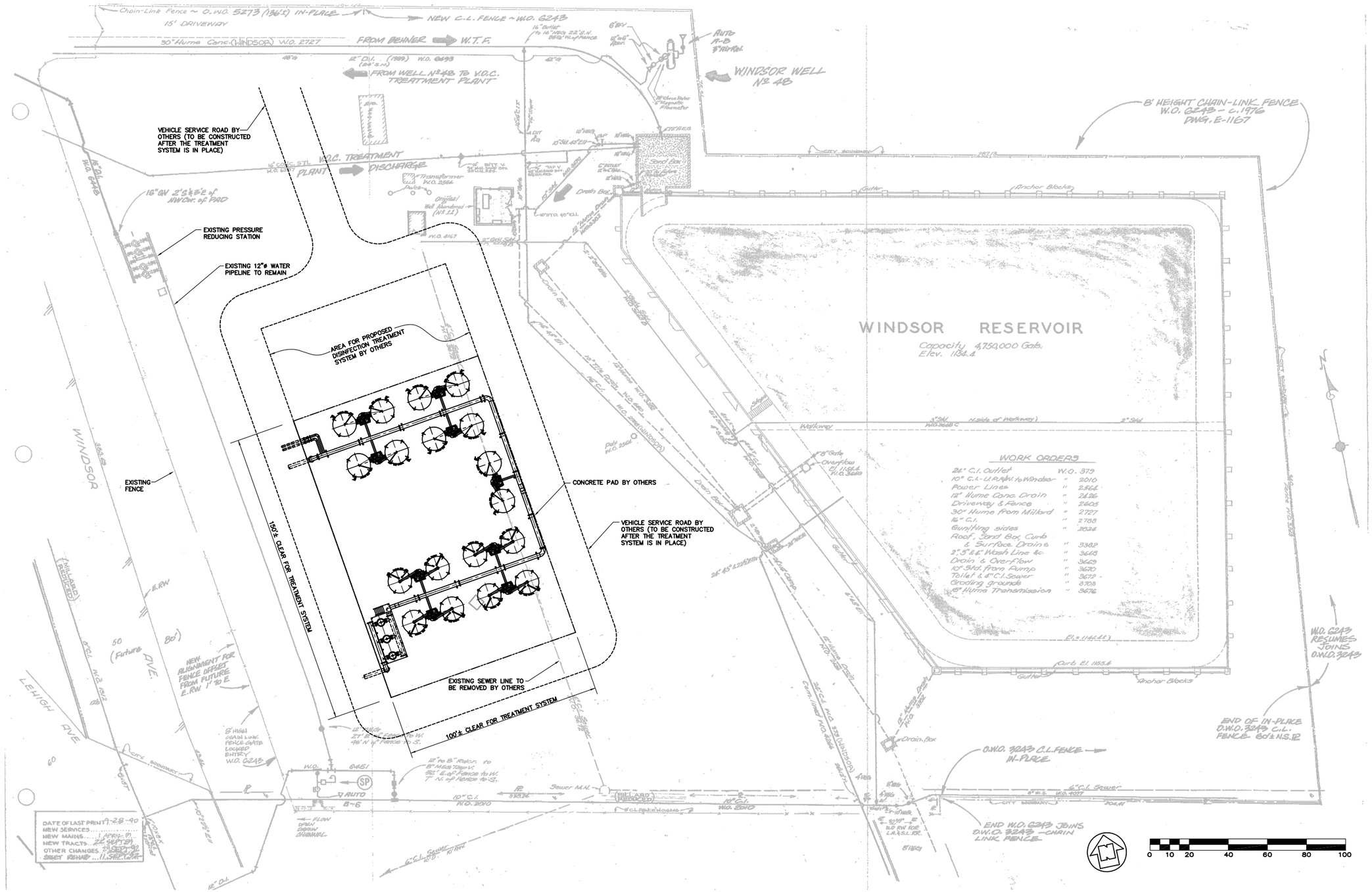
CLIENT: MONK HILLS WELLS
PASADENA, CA

TITLE: V.O.C. REMOVAL
GRANULAR ACTIVATED CARBON
SYSTEM FLOW DIAGRAM

DWG. Size	SHEET No.	SCALE
D	1 OF 1	NONE

DWG. No. 91075171 REV. B

V:\2008\IX-08089.MHLL\Drawings\Process\91075171 GAC System Flow Diagram.dwg Jan 28, 2009 - 2:02pm



PLAN

C	ISSUED FOR APPROVAL	RES	1/26/09
REV	DESCRIPTION	APP	DATE

REVISIONS

TOLERANCES (unless otherwise specified)

ANGULAR	±0°30'	DECIMAL (2 PLACES)	±.010
FRACTIONAL	±1/16"	DECIMAL (3 PLACES)	±.005
DECIMAL (1 PLACE)	±.015	DECIMAL (4 PLACES)	±.0005

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	NAME	DATE
DRAFTER	RES	7/12/2007
DESIGNER		
CHECKER		
APPROVAL		
PROJECT No.	IX-08089.MHLL	

CALGON

CALGON CARBON CORPORATION

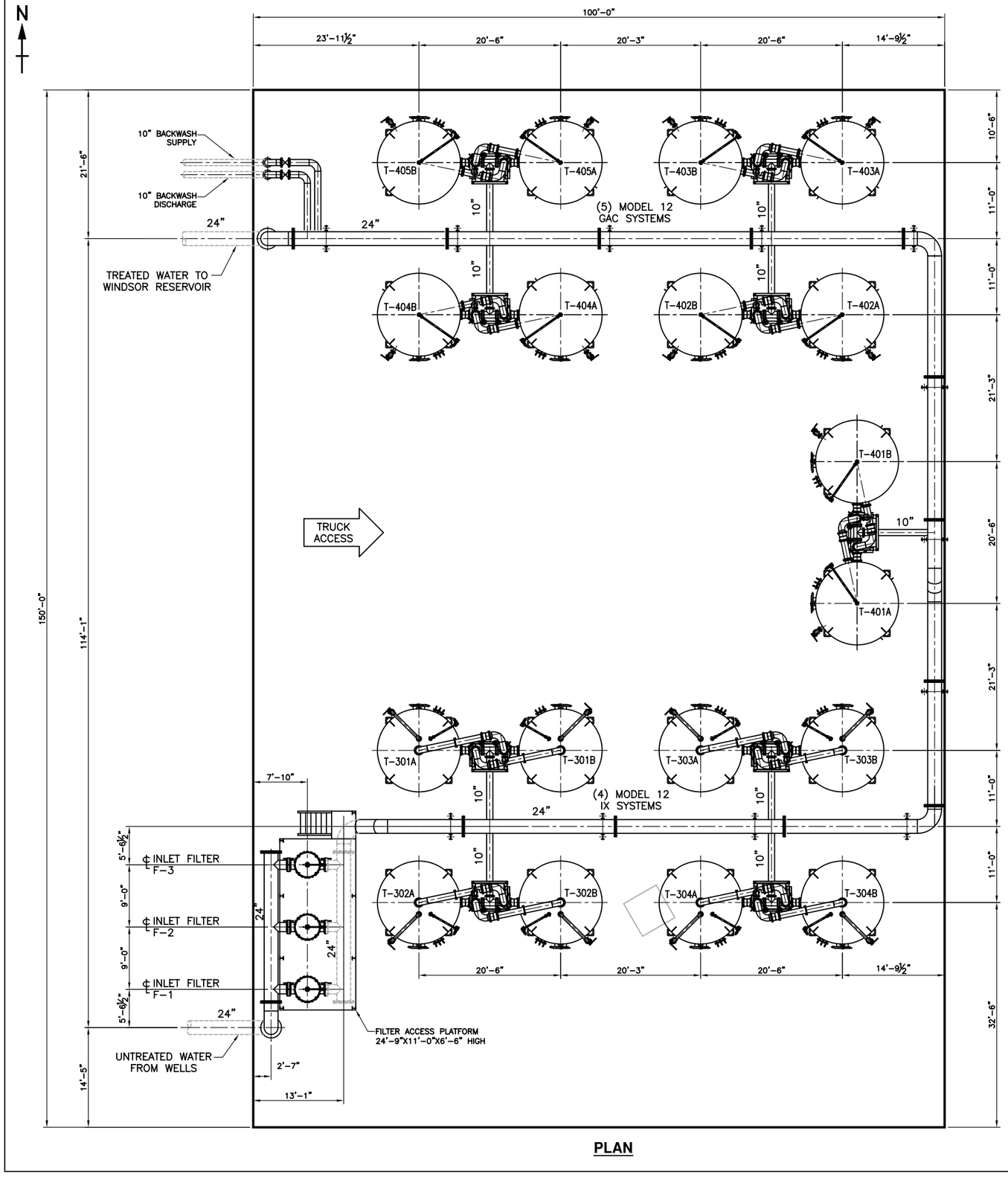
CLIENT: MONK HILLS WELLS
PASADENA, CA

TITLE: PERCHLORATE AND VOC REMOVAL
GAC AND IX RESIN
SITE PLAN

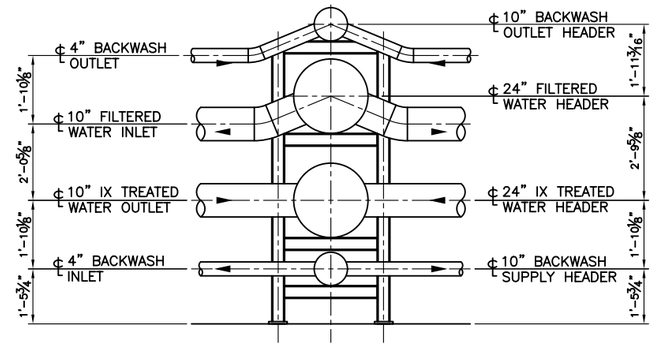
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DWG. No. 91075162 REV. C

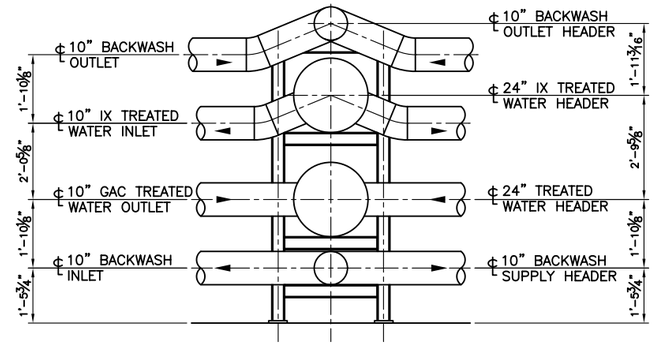
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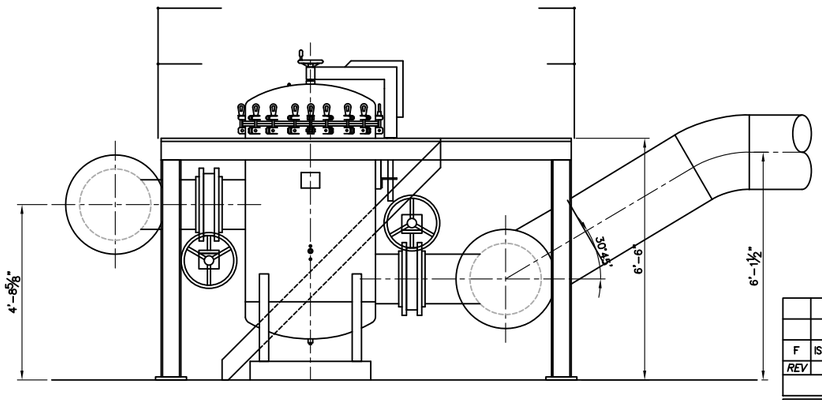
PLAN



ELEVATION
IX AREA PIPE RACK



ELEVATION
GAC AREA PIPE RACK



ELEVATION
LOOKING NORTH
AT INLET FILTERS

REV	DESCRIPTION	APP	DATE
F	ISSUED FOR APPROVAL	RES	1/26/09

REVISIONS

TOLERANCES (unless otherwise specified)

ANGULAR	±0°30'	DECIMAL (2 PLACES)	±.010
FRACTIONAL	±1/16"	DECIMAL (3 PLACES)	±.005
DECIMAL (1 PLACE)	±.015	DECIMAL (4 PLACES)	±.0005

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	NAME	DATE
DRAFTER	RES	07/12/2007
DESIGNER		
CHECKER		
APPROVAL		
PROJECT No.	IX-08089.MHLL	

CALGON
CALGON CARBON CORPORATION

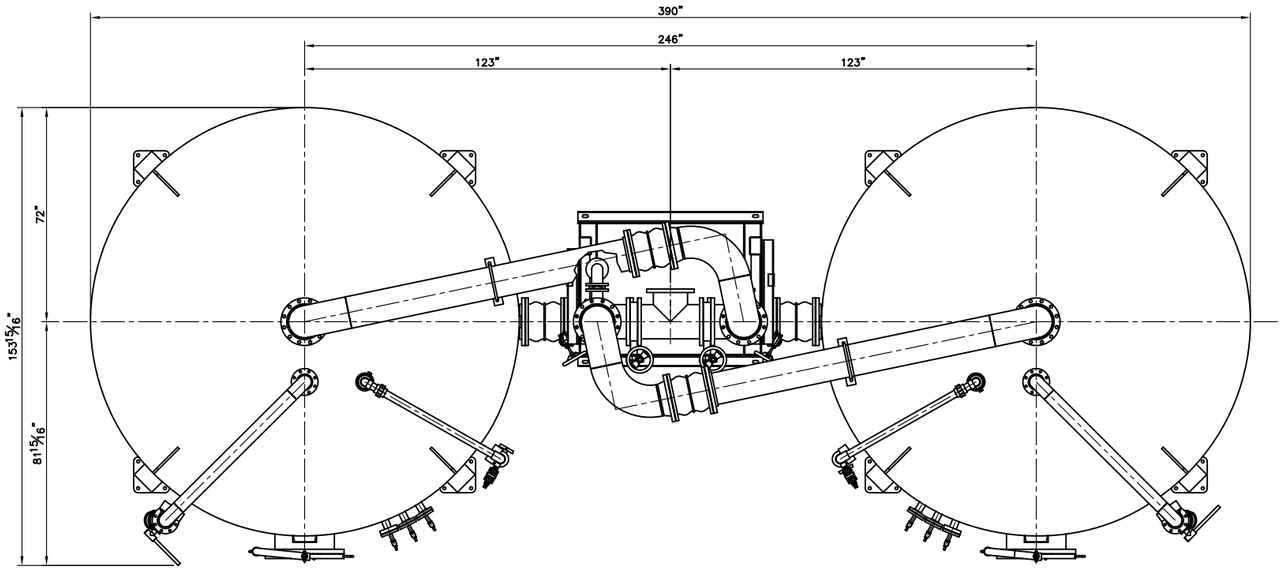
CLIENT
MONK HILLS WELLS
PASADENA, CA

TITLE
PERCHLORATE AND VOC REMOVAL
GAC AND IX RESIN
GENERAL ARRANGEMENT

DWG. Size	SHEET No.	SCALE
D	1 OF 1	NONE

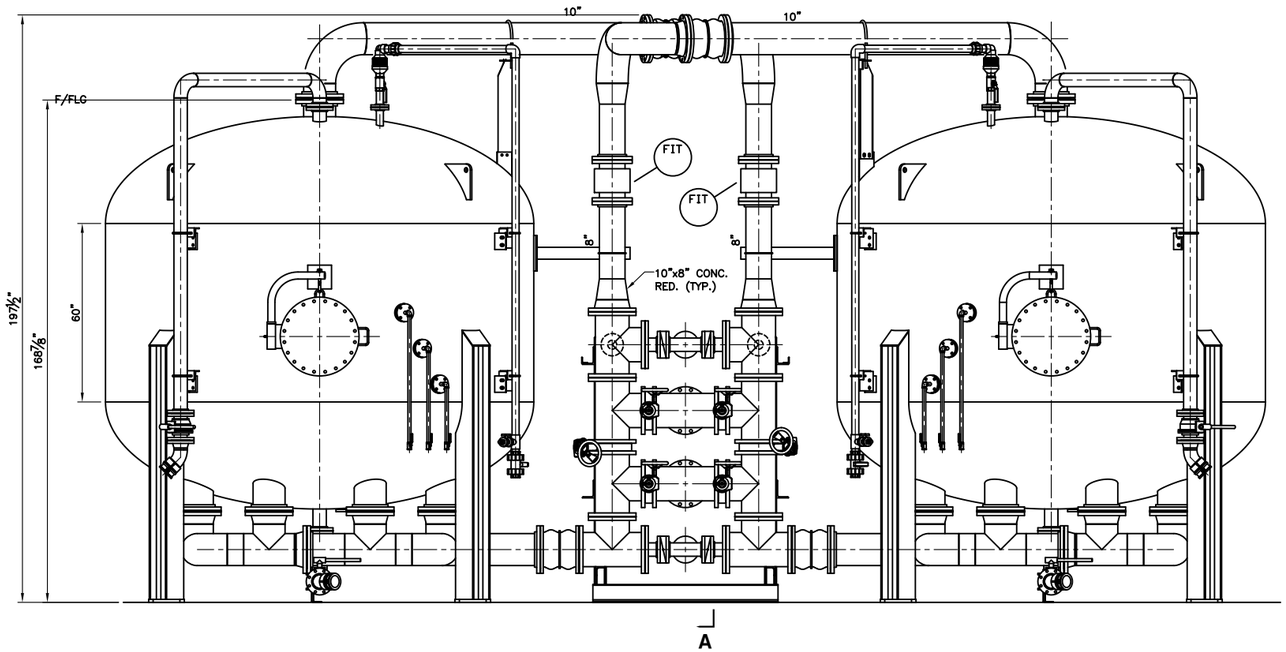
DWG. No. 91075161 REV. F

V:\2008\IX-08089.MHLL\Drawings\General Arrangements\91075161 General Arrangement.dwg Jan 28, 2009 - 1:17pm



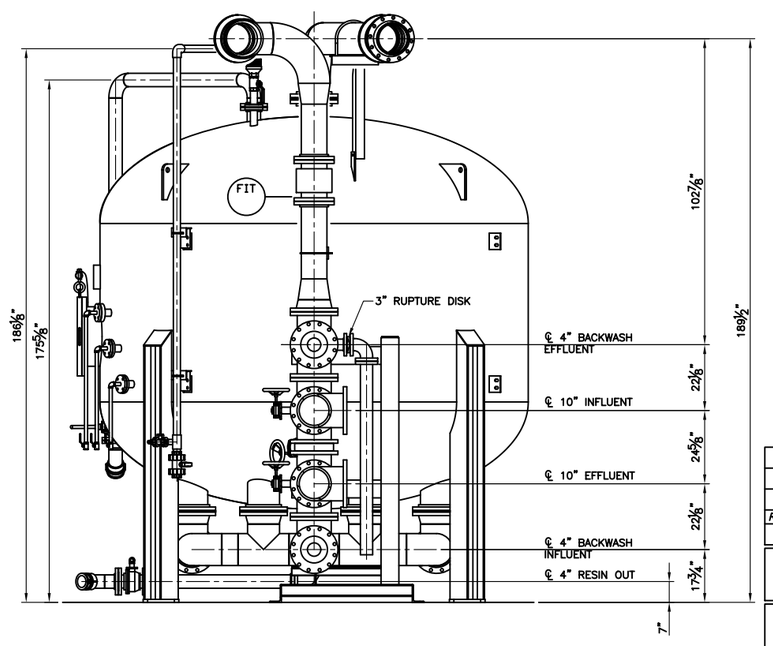
PLAN

A



A

ELEVATION



SECTION A-A

NOTES:
1. SYSTEM SHOWN IS TYPICAL OF (4) SYSTEMS TO BE SUPPLIED.
2. PAINT TO BE PER CCC SPECIFICATION RS-17 WITH POLYURETHANE TOP COAT.

REV	DESCRIPTION	APP	DATE
B	ISSUED FOR APPROVAL	RES	1/26/09

REVISIONS

TOLERANCES (unless otherwise specified)

ANGULAR	±0°30'	DECIMAL (2 PLACES)	±.010
FRACTIONAL	±1/16"	DECIMAL (3 PLACES)	±.005
DECIMAL (1 PLACE)	±.015	DECIMAL (4 PLACES)	±.0005

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	NAME	DATE
DRAFTER	RES	9/25/06
DESIGNER		
CHECKER		
APPROVAL		
PROJECT No.	IX-08089.MHLL	

CALGON

CALGON CARBON CORPORATION

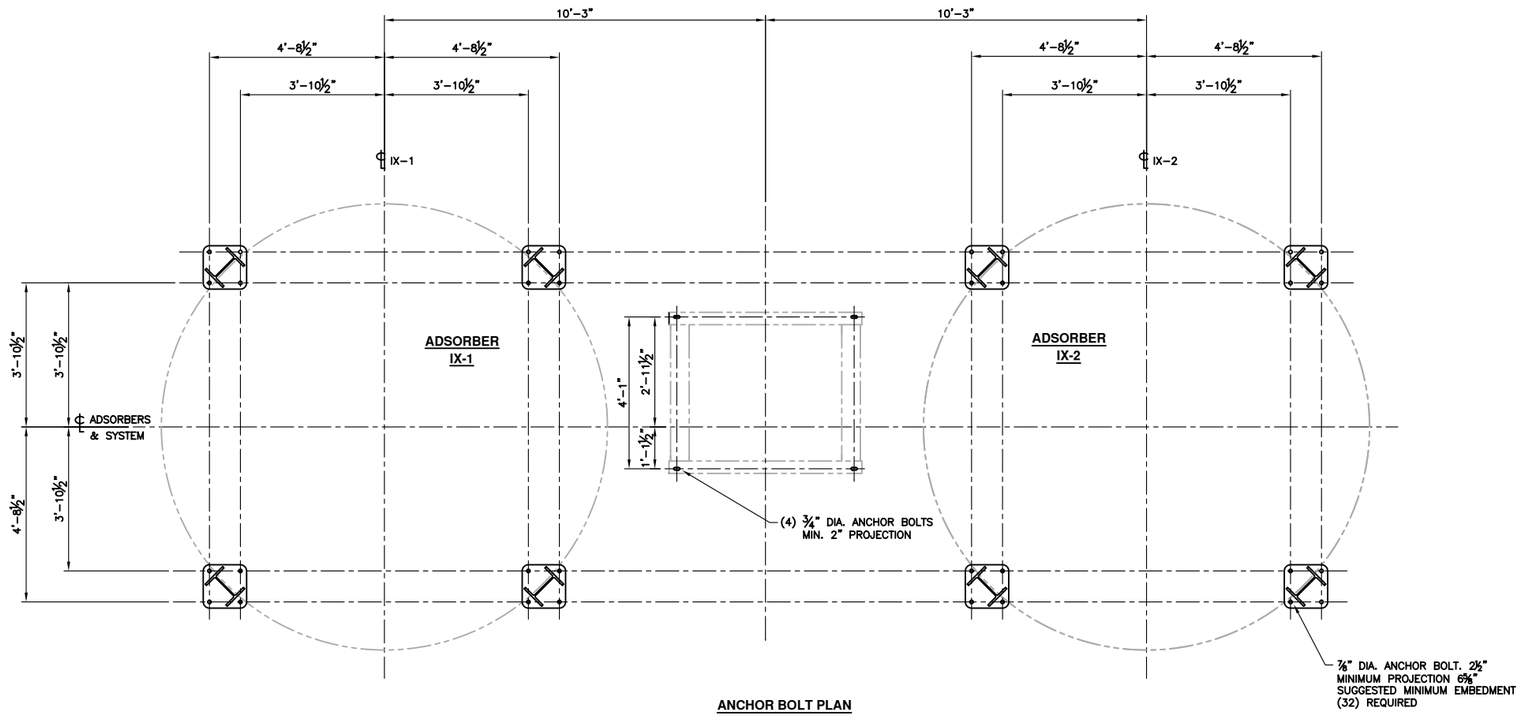
CLIENT: MONK HILLS WELS
PASADENA, CA

TITLE: IX RESIN SERVICE
MODEL 12
GENERAL ARRANGEMENT

DWG. Size	SHEET No.	SCALE
D	1 OF 2	NONE

DWG. No. 91075163 REV. B

V:\2008\IX-08089.MHLL\Drawings\General Arrangements\91075163 - GA IX.dwg Jun 28, 2009 - 1:04pm



ANCHOR BOLT PLAN

ANCHOR PATTERN SHOWN IS FOR ATTACHMENT OF VESSEL BASEPLATES TO A CONCRETE SLAB IN SIESMIC ZONE 4. TWO LARGE CENTER HOLES ARE PROVIDED IN EACH BASEPLATE FOR ATTACHEMENT TO STEEL FRAMING.

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	NAME	DATE
DRAFTER	RES	9/25/06
DESIGNER		
CHECKER		
APPROVAL		
PROJECT No.	IX-08089.MHLL	

REV	DESCRIPTION	APP	DATE
B	ISSUED FOR APPROVAL	RES	1/26/09

REVISIONS

TOLERANCES (unless otherwise specified)

ANGULAR	±0°30'	DECIMAL (2 PLACES)	±.010
FRACTIONAL	±1/16"	DECIMAL (3 PLACES)	±.005
DECIMAL (1 PLACE)	±.015	DECIMAL (4 PLACES)	±.0005

CALGON CARBON CORPORATION

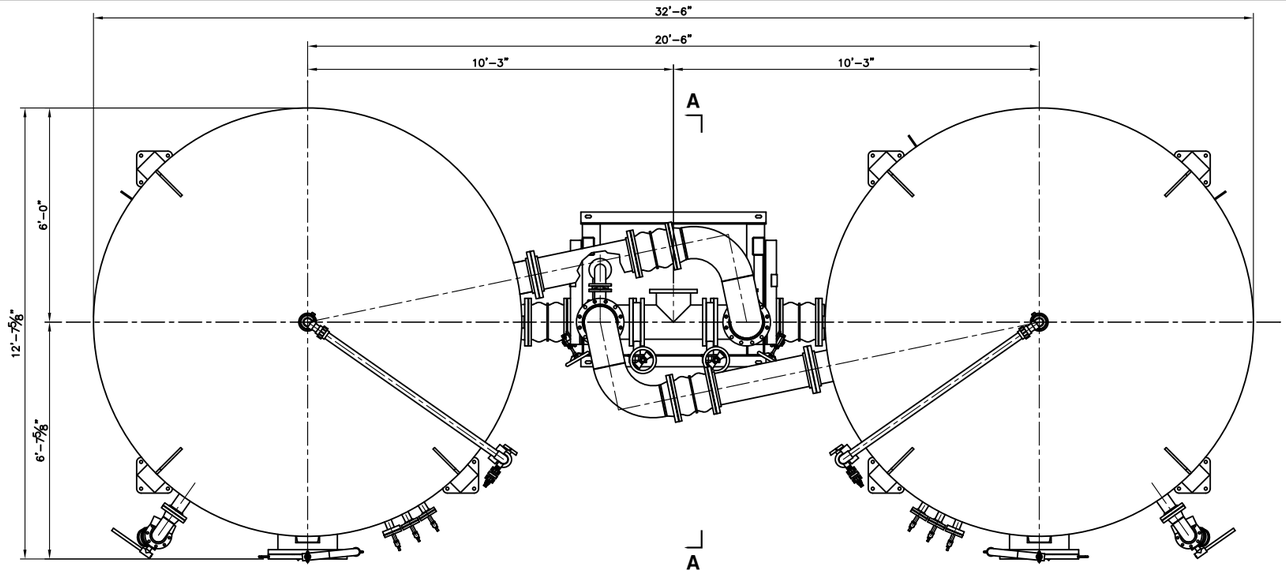
CLIENT: MONK HILLS WELS
PASADENA, CA

TITLE: IX RESIN SERVICE
MODEL 12
GENERAL ARRANGEMENT

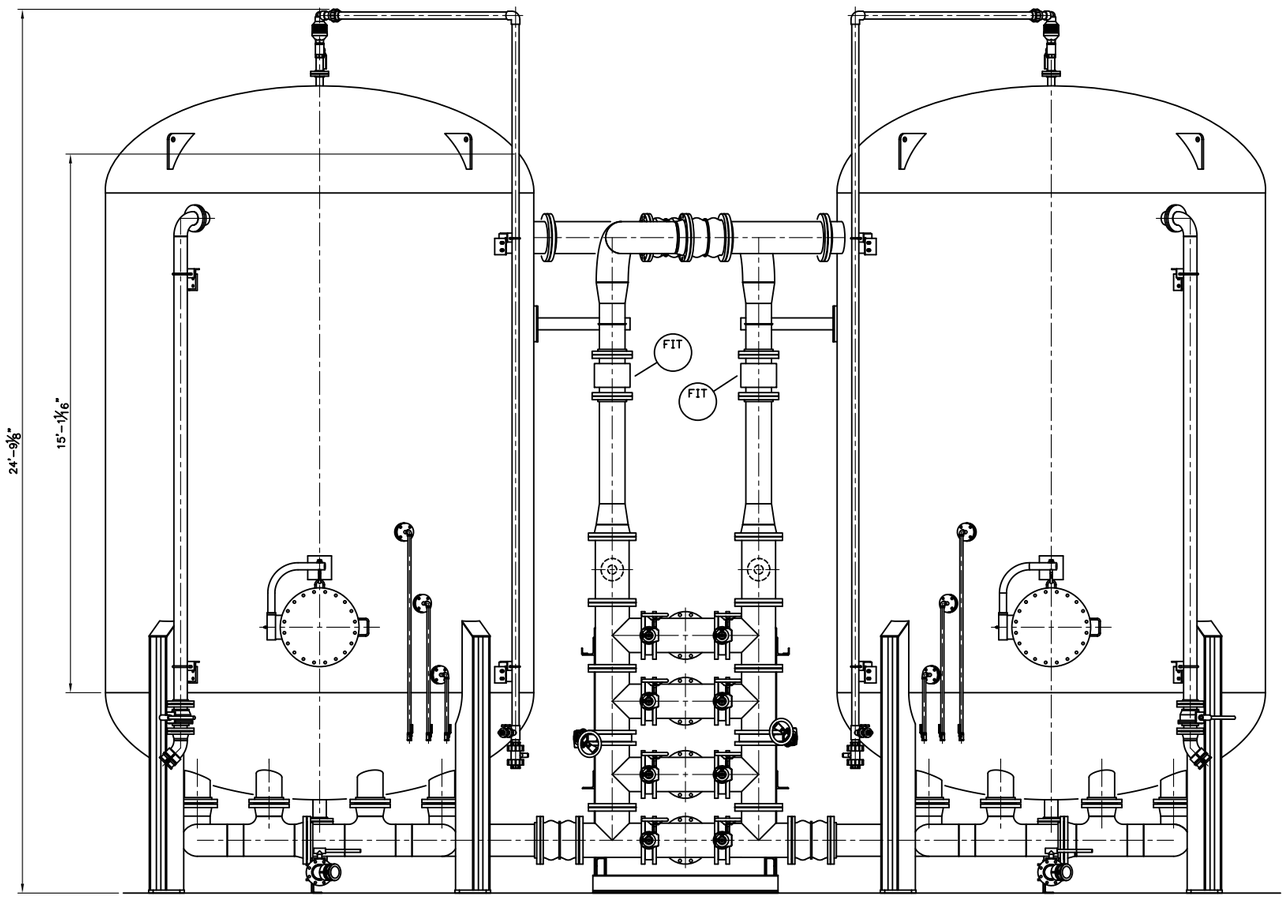
DWG. Size: D | SHEET No.: 2 OF 2 | SCALE: NONE

DWG. No.: 91075163 | REV.: B

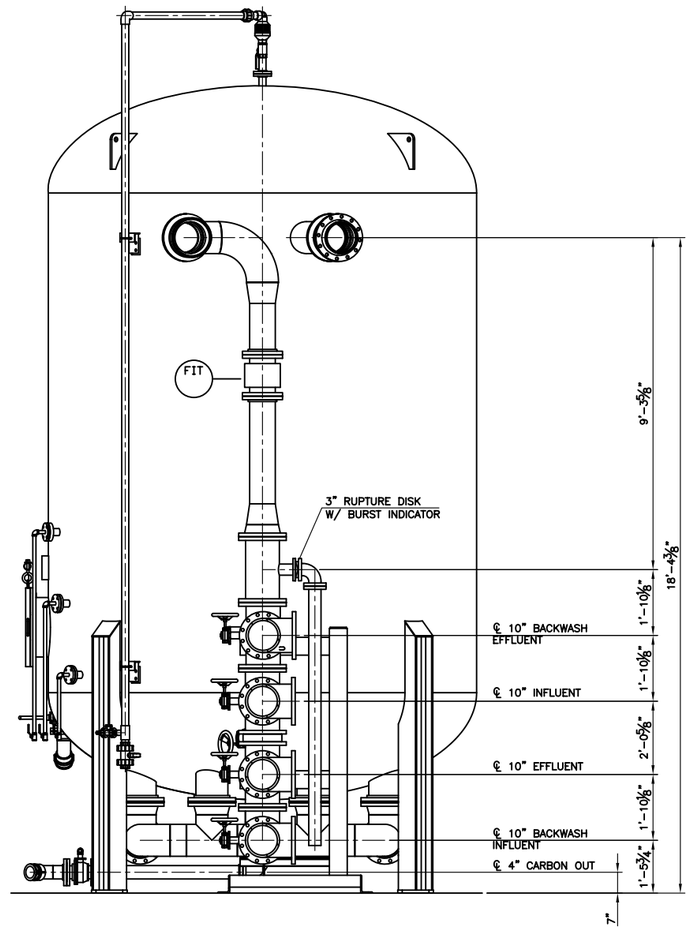
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PLAN



ELEVATION



SECTION A-A

NOTES:
1. SYSTEM SHOWN IS TYPICAL OF (5) SYSTEMS TO BE SUPPLIED.
2. PAINT TO BE PER CCC SPECIFICATION RS-17 WITH POLYURETHANE TOP COAT.

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	NAME	DATE
DRAFTER	RES	9/25/06
DESIGNER		
CHECKER		
APPROVAL		
PROJECT No.	IX-08089.MHLL	

REV	DESCRIPTION	APP	DATE

REVISIONS

TOLERANCES (unless otherwise specified)

ANGULAR	±0°30'	DECIMAL (2 PLACES)	±.010
FRACTIONAL	±1/16"	DECIMAL (3 PLACES)	±.005
DECIMAL (1 PLACE)	±.015	DECIMAL (4 PLACES)	±.0005

CALGON

CALGON CARBON CORPORATION

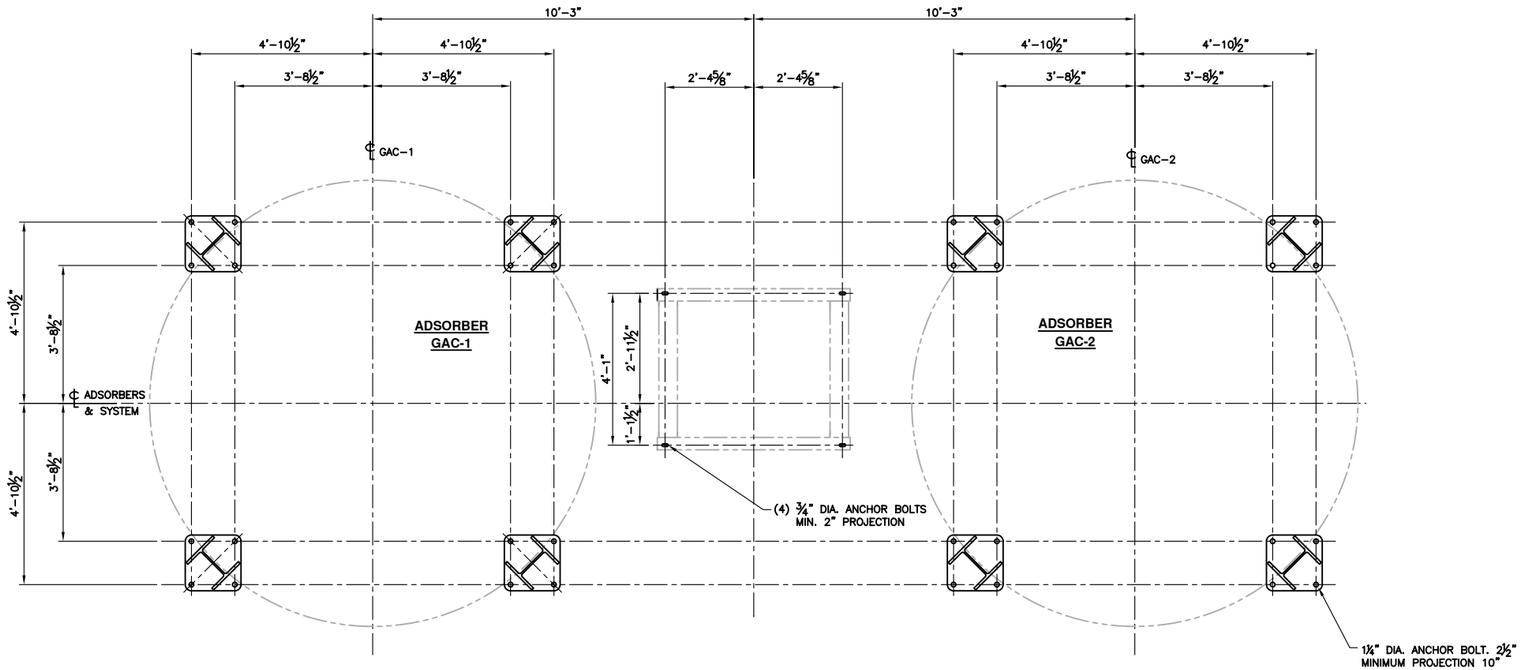
CLIENT
MONK HILLS WELS
PASADENA, CA

TITLE
GAC SERVICE
MODEL 12
GENERAL ARRANGEMENT

DWG. Size	SHEET No.	SCALE
D	1 OF 2	NONE

DWG. No. 91074164 REV. A

V:\2008\IX-08089.MHLL\Drawings\General Arrangements\91075164 - GA GAC.dwg Jan 28, 2009 - 1:03pm



ANCHOR BOLT PLAN

ANCHOR PATTERN SHOWN IS FOR ATTACHMENT OF VESSEL BASEPLATES TO A CONCRETE SLAB IN SIESMIC ZONE 4. TWO LARGE CENTER HOLES ARE PROVIDED IN EACH BASEPLATE FOR ATTACHEMENT TO STEEL FRAMING.

REV	DESCRIPTION	APP	DATE
	REVISIONS		

TOLERANCES (unless otherwise specified)

ANGULAR	±0°30'	DECIMAL (2 PLACES)	±.010
FRACTIONAL	±1/16"	DECIMAL (3 PLACES)	±.005
DECIMAL (1 PLACE)	±.015	DECIMAL (4 PLACES)	±.0005

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	NAME	DATE
DRAFTER	RES	9/25/06
DESIGNER		
CHECKER		
APPROVAL		
PROJECT No.	IX-08089.MHLL	

CALGON

CALGON CARBON CORPORATION

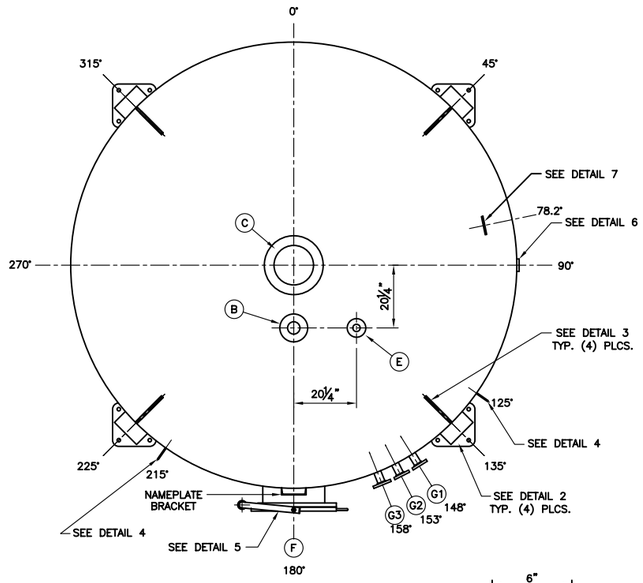
CLIENT: MONK HILLS WELS
PASADENA, CA

TITLE: GAC SERVICE
MODEL 12
GENERAL ARRANGEMENT

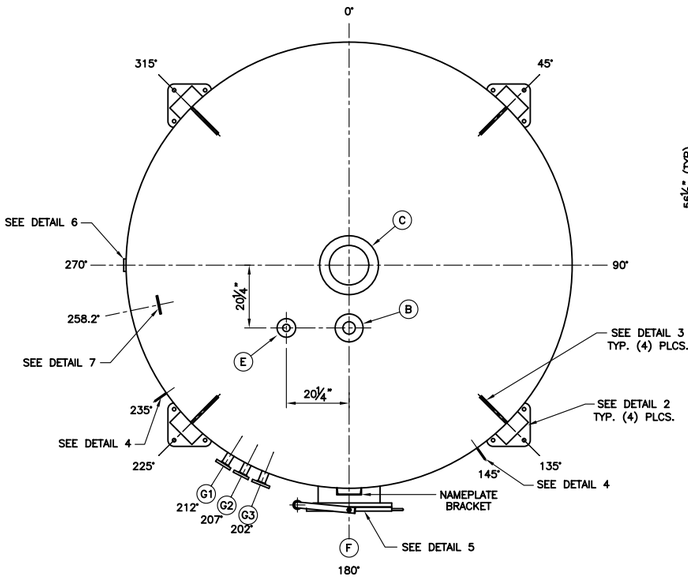
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DWG. No. 91075164 REV. A

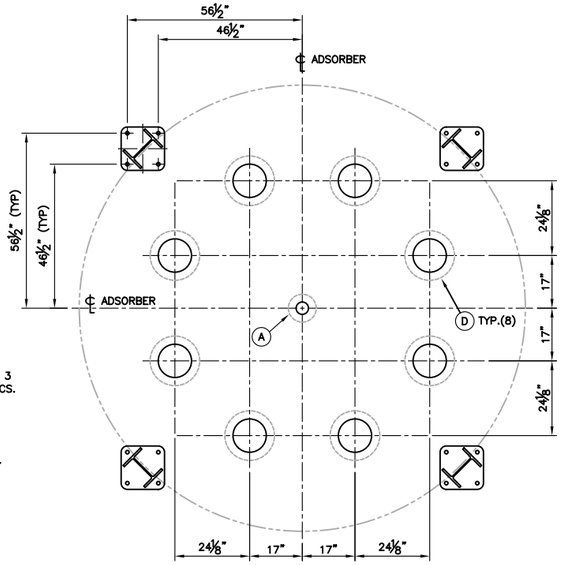
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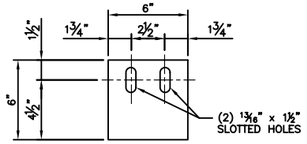
PLAN
T-301A THRU T-304A



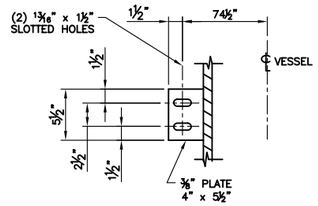
PLAN
T-301B THRU T-304B



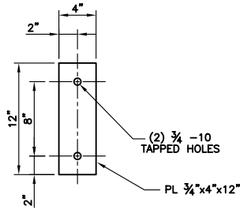
SECTION A-A



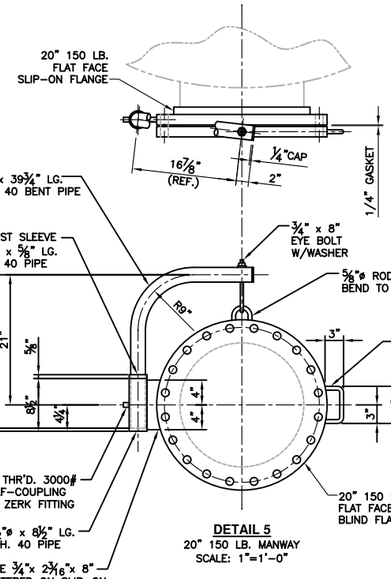
DETAIL 7
PIPE SUPPORT CLIP
(1) REQ'D./VESSEL



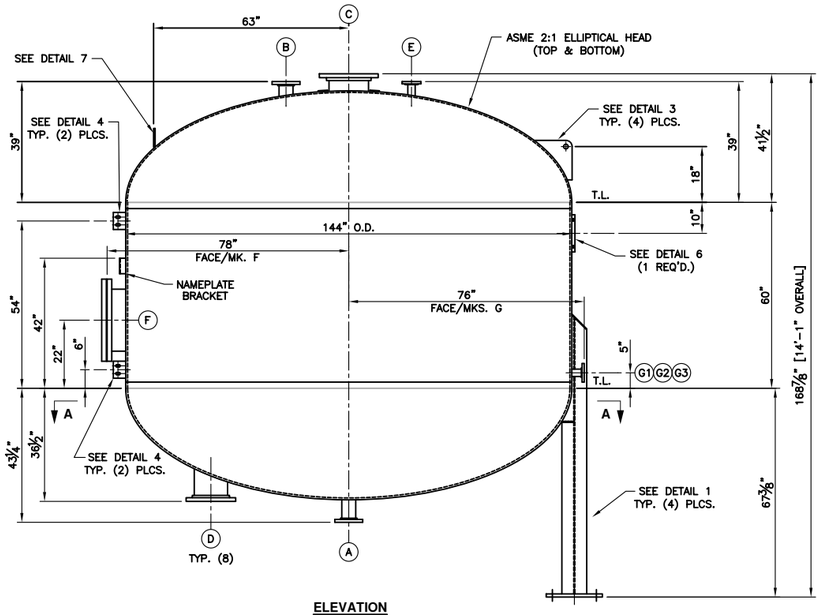
DETAIL 4
PIPE SUPPORT CLIP
(4) REQ'D./VESSEL



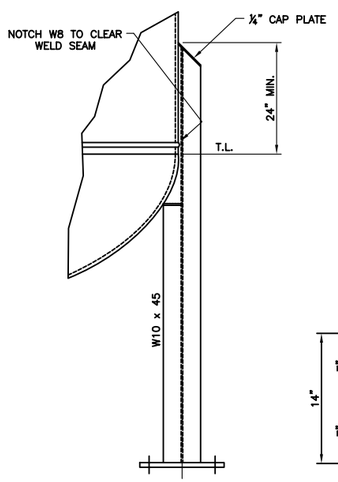
DETAIL 6
PIPE SUPPORT
(1 REQ'D)



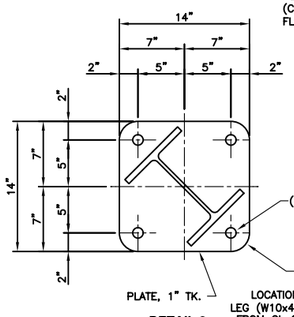
DETAIL 5
20" 150 LB. MANWAY
SCALE: 1"=1'-0"



ELEVATION
APPERTENANCES ARE ROTATED FOR CLARITY
SEE PLAN FOR TRUE ORIENTATIONS

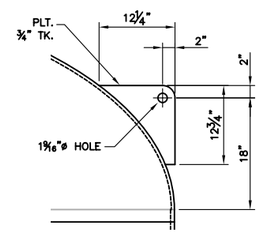


DETAIL 1
VESSEL SUPPORT LEG
(4) REQ'D.



DETAIL 2
TYP. BASEPLATE

LOCATION OF BASEPLATE ON LEG (W10x45) TO BE SET BY DIMS. FROM CL OF VESSEL AFTER LEGS ARE WELDED TO SHELL.



DETAIL 3
LIFTING LUG
(4) REQ'D.

VESSEL DESCRIPTION	EXCHANGER T-301A & B THRU T-304A & B
REFERENCES	VESSEL SPECIFICATION VS1
DESIGN CONDITIONS	125 PSIG @ 140° F
OPERATING CONDITIONS	125 PSIG @ 70° F
PROCESS FLUID	1.0 S.G. (WATER)
WALL THICK.	HEAD : T.B.D. (PER CODE CALCS.) SHELL : T.B.D. (PER CODE CALCS.)

MATERIALS OF CONSTRUCTION	
SHELL	SA-516 GRADE 70
TOP HEAD	SA-516 GRADE 70
BOT. HEAD	SA-516 GRADE 70
LINING	PLASITE 4006, 25-35 MIL NOMINAL DFT FORCE CURED PER NSF 61 CRITERIA PIN HOLE FREE FOR IMMERSION SERVICE PER CCC SPEC. VS-23
LEG SUPPORT	A992
BOLTING	SA-325-1 WITH HVY HX NUT - SEE NOTE 7
GASKETS	1/8" EPDM (MANWAY 1/4")

TYPE CONSTRUCTION	FUSION WELDED
CORROS. ALLOW.	NONE
CODE	ASME SECTION VIII, DIVISION I, LATEST EDITION
INSPECTION	BY CALGON & AUTHORIZED INSPECTOR
STAMPING	ASME " U ", NBR
TESTING	HYDROSTATIC PER CODE
STRESS RELIEF	PER CODE
RADIOGRAPH	PER CODE
NAMEPLATE	ASME
STENCILS	"LINED TANK - DO NOT WELD OR BURN"
SEISMIC LOAD	IBC 2006, Ss=1.774, SITE CLASS D, I=1.25
INSULATION	NONE
SURFACE PREP	INTERIOR: WHITE METAL BLAST PER SSPC-SP5 EXTERIOR: ABRASIVE BLAST PER SSPC-SP10
PAINTING	PER CCC SPEC. RS-17, 5-7 MILS DFT EPOXY MASTIC W/ POLYURETHANE TOP COAT COLOR: TO BE DETERMINED
LOCATION	

CAPACITIES			
FULL	7,500 GAL.		
OPERATING	7,500 GAL.	AT 100% FILL	
MEDIA	353 CU. FT.		

WEIGHTS		
EMPTY	18,700 LBS.	
FULL H_2O	82,000 LBS.	
FULL PRODUCT	33,900 LBS.	(DRY MEDIA)
OPERATING	83,000 LBS.	

NOZZLE SCHEDULE

MARK	REQ'D	SIZE	DRILLING	FACING	DESCRIPTION
A	1	4"	150#	F.F.	MEDIA OUTLET
B	1	4"	150#	F.F.	MEDIA INLET/VENT
C	1	10"	150#	F.F.	INFLUENT
D	8	10"	150#	F.F.	EFFLUENT
E	1	2"	150#	F.F.	AIR RELEASE VENT
F	1	20"	150#	F.F.	MANWAY (BLIND FLANGE GSKT.)
G	3	2"	150#	F.F.	SAMPLE POINT

NOTES:
1. ALL INTERIOR WELDS & EDGES TO BE GROUND TO 1/8" MIN. RAD.
2. ALL NOZZLES AND MANWAYS MUST BE FLUSH ON INSIDE OF SHELL, U.O.N.
3. 20" MANWAY FLG. TO BE SECURED WITH (2) BOLTS. REMAINDER OF COVER BOLTS TO BE BOXED FOR SHIPMENT.
4. REMOVE ALL WATER & DIRT AFTER HYDRO.
5. REMOVE ALL WELD SPATTER.
6. ALL NOZZLE BOLT HOLES TO STRADDLE CENTERLINES
7. ALL NUTS & BOLTS TO BE ZINC PLATED.

REV	DESCRIPTION	APP	DATE
A	ISSUED FOR APPROVAL	RES	1-26-09

REVISIONS

TOLERANCES (unless otherwise specified)
ANGULAR ±1/16" DECIMAL (2 PLACES)
FRACTIONAL DECIMAL (3 PLACES)
DECIMAL (1 PLACE) DECIMAL (4 PLACES)

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	NAME	DATE
DRAFTER	JFS	1-21-09
DESIGNER		
CHECKER		
APPROVAL		
PROJECT No.	IX-08089.MHLL	

CALGON
CALGON CARBON CORPORATION

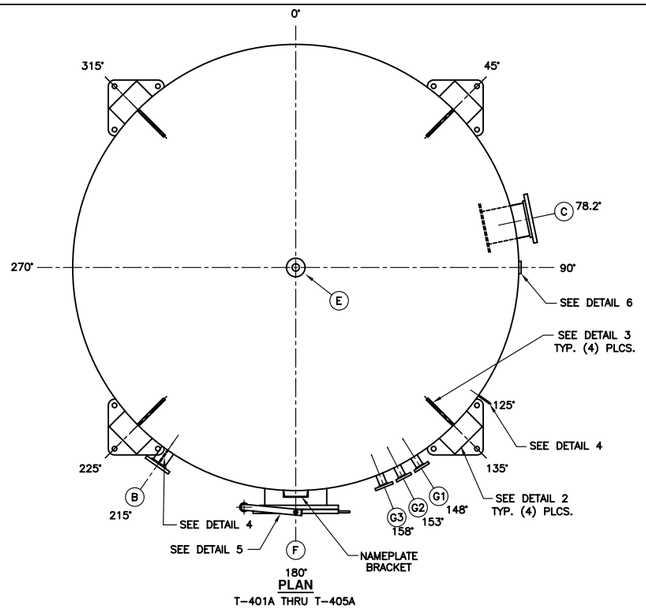
CLIENT
MONK HILLS WELLS
PASEDENA, CA

TITLE
MODULAR ION EXCHANGE SYSTEM
12' DIA. - 125 PSIG
LINED VESSEL

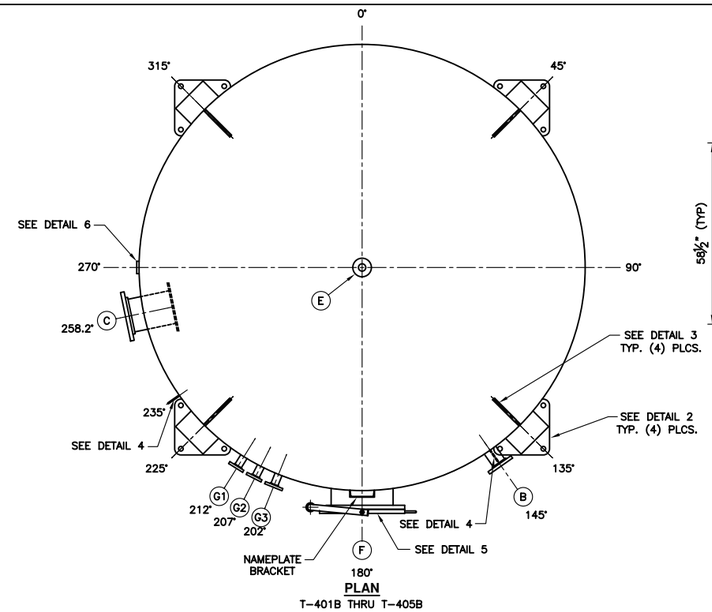
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D	1 OF 1	NONE

DWG. No. 91075172 REV. A

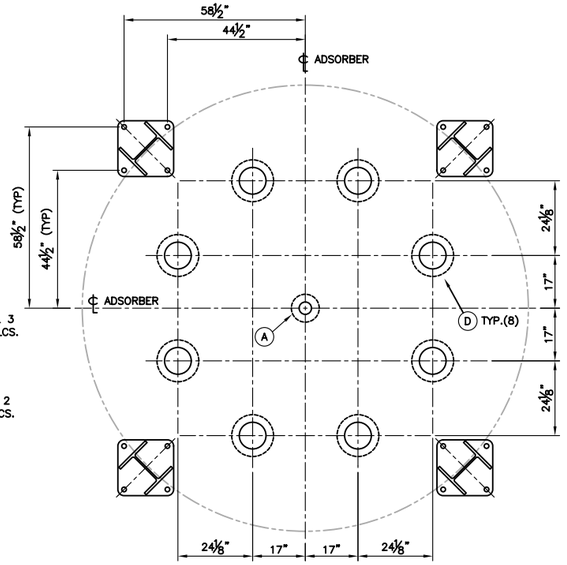
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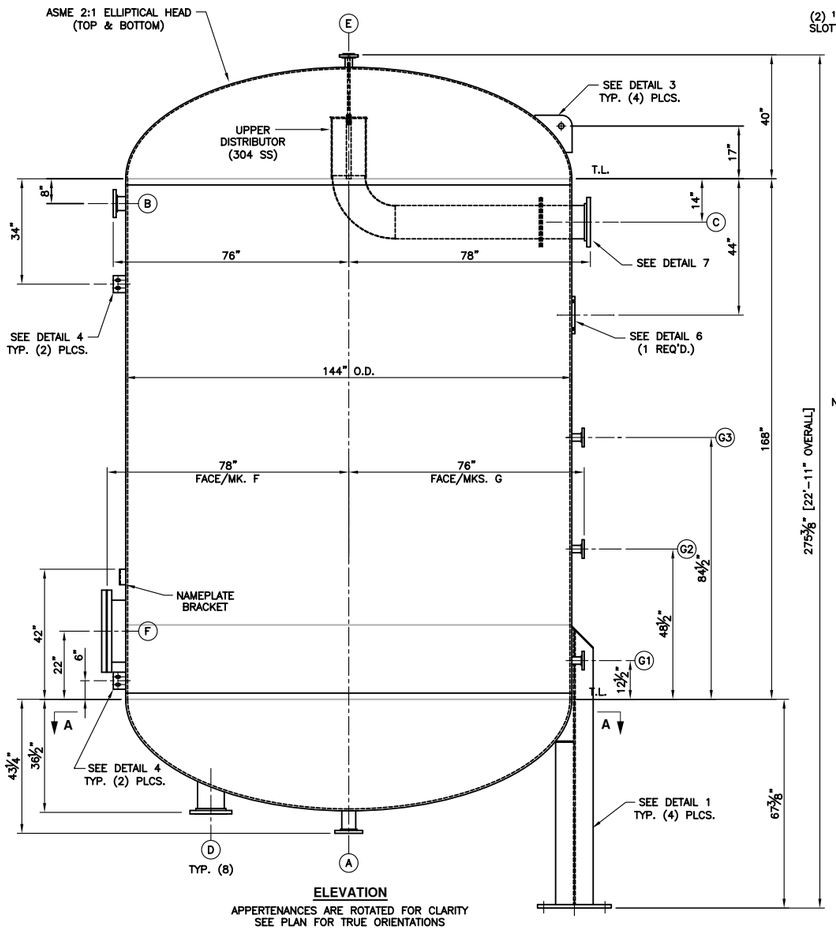
PLAN
T-401A THRU T-405A



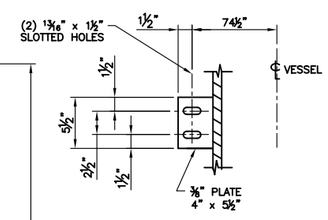
PLAN
T-401B THRU T-405B



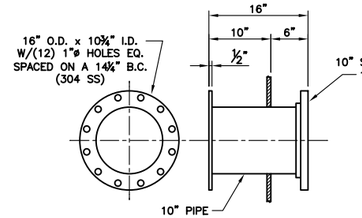
SECTION A-A



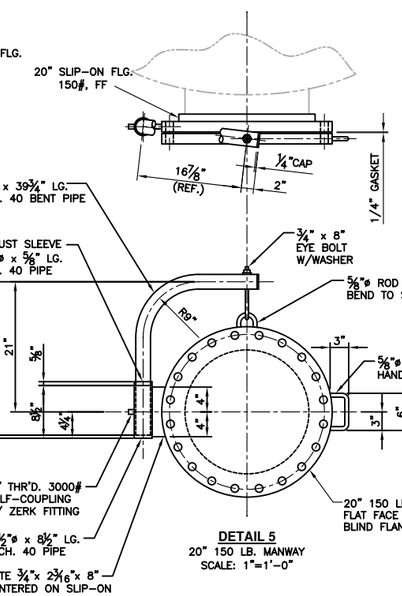
ELEVATION
APPERTENANCES ARE ROTATED FOR CLARITY
SEE PLAN FOR TRUE ORIENTATIONS



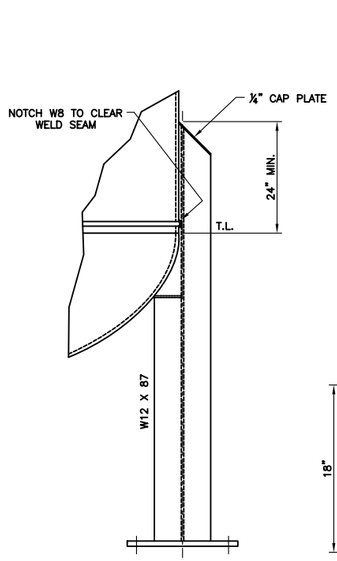
DETAIL 4
PIPE SUPPORT CLIP
(4) REQ'D./VESSEL



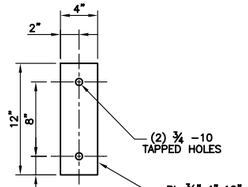
DETAIL 7
INFLUENT NOZZLE



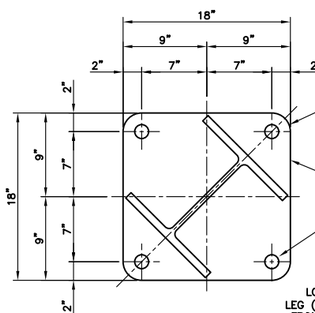
DETAIL 5
20" 150 LB. MANWAY
SCALE: 1"=1'-0"



DETAIL 1
VESSEL SUPPORT LEG
(4) REQ'D.

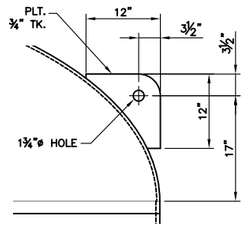


DETAIL 6
PIPE SUPPORT
(1 REQ'D)



LOCATION OF BASEPLATE ON LEG (W12x87) TO BE SET BY DIMS. FROM CL OF VESSEL AFTER LEGS ARE WELDED TO SHELL.

DETAIL 2
TYP. BASEPLATE



DETAIL 3
LIFTING LUG
(4) REQ'D.

VESSEL DESCRIPTION	ADSORBER T-401A & B THRU T-405A & B
REFERENCES	VESSEL SPECIFICATION VS1
DESIGN CONDITIONS	125 PSIG @ 140° F
OPERATING CONDITIONS	125 PSIG @ 70° F
PROCESS FLUID	1.0 S.G. (WATER)
WALL THICK.	HEAD : T.B.D. (PER CODE CALCS.) SHELL : T.B.D. (PER CODE CALCS.)
MATERIALS OF CONSTRUCTION	SHELL: SA-516 GRADE 70 TOP HEAD: SA-516 GRADE 70 BOT. HEAD: SA-516 GRADE 70 LINING: PLASITE 4006, 25-35 MIL NOMINAL DFT FORCE CURED PER NSF 61 CRITERIA PIN HOLE FREE FOR IMMERSION SERVICE PER CCC SPEC. VS-23 LEG SUPPORT: A992 BOLTING: SA-325-1 WITH HVY HX NUT - SEE NOTE 7 GASKETS: 1/8" EPDM (MANWAY 1/4")
TYPE CONSTRUCTION	FUSION WELDED
CORROS. ALLOW.	NONE
CODE	ASME SECTION VIII, DIVISION I, LATEST EDITION
INSPECTION	BY CALGON & AUTHORIZED INSPECTOR
STAMPING	ASME " U ", NBR
TESTING	HYDROSTATIC PER CODE
STRESS RELIEF	PER CODE
RADIOGRAPH	PER CODE
NAMEPLATE	ASME
STENCILS	"LINED TANK - DO NOT WELD OR BURN"
SEISMIC LOAD	IBC 2006, Ss=1.774, SITE CLASS D, I=1.25
INSULATION	NONE
SURFACE PREP	INTERIOR: WHITE METAL BLAST PER SSPC-SP5 EXTERIOR: ABRASIVE BLAST PER SSPC-SP10
PAINTING	PER CCC SPEC. RS-17, 5-7 MILS DFT EPOXY MASTIC W/ POLYURETHANE TOP COAT COLOR: TO BE DETERMINED
LOCATION	
CAPACITIES	FULL: 15,000 GAL. OPERATING: 15,000 GAL. AT 100% FILL MEDIA: 40,000 LBS.
WEIGHTS	EMPTY: 28,000 LBS. FULL H_2O: 154,000 LBS. FULL PRODUCT: 68,000 LBS. (DRY MEDIA) OPERATING: 175,000 LBS.

NOZZLE SCHEDULE

MARK	REQ'D	SIZE	DRILLING	FACING	DESCRIPTION
A	1	4"	150#	F.F.	MEDIA OUTLET
B	1	4"	150#	F.F.	MEDIA INLET/VENT
C	1	10"	150#	F.F.	INFLUENT
D	8	8"	150#	F.F.	EFFLUENT
E	1	2"	150#	F.F.	AIR RELEASE VENT
F	1	20"	150#	F.F.	MANWAY (BLIND FLANGE GSKT.)
G	3	2"	150#	F.F.	SAMPLE POINT

NOTES:
1. ALL INTERIOR WELDS & EDGES TO BE GROUND TO 1/8" MIN. RAD.
2. ALL NOZZLES AND MANWAYS MUST BE FLUSH ON INSIDE OF SHELL, U.O.N.
3. 20" MANWAY FLG. TO BE SECURED WITH (2) BOLTS. REMAINDER OF COVER BOLTS TO BE BOXED FOR SHIPMENT.
4. REMOVE ALL WATER & DIRT AFTER HYDRO.
5. REMOVE ALL WELD SPATTER.
6. ALL NOZZLE BOLT HOLES TO STRADDLE CENTERLINES
7. ALL NUTS & BOLTS TO BE ZINC PLATED.

REV	DESCRIPTION	APP	DATE
A	ISSUED FOR APPROVAL	RES	1/26/09

REVISIONS

TOLERANCES (unless otherwise specified)
ANGULAR ±1/16" DECIMAL (2 PLACES)
FRACTIONAL DECIMAL (3 PLACES)
DECIMAL (1 PLACE) DECIMAL (4 PLACES)

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	NAME	DATE
DRAFTER	JFS	1-21-09
DESIGNER		
CHECKER		
APPROVAL		
PROJECT No.	IX-08089.MHLL	

CALGON
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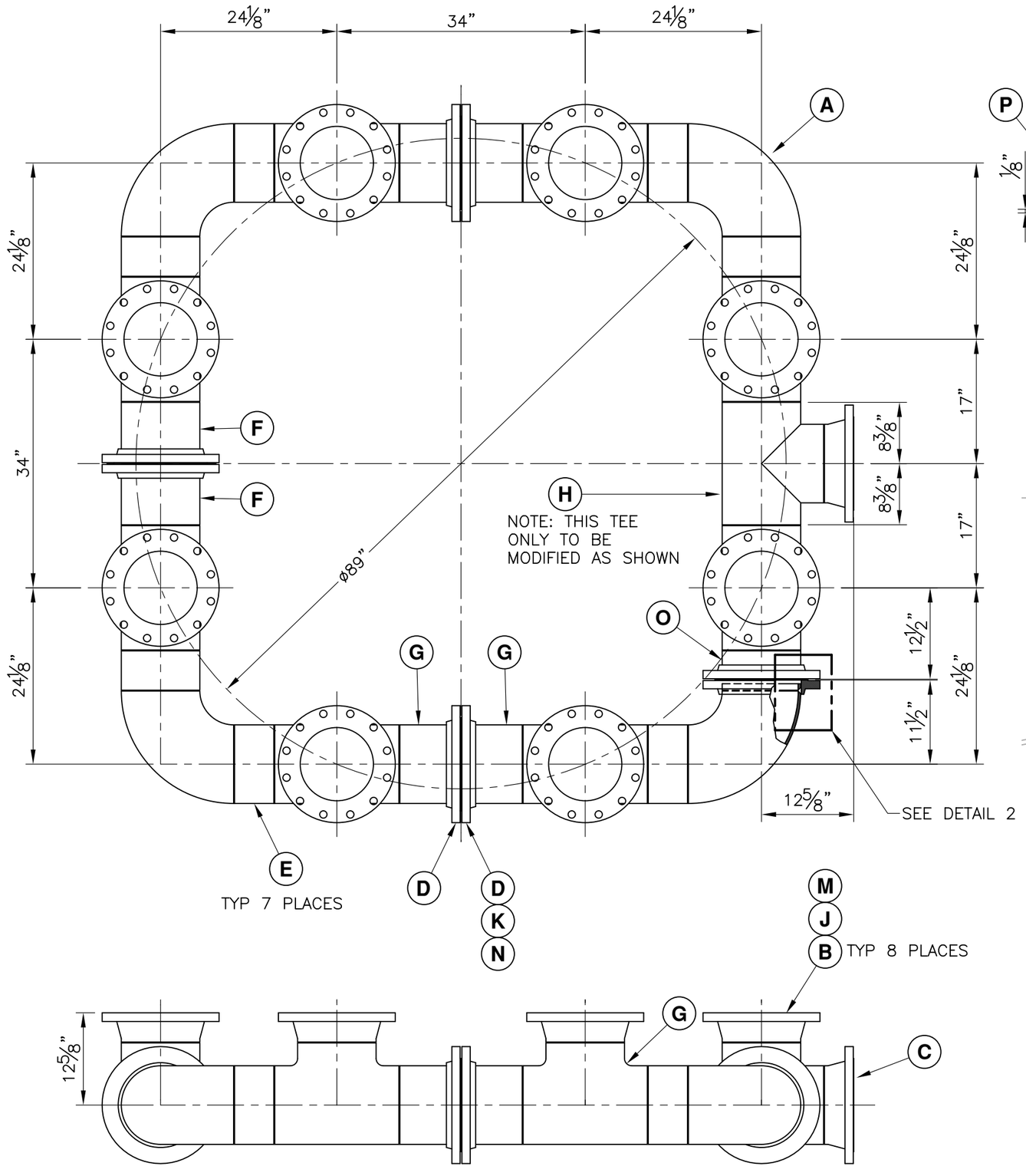
CLIENT: MONK HILLS WELLS PASEDENA, CA

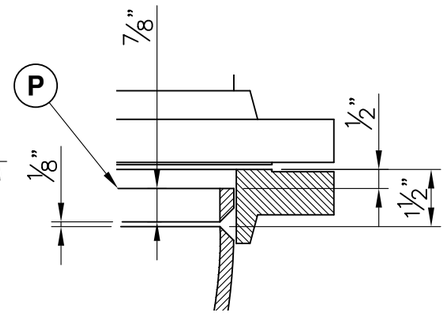
TITLE: MODULAR GAC SYSTEM 12' DIA. - 125 PSIG LINED VESSEL

DWG. SIZE: D | SHEET No.: 1 OF 1 | SCALE: NONE

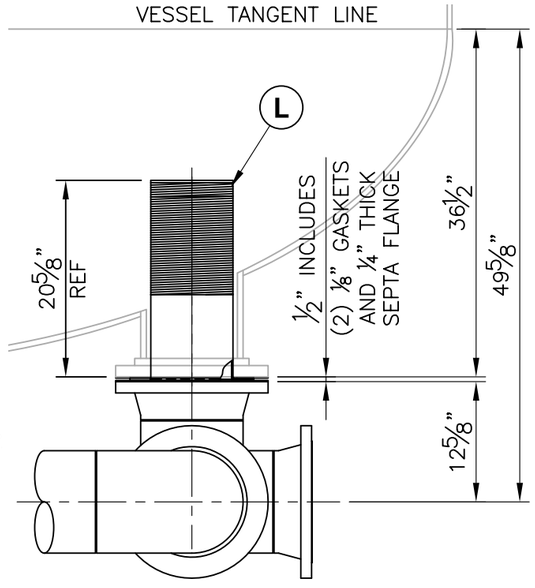
DWG. No.: 91075173 | REV.: A

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DETAIL 2



DETAIL 1
SEPTA ASSEMBLY

BILL OF MATERIALS

ITEM	QTY.	PART NO.	DESCRIPTION	MAT'L.
A	4	---	ELBOW, S.R., 90 DEG, SCH 40, 10"	
B	8	---	FLANGE, WELD NECK, F.F., CLASS 150, 10"	
C	1	---	FLANGE, WELD NECK, R.F., CLASS 150, 10"	
D	8	---	FLANGE, SLIP-ON, R.F., CLASS 150, 10"	
E	7	---	PIPE, SCH 40, 10" x 5-3/8" LG.	
F	2	---	PIPE, SCH 40, 10" x 7-13/16" LG.	
G	4	---	PIPE, SCH 40, 10" x 7-13/16" LG.	
H	9	---	TEE, STRAIGHT, SCH 40, 10"	
J	16	---	GASKET, 10" FULL FACE, 1/8" TK., 150# DRILLING	
K	4	---	GASKET, 10" RING, 1/8" TK.	
L	8	---	8" BAYONET SEPTA (CCC TO SUPPLY)	316L SS
M	96	---	BOLT, 7/8" x 4 1/2", HVY. HEX W/NUT	
N	24	---	BOLT, 7/8" x 4", HVY. HEX W/NUT	
O	1	---	PIPE, SCH 40, 10" x 3-3/8" LG.	
P	1	---	PIPE, SCH 40, 10" x 7/8" LG.	

NOTES:

1. APPROXIMATE WEIGHT: 2,400 LB
2. PIPE AND FITTINGS TO BE PER CCC SPECIFICATIONS C2 & L6.
3. GASKETS TO BE PER CCC SPECIFICATION G2.
4. BOLTING TO BE PER CCC SPECIFICATION F3.
5. B.O.M. CUT LENGTHS INCLUDE 1/8" WELD GAP AT FITTINGS & 1/2" SETBACK AT SLIP-ON FLANGES (U.N.O.).
6. EACH COLLECTION HEADER TO BE MATCH MARKED TO A SPECIFIC VESSEL.
7. BOLT HOLES TO STRADDLE VESSEL CENTERLINES.

REV	DESCRIPTION	APP	DATE
A	ISSUED FOR APPROVAL	RES	1/26/09

REVISIONS

TOLERANCES (unless otherwise specified)

ANGULAR	±0°30'	DECIMAL (2 PLACES)	±.010
FRACTIONAL	±1/16"	DECIMAL (3 PLACES)	±.005
DECIMAL (1 PLACE)	±.015	DECIMAL (4 PLACES)	±.0005

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	NAME	DATE
DRAFTER	JFS	1/26/09
DESIGNER		
CHECKER		
APPROVAL		
PROJECT No.	IX-08089.MHLL	

CALGON

CALGON CARBON CORPORATION

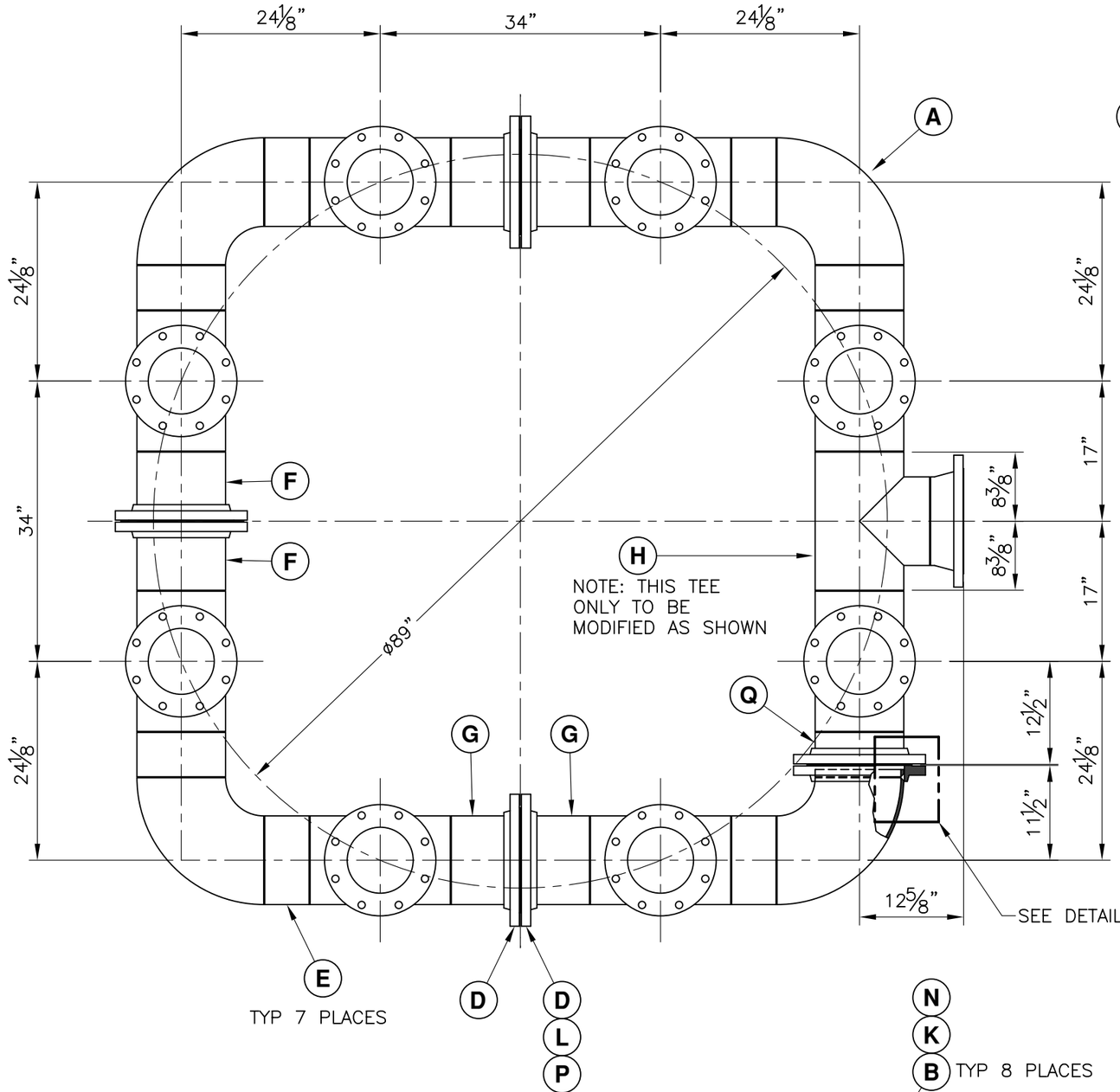
CLIENT: MONK HILLS WELLS
PASEDENA, CA

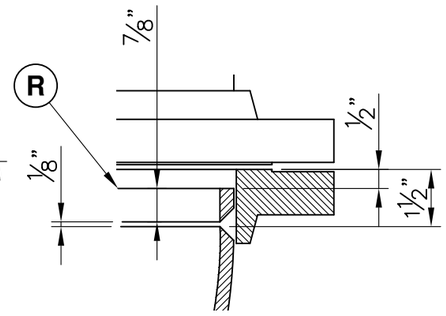
TITLE: 12'-0" DIA. VESSEL (RESIN)
COLLECTION HEADER
DETAIL & ASSEMBLY

DWG. Size	SHEET No.	SCALE
B	1 OF 1	NTS

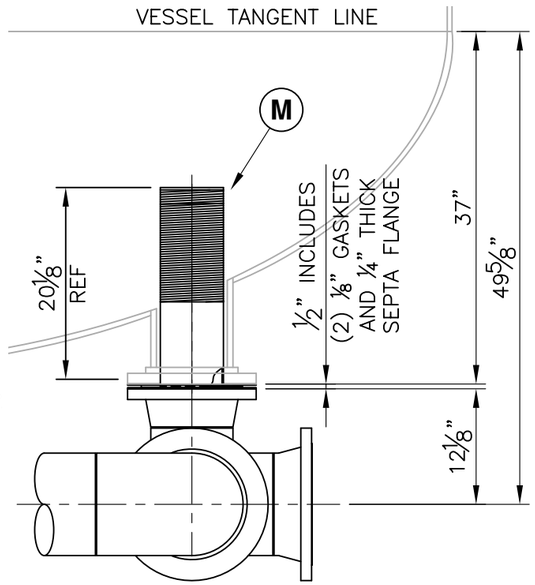
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DETAIL 2



DETAIL 1
SEPTA ASSEMBLY

BILL OF MATERIALS

ITEM	QTY.	PART NO.	DESCRIPTION	MAT'L.
A	4	---	ELBOW, S.R., 90 DEG, SCH 40, 10"	
B	8	---	FLANGE, WELD NECK, F.F., CLASS 150, 8"	
C	1	---	FLANGE, WELD NECK, R.F., CLASS 150, 10"	
D	8	---	FLANGE, SLIP-ON, R.F., CLASS 150, 10"	
E	7	---	PIPE, SCH 40, 10" x 5-3/8" LG.	
F	2	---	PIPE, SCH 40, 10" x 7-13/16" LG.	
G	4	---	PIPE, SCH 40, 10" x 7-13/16" LG.	
H	1	---	TEE, STRAIGHT, SCH 40, 10"	
J	8	---	TEE, REDUCING, SCH 40, 10" x 8"	
K	16	---	GASKET, 8" FULL FACE, 1/8" TK., 150# DRILLING	
L	4	---	GASKET, 10" RING, 1/8" TK.	
M	8	---	6" BAYONET SEPTA (CCC TO SUPPLY)	316L SS
N	64	---	BOLT, 3/4" x 4", HVY. HEX W/NUT	
P	24	---	BOLT, 7/8" x 4", HVY. HEX W/NUT	
Q	1	---	PIPE, SCH 40, 10" x 3-3/8" LG.	
R	1	---	PIPE, SCH 40, 10" x 7/8" LG.	

NOTES:

1. APPROXIMATE WEIGHT: 2,400 LB
2. PIPE AND FITTINGS TO BE PER CCC SPECIFICATIONS C2 & L6.
3. GASKETS TO BE PER CCC SPECIFICATION G2.
4. BOLTING TO BE PER CCC SPECIFICATION F3.
5. B.O.M. CUT LENGTHS INCLUDE 1/8" WELD GAP AT FITTINGS & 1/2" SETBACK AT SLIP-ON FLANGES (U.N.O.).
6. EACH COLLECTION HEADER TO BE MATCH MARKED TO A SPECIFIC VESSEL.
7. BOLT HOLES TO STRADDLE VESSEL CENTERLINES.

REV	DESCRIPTION	APP	DATE
A	ISSUED FOR APPROVAL	RES	1/26/09

REVISIONS

TOLERANCES (unless otherwise specified)

ANGULAR	±0°30'	DECIMAL (2 PLACES)	±.010
FRACTIONAL	±1/16"	DECIMAL (3 PLACES)	±.005
DECIMAL (1 PLACE)	±.015	DECIMAL (4 PLACES)	±.0005

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	NAME	DATE
DRAFTER	JFS	1/26/09
DESIGNER		
CHECKER		
APPROVAL		
PROJECT No.	IX-08089.MHLL	

CALGON

CALGON CARBON CORPORATION

CLIENT: MONK HILLS WELLS
PASEDENA, CA

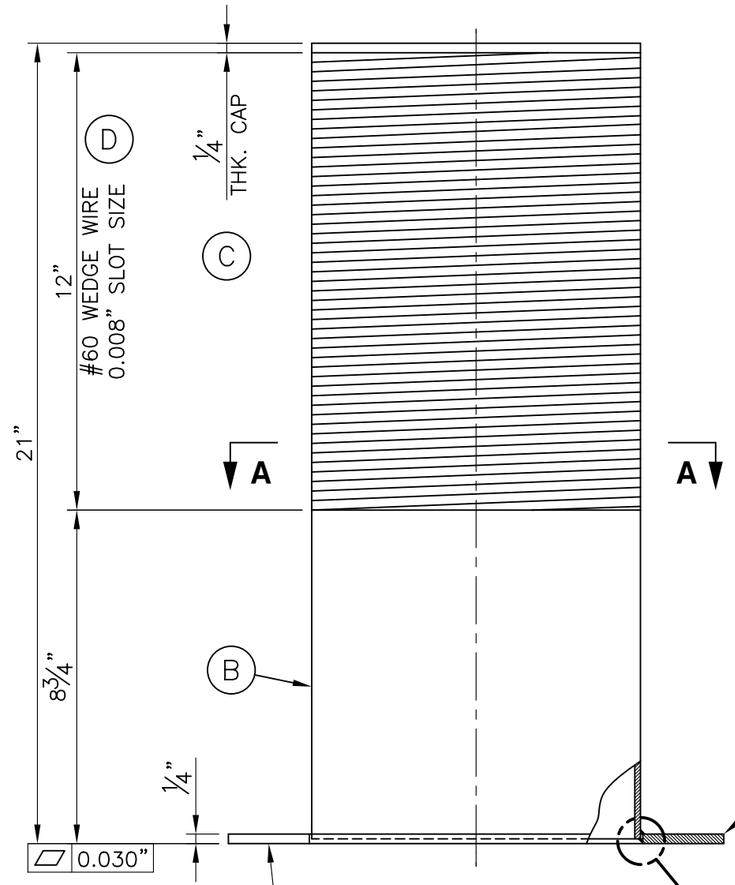
TITLE: 12'-0" DIA. VESSEL (CARBON)
COLLECTION HEADER
DETAIL & ASSEMBLY

DWG. Size	SHEET No.	SCALE
B	1 OF 1	NTS

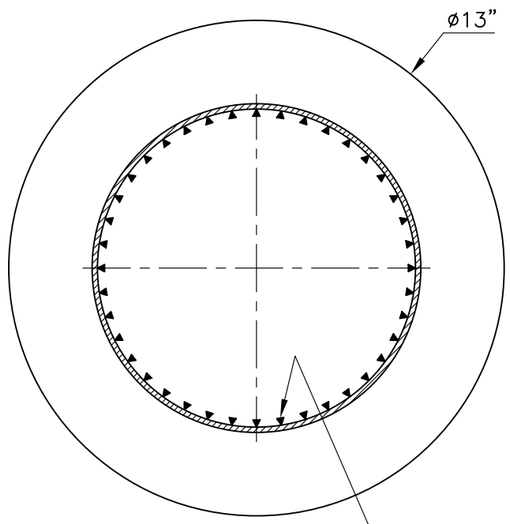
DWG. No. 91075175 REV. A

V:\2008\IX-08089.MHLL\Drawings\Piping\91075175 - GAC UD.dwg Jan 26, 2009 - 3:24pm

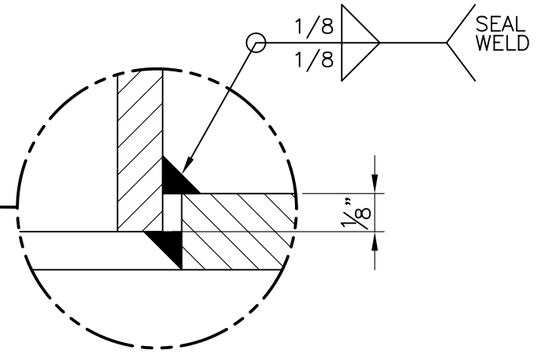
BILL OF MATERIALS				
ITEM	QTY.	PART NO.	DESCRIPTION	MAT'L.
A	1	---	PLATE FLANGE – 13 O.D. ±1/16" x 8-3/4" I.D.	316L SS
			x 1/4" THICK	
B	1	---	PIPE – 8", SCH 10S, 8-5/8" LG.	A312
C	1	---	CAP PLATE – 8-5/8" O.D. x 1/4" THICK	316L SS
D	1	---	BASKET – WEDGE WIRE #60, 8-5/8" O.D. x 12" LG.	316L SS
E	40	---	SUPPORT ROD – WEDGE WIRE 0.1875 x 12" LG.	316L SS



STANDARD ANSI FLANGE FINISH (250 AARH) ACROSS SURFACE. BOTH SIDES



SECTION A-A



NOTES:

1. REMOVE ALL BURRS AND SHARP EDGES.

SAP NUMBER: 1048625

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	NAME	DATE
DRAFTER	VGM	8/22/06
DESIGNER	VGM	8/22/06
CHECKER	BKM	8/29/06
APPROVAL		
PROJECT No.	STANDARD	

REV	DESCRIPTION	APP	DATE
0	ISSUED FOR FABRICATION	RES	8/30/06

REVISIONS

TOLERANCES (unless otherwise specified)

ANGULAR ±1/16" DECIMAL (2 PLACES)
FRACTIONAL DECIMAL (3 PLACES)
DECIMAL (1 PLACE) DECIMAL (4 PLACES)

CALGON CARBON CORPORATION

CLIENT: STANDARD

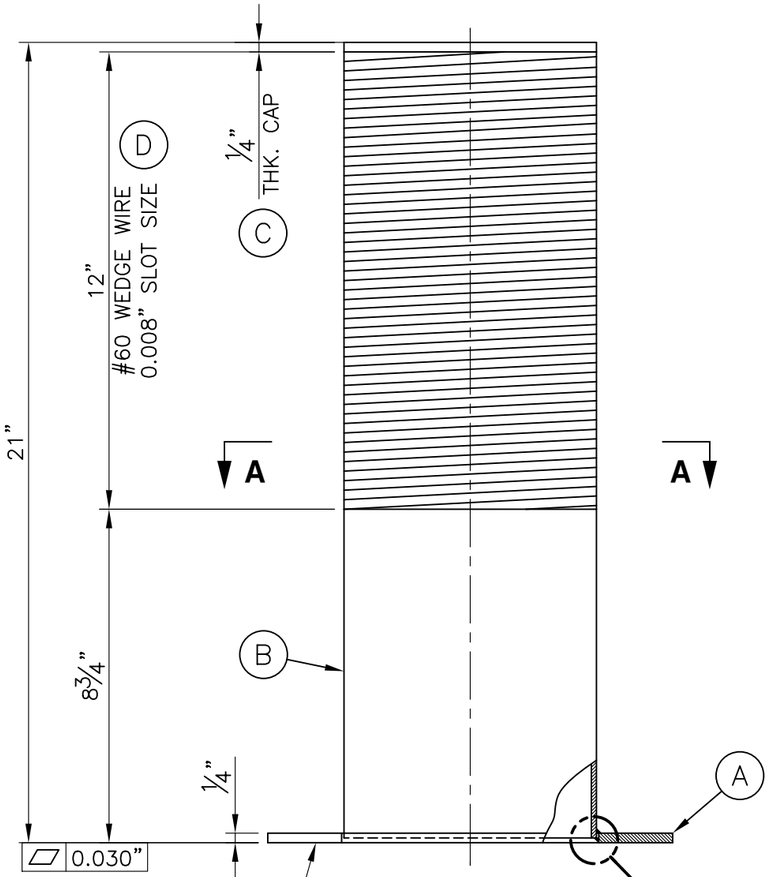
TITLE: BAYONET SEPTA, 8" DIA. 316LSS, 0.008" SLOT DETAILS

DWG. Size	SHEET No.	SCALE
B	1 OF 1	NTS

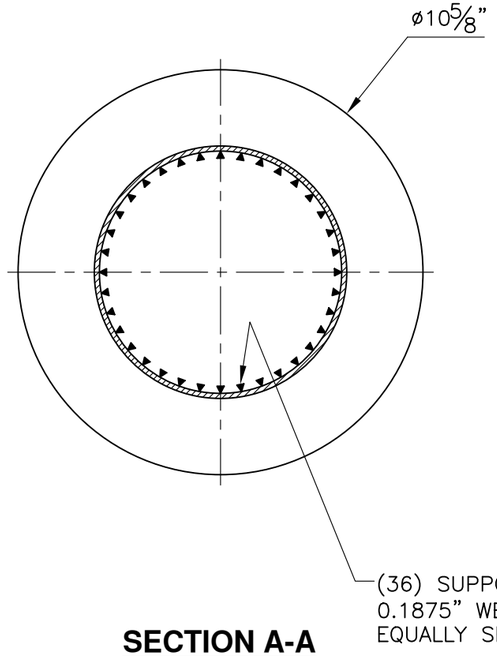
DWG. No. 90060210 REV. 0

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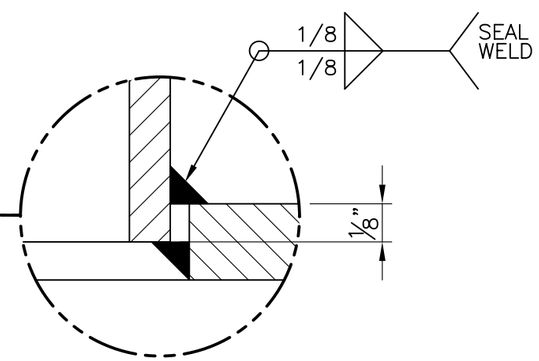
BILL OF MATERIALS				
ITEM	QTY.	PART NO.	DESCRIPTION	MAT'L.
A	1	---	PLATE FLANGE – 10-5/8" O.D. ±1/16" x 6-3/4" I.D.	316L SS
			x 1/4" THICK	
B	1	---	PIPE – 6", SCH 10S, 8-5/8" LG.	A312
C	1	---	CAP PLATE – 6-5/8" O.D. x 1/4" THICK	316L SS
D	1	---	BASKET – WEDGE WIRE #60, 6-5/8" O.D. x 12" LG.	316L SS
E	40	---	SUPPORT ROD – WEDGE WIRE 0.1875 x 12" LG.	316L SS



STANDARD ANSI FLANGE FINISH (250 AARH) ACROSS SURFACE. BOTH SIDES



SECTION A-A



NOTES:

1. REMOVE ALL BURRS AND SHARP EDGES.

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	NAME	DATE
DRAFTER	G.MARRA	1/23/09
DESIGNER		
CHECKER		
APPROVAL		
PROJECT No.	STANDARD	

REV	DESCRIPTION	APP	DATE
0	ISSUED FOR FABRICATION		1/23/09
	REVISIONS		

TOLERANCES (unless otherwise specified)

ANGULAR ±1/16" DECIMAL (2 PLACES)
FRACTIONAL DECIMAL (3 PLACES)
DECIMAL (1 PLACE) DECIMAL (4 PLACES)

CALGON

CALGON CARBON CORPORATION

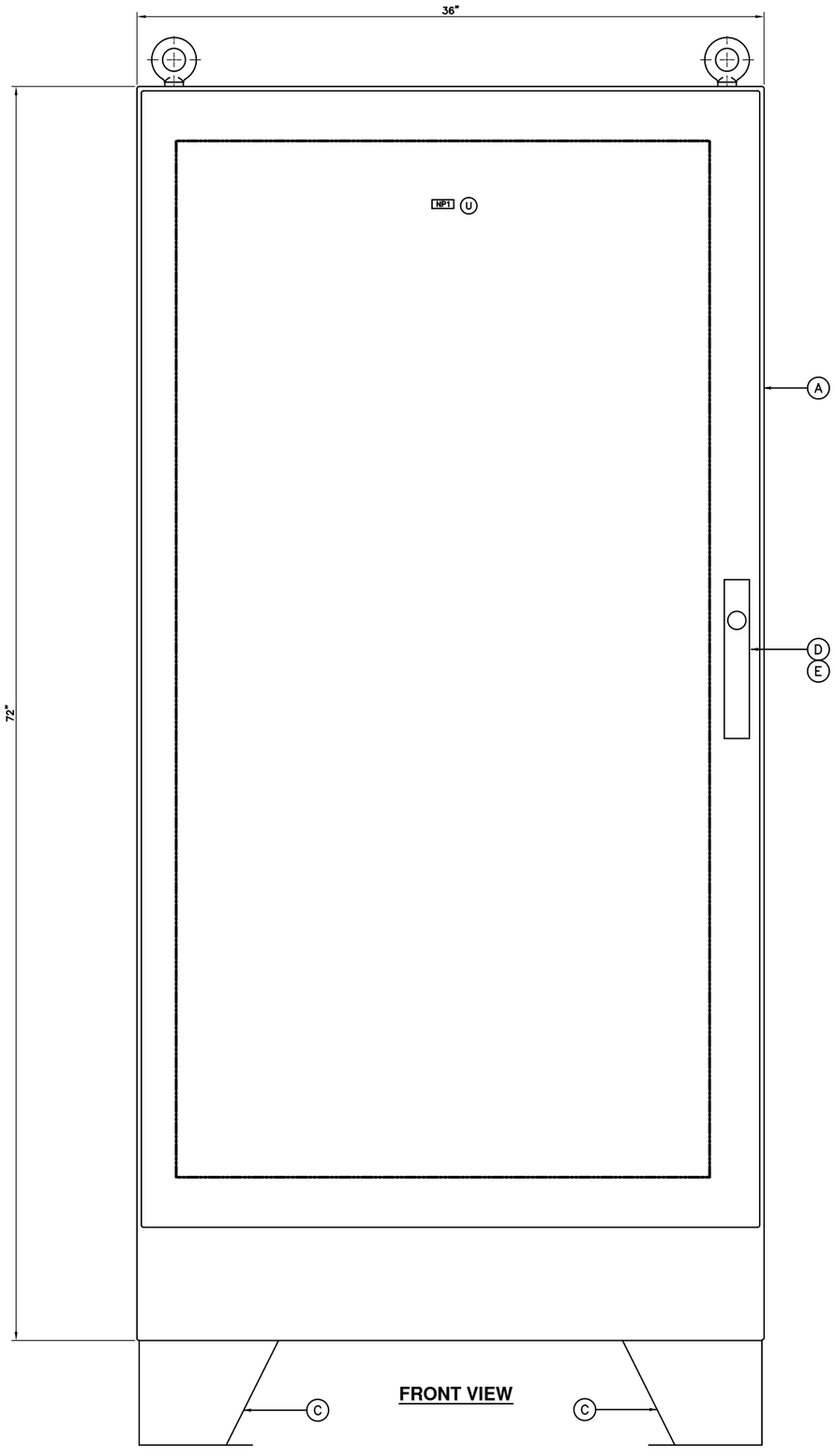
CLIENT: STANDARD

TITLE: BAYONET SEPTA, 6" DIA. 316LSS, 0.008" SLOT DETAILS

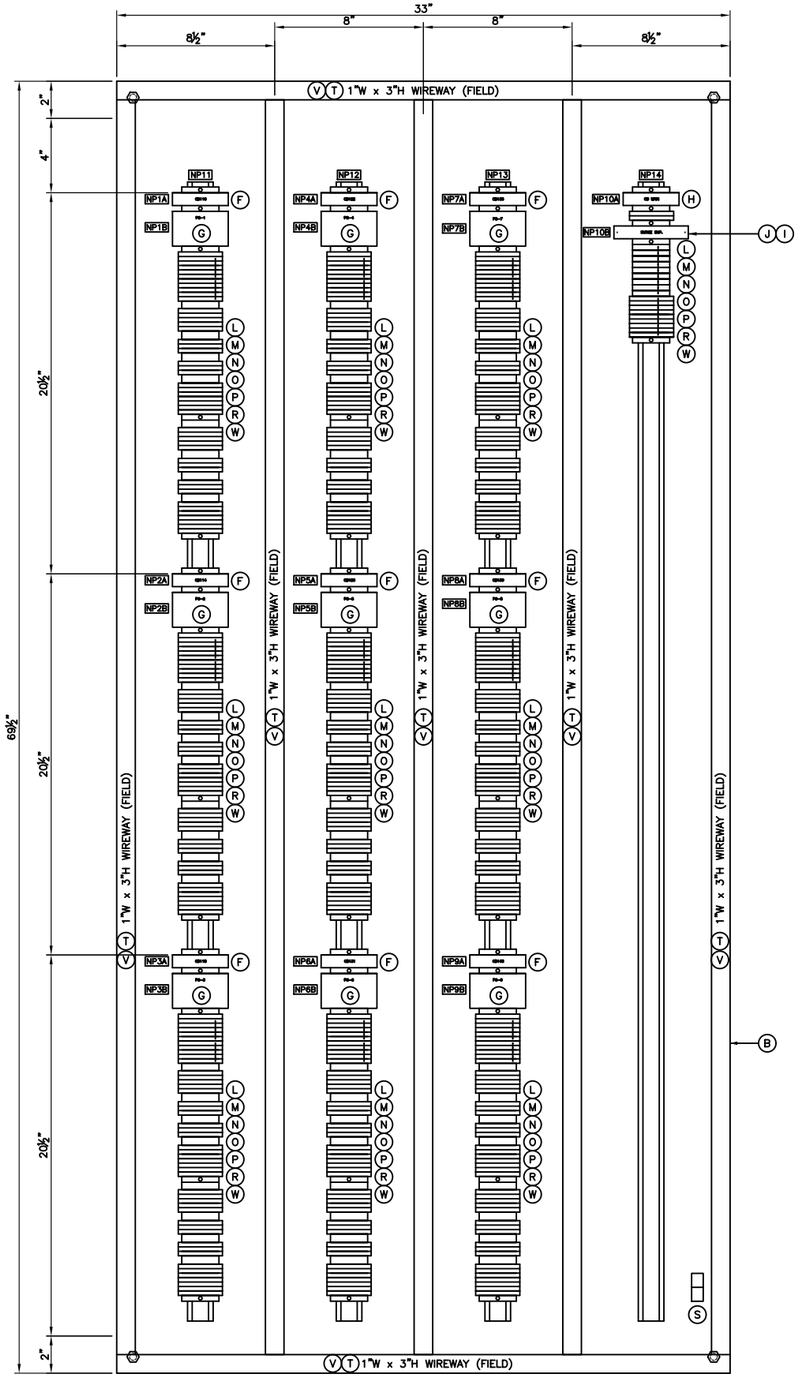
DWG. Size	SHEET No.	SCALE
B	1 OF 1	NTS

DWG. No. 90060218 REV. 0

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FRONT VIEW



SUBPANEL

BILL OF MATERIAL

ITEM	QTY	DESCRIPTION
A	1 EA	ENCLOSURE, 20"Hx20"Wx8"D, NEMA 4X, 316L STAINLESS STEEL HOFFMAN #A20H2008SS6LP
B	1 EA	SUBPANEL, 17"Hx17"W, STEEL HOFFMAN #A20P20
C	1 EA	PANEL FLOOR KIT SAGINAW #SCE-FK0624
D	1 EA	PANEL 3 PT DOOR ROD KIT SAGINAW #SCE-3PTL
E	1 EA	PANEL DOOR HANDLE SAGINAW #SCE-PCH5
F	9 EA	CIRCUIT BREAKER, SINGLE POLE, 2 AMP A-B #1489-AIC020
G	9 EA	POWER SUPPLY 24VDC 4.2 AMP SOLA #SDP4-24-100RT
H	1 EA	CIRCUIT BREAKER, SINGLE POLE, 30 AMP A-B #1489-AIC300
I	1 EA	SURGE SUPPRESSOR PLUG, 120VAC PHOENIX #2807586
J	1 EA	SURGE SUPPRESSOR BASE PHOENIX #2817738
K	72 EA	FUSE HOLDERS A-B #1492-WFB424
L	435 EA	TERMINAL BLOCK, 600V, 30A, #22-10 AWG WIRE ALLEN-BRADLEY #1492-J4
M	10 EA	TERMINAL BLOCK, GROUND BLOCK, #22-10 AWG WIRE ALLEN-BRADLEY #1492-JG4
N	7 EA	TERMINAL BLOCK, DIN RAIL, 1 METER, STEEL ALLEN-BRADLEY #199-DR1
O	45 EA	TERMINAL BLOCK, END ANCHOR ALLEN-BRADLEY #1492-EAJ35
P	10 EA	TERMINAL BLOCK, SNAP-IN MARKER CARD (120/CARD) ALLEN-BRADLEY #1492-M6X12
Q		NOT USED
R	50 EA	TERMINAL BLOCK, END BARRIER ALLEN-BRADLEY #1492-EBJ3
S	1 EA	GROUND LUG PANDUIT #LAMA-1/0-14-0
T	6 EA	WIRING DUCT, 1"Wx3"H, GRAY VINYL, WITH COVER, 6 FT. LG. PANDUIT #G1X3LG6
U	1 EA	NAMEPLATES, LAMACOID, BLACK LETTERS ON WHITE BACKGROUND TEXT AS SHOWN ON DWG. 91085626 SHT. 2
V	6 EA	WIRING DUCT, GRAY VINYL COVER, 6 FT. LG. PANDUIT #C1LG6
W	20 EA	CENTER JUMPERS ALLEN-BRADLEY #1492-CJJ6-10

NOTES:

1. FOR NAMEPLATE ENGRAVING SEE DWG. 91085625 SH. 3.
2. ALL INTERNAL PANEL WIRING TO HAVE WIRE NUMBER LABELS AT BOTH ENDS OF THE WIRE.

REV	DESCRIPTION	APP	DATE
A	ISSUED FOR SUBMITTAL	XXX	01/29/09

REVISIONS

TOLERANCES (unless otherwise specified)

ANGULAR	±0°30'	DECIMAL (2 PLACES)	±.010
FRACTIONAL	±1/16"	DECIMAL (3 PLACES)	±.005
DECIMAL (1 PLACE)	±.015	DECIMAL (4 PLACES)	±.0005

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	NAME	DATE
DRAFTER	DRC	01/21/09
DESIGNER	DRC	01/21/09
CHECKER	SJS	XX/XX/XX
APPROVAL		

PROJECT No. IX-08089.MHLL

CALGON CARBON CORPORATION

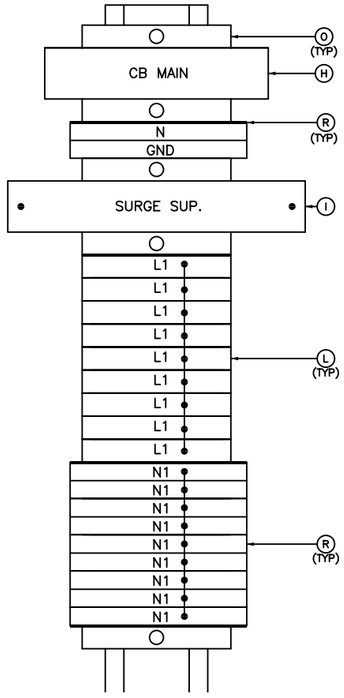
CLIENT: MONK HILLS WELS
PASADENA, CA

TITLE: MODEL 12 MODULAR ADSORBER SYS.
FILTER CELL CONTROL PANEL
GENERAL ARRANGEMENT

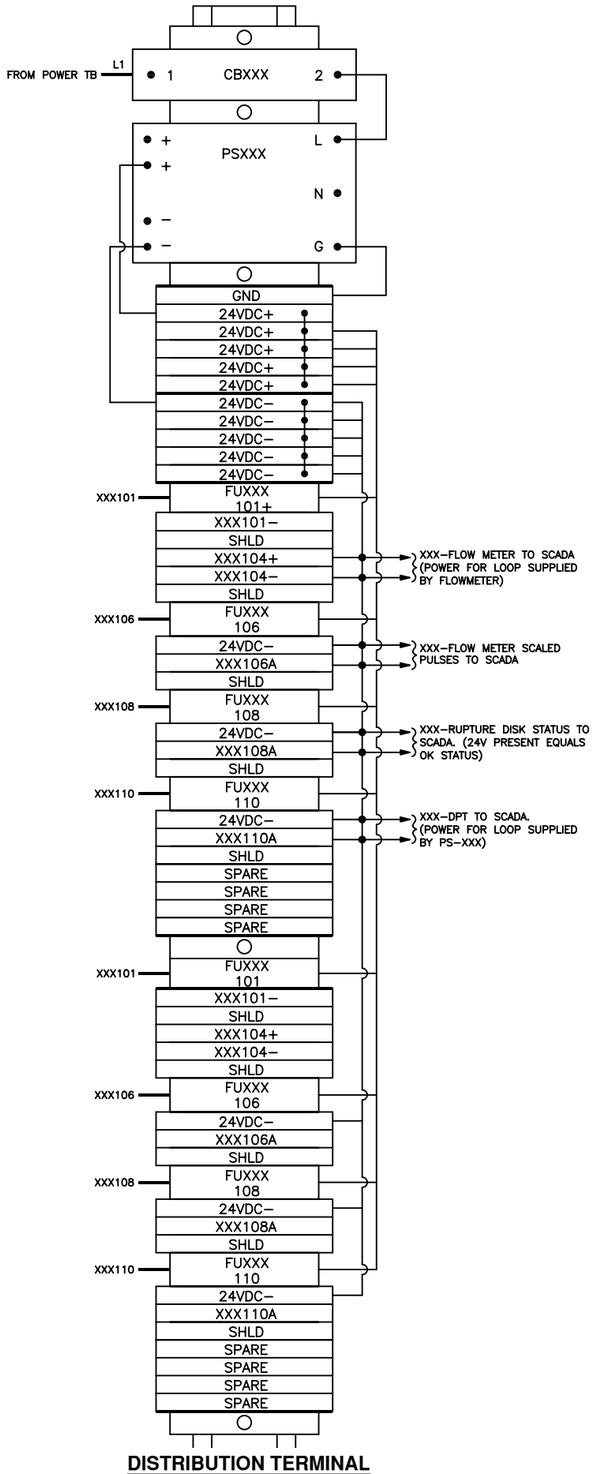
DWG. Size D | SHEET No. 1 OF 3 | SCALE NTS

DWG. No. 91085626 | REV. A

V:\2008\IX-08089.MHLL\Drawings\Electrical\91085625-CONTROL PNL.dwg Jan 30, 2009 - 10:59am



POWER DISTRIBUTION TERMINAL
MAIN ION EXCHANGE PANEL



DISTRIBUTION TERMINAL
MAIN ION EXCHANGE PANEL

NOTES:

1. FOR FRONTVIEW & SUBPANEL ARRANGEMENT SEE DWG. 91085626 SH. 1.
2. TERMINAL BLOCKS AND FUSE BLOCKS TO HAVE MARKERS ON BOTH SIDES. TWO (2) PER TERMINAL AND PRINTED HORIZONTALLY.

REV	DESCRIPTION	APP	DATE
A	ISSUED FOR SUBMITTAL	XXX	01/29/09

REVISIONS

TOLERANCES (unless otherwise specified)

ANGULAR	±0°30'	DECIMAL (2 PLACES)	±.010
FRACTIONAL	±1/16"	DECIMAL (3 PLACES)	±.005
DECIMAL (1 PLACE)	±.015	DECIMAL (4 PLACES)	±.0005

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	NAME	DATE
DRAFTER	DRC	01/21/09
DESIGNER	DRC	01/21/09
CHECKER	SJS	XX/XX/XX
APPROVAL		
PROJECT		

CALGON

CALGON CARBON CORPORATION

CLIENT
MONK HILLS WELS
PASADENA, CA

TITLE
MODEL 12 MODULAR ADSORBER SYS.
FILTER CELL CONTROL PANEL
GENERAL ARRANGEMENT

DWG. Size	SHEET No.	SCALE
D	2 OF 3	NTS

DWG. REV

MAIN ION EXCHANGE PANEL

NAMEPLATE ENGRAVING				
ITEM	QTY	ENGRAVING LINE 1	ENGRAVING LINE 2	LETTER SIZE–BACKGROUND SIZE
NP1	1	MAIN ION	EXCHANGE PANEL	1/4" – 1" X 6"
NP1A	1	CB–1	2AMP	5/32" – 1/2" X 2"
NP1B	1	PS–1	24 VDC PWR SUP	5/32" – 1/2" X 2"
NP2A	1	CB–2	2AMP	5/32" – 1/2" X 1"
NP2B	1	PS–2	24 VDC PWR SUP	5/32" – 1/2" X 1"
NP3A	1	CB–3	2AMP	5/32" – 1/2" X 2"
NP3B	1	PS–3	24 VDC PWR SUP	5/32" – 1/2" X 2"
NP4A	1	CB–4	2AMP	5/32" – 1/2" X 2"
NP4B	1	PS–4	24 VDC PWR SUP	5/32" – 1/2" X 2"
NP5A	1	CB–5	2AMP	5/32" – 1/2" X 2"
NP5B	1	PS–5	24 VDC PWR SUP	5/32" – 1/2" X 2"
NP6A	1	CB–6	2AMP	5/32" – 1/2" X 2"
NP6B	1	PS–6	24 VDC PWR SUP	5/32" – 1/2" X 2"
NP7A	1	CB–7	2AMP	5/32" – 1/2" X 2"
NP7B	1	PS–7	24 VDC PWR SUP	5/32" – 1/2" X 2"
NP8A	1	CB–8	2AMP	5/32" – 1/2" X 2"
NP8B	1	PS–8	24 VDC PWR SUP	5/32" – 1/2" X 2"
NP9A	1	CB–9	2AMP	5/32" – 1/2" X 2"
NP9B	1	PS–9	24 VDC PWR SUP	5/32" – 1/2" X 2"
NP10A	1	MAIN BREAKER	30AMP	5/32" – 1/2" X 2"
NP10B	1	SURGE	SUPP	5/32" – 1/2" X 2"
NP11	1	DT–1	24 VDC	5/32" – 1/2" X 2"
NP12	1	DT–2	24 VDC	5/32" – 1/2" X 2"
NP13	1	DT–3	24 VDC	5/32" – 1/2" X 2"
NP14	1	PT–1	120 VAC	5/32" – 1/2" X 2"

NOTES:

1. FOR FRONT VIEW & SUBPANEL ARRANGEMENT SEE DWG. 91085626 SH. 1.
2. NAMEPLATES TO BE LAMACOID WHITE BACKGROUND WITH ADHESIVE BACKING. LETTERS TO BE BLACK CENTERED VERTICALLY AND HORIZONTALLY.

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	NAME	DATE
DRAFTER	DRC	01/21/09
DESIGNER	DRC	01/21/09
CHECKER	SJS	XX/XX/XX
APPROVAL		
PROJECT No.	IX–08089.MHLL	

REV	DESCRIPTION	APP	DATE
A	ISSUED FOR SUBMITTAL	XXX	01/29/09

REVISIONS

TOLERANCES (unless otherwise specified)

ANGULAR	±0°30'	DECIMAL (2 PLACES)	±.010
FRACTIONAL	±1/16"	DECIMAL (3 PLACES)	±.005
DECIMAL (1 PLACE)	±.015	DECIMAL (4 PLACES)	±.0005

CALGON

CALGON CARBON CORPORATION

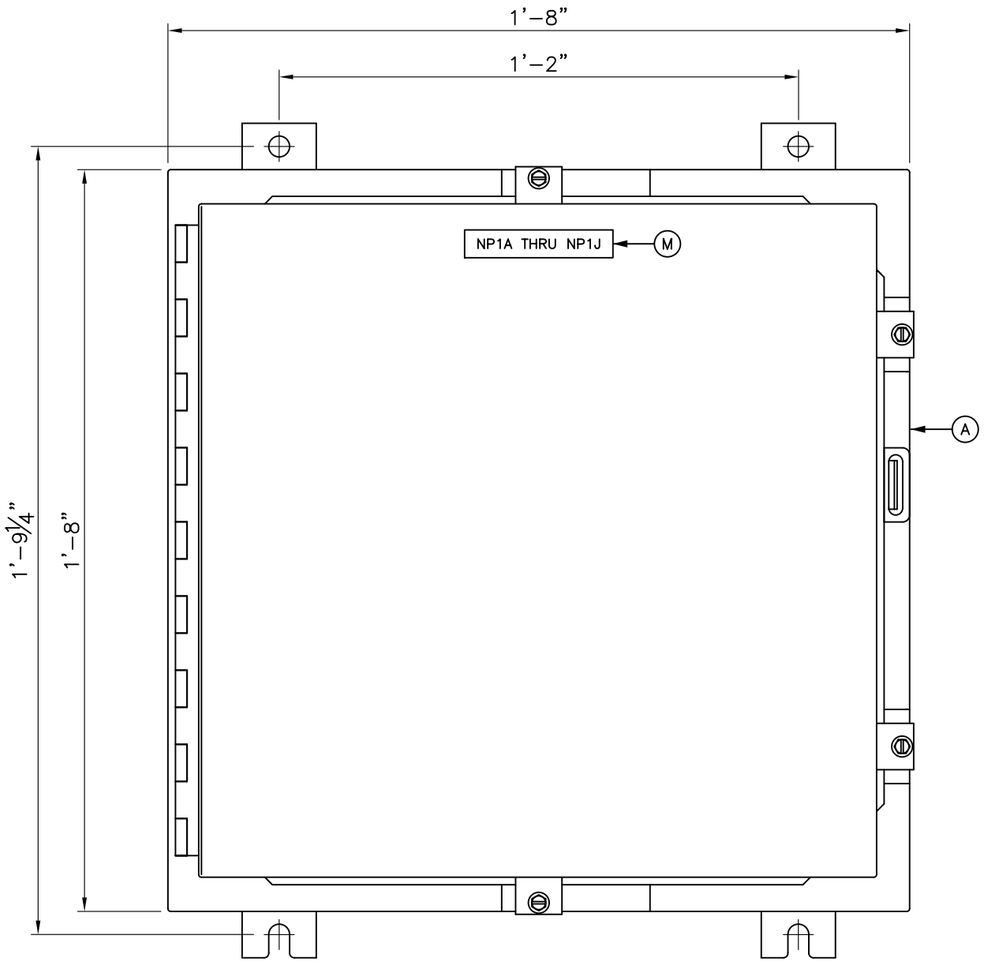
CLIENT: MONK HILLS WELS
PASADENA, CA

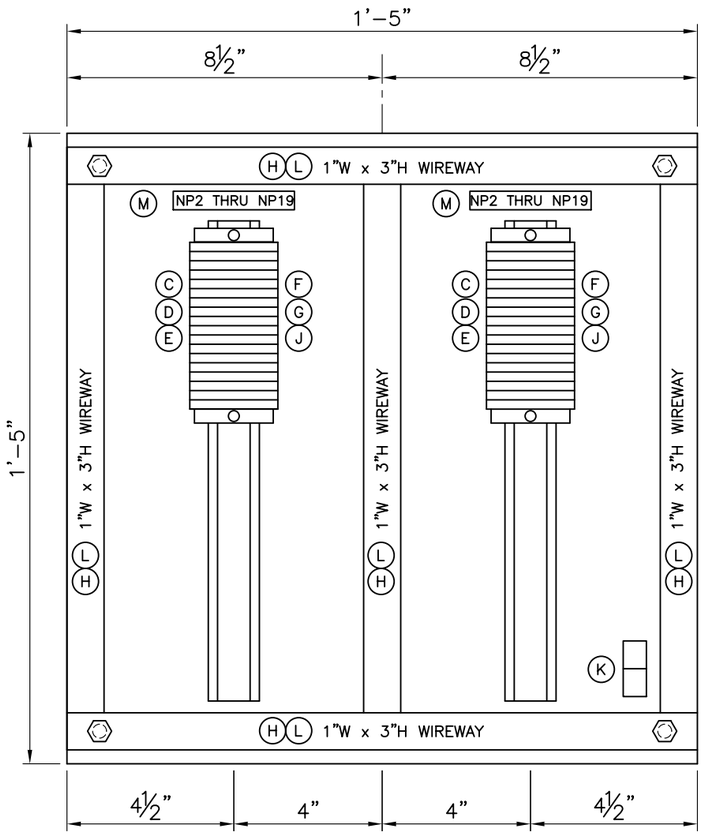
TITLE: MODEL 12 MODULAR ADSORBER SYS.
FILTER CELL CONTROL PANEL
GENERAL ARRANGEMENT

DWG. Size	SHEET No.	SCALE
D	3 OF 3	NTS

DWG. No. 91085626 REV. A

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BILL OF MATERIAL

ITEM	QTY	DESCRIPTION
A	1 EA	ENCLOSURE, 20"Hx20"Wx8"D, NEMA 4X, 316L STAINLESS STEEL HOFFMAN #A20H2008SS6LP
B	1 EA	SUBPANEL, 17"Hx17"W, STEEL HOFFMAN #A20P20
C	34 EA	TERMINAL BLOCK, 600V, 30A, #22–10 AWG WIRE ALLEN–BRADLEY #1492–J4
D	2 EA	TERMINAL BLOCK, GROUND BLOCK, #22–10 AWG WIRE ALLEN–BRADLEY #1492–JG4
E	1 EA	TERMINAL BLOCK, DIN RAIL, 1 METER, STEEL ALLEN–BRADLEY #199–DR1
F	4 EA	TERMINAL BLOCK, END ANCHOR ALLEN–BRADLEY #1492–EAJ35
G	1 EA	TERMINAL BLOCK, SNAP–IN MARKER CARD (120/CARD) ALLEN–BRADLEY #1492–M6X12
H	2 EA	WIRING DUCT, 1"Wx6', GRAY VINYL COVER, 6 FT. LG. PANDUIT #C1LG6
J	4 EA	TERMINAL BLOCK, END BARRIER ALLEN–BRADLEY #1492–EBJ3
K	1 EA	GROUND LUG PANDUIT #LAMA–1/0–14–0
L	2 EA	WIRING DUCT, 1"Wx3"H, GRAY VINYL, WITH COVER, 6 FT. LG. PANDUIT #G1X3LG6
M	3 EA	NAMEPLATES, LAMACOID, BLACK LETTERS ON WHITE BACKGROUND TEXT AS SHOWN ON DWG. 91085626 SHT. 2

NOTES: (SEE DWG 91085626 SHEET 2)

1. ON JUNCTION BOX 1, PANEL DOOR ITEM Ⓜ USE DWG 91085626, SHT.2, BOM# NPIA. ON JUNCTION BOX 1 SUBPANEL ITEM Ⓟ USE DWG 91085626, SHT 2, BOM# NP2 FOR LEFT SIDE AND NP3 FOR RIGHT SIDE.

2. ON JUNCTION BOX 2, PANEL DOOR ITEM Ⓜ USE DWG 91085626, SHT.2, BOM# NPIB. ON JUNCTION BOX 1 SUBPANEL ITEM Ⓟ USE DWG 91085626, SHT 2, BOM# NP4 FOR LEFT SIDE AND NP5 FOR RIGHT SIDE.

3. ON JUNCTION BOX 3, PANEL DOOR ITEM Ⓜ USE DWG 91085626, SHT.2, BOM# NPIC. ON JUNCTION BOX 1 SUBPANEL ITEM Ⓟ USE DWG 91085626, SHT 2, BOM# NP6 FOR LEFT SIDE AND NP7 FOR RIGHT SIDE.

4. ON JUNCTION BOX 4, PANEL DOOR ITEM Ⓜ USE DWG 91085626, SHT.2, BOM# NPID. ON JUNCTION BOX 1 SUBPANEL ITEM P USE DWG 91085626, SHT 2, BOM# NP8 FOR LEFT SIDE AND NP9 FOR RIGHT SIDE.

5. ON JUNCTION BOX 5, PANEL DOOR ITEM Ⓜ USE DWG 91085626, SHT.2, BOM# NPIE. ON JUNCTION BOX 1 SUBPANEL ITEM Ⓟ USE DWG 91085626, SHT 2, BOM# NP10 FOR LEFT SIDE AND NP11 FOR RIGHT SIDE.

6. ON JUNCTION BOX 6, PANEL DOOR ITEM Ⓜ USE DWG 91085626, SHT.2, BOM# NPIF. ON JUNCTION BOX 1 SUBPANEL ITEM Ⓟ USE DWG 91085626, SHT 2, BOM# NP12 FOR LEFT SIDE AND NP13 FOR RIGHT SIDE.

7. ON JUNCTION BOX 7, PANEL DOOR ITEM Ⓜ USE DWG 91085626, SHT.2, BOM# NPIG. ON JUNCTION BOX 1 SUBPANEL ITEM Ⓟ USE DWG 91085626, SHT 2, BOM# NP14 FOR LEFT SIDE AND NP15 FOR RIGHT SIDE.

8. ON JUNCTION BOX 8, PANEL DOOR ITEM Ⓜ USE DWG 91085626, SHT.2, BOM# NPIH. ON JUNCTION BOX 1 SUBPANEL ITEM P USE DWG 91085626, SHT 2, BOM# NP16 FOR LEFT SIDE AND NP17 FOR RIGHT SIDE.

9. ON JUNCTION BOX 9, PANEL DOOR ITEM Ⓜ USE DWG 91085626, SHT.2, BOM# NPIJ. ON JUNCTION BOX 1 SUBPANEL ITEM P USE DWG 91085626, SHT 2, BOM# NP18 FOR LEFT SIDE AND NP19 FOR RIGHT SIDE.

REV	DESCRIPTION	APP	DATE
A	ISSUED FOR SUBMITTAL	XXX	XX/XX/XX

REVISIONS

TOLERANCES (unless otherwise specified)

ANGULAR	±0°30'	DECIMAL (2 PLACES)	±.010
FRACTIONAL	±1/16"	DECIMAL (3 PLACES)	±.005
DECIMAL (1 PLACE)	±.015	DECIMAL (4 PLACES)	±.0005

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	NAME	DATE
DRAFTER	DRC	01/21/09
DESIGNER	DRC	01/21/09
CHECKER	SJS	XX/XX/XX
APPROVAL		

PROJECT No. IX–08089.MHLL

CALGON CARBON CORPORATION

CLIENT: MONK HILL WELLS
PASADENA, CA

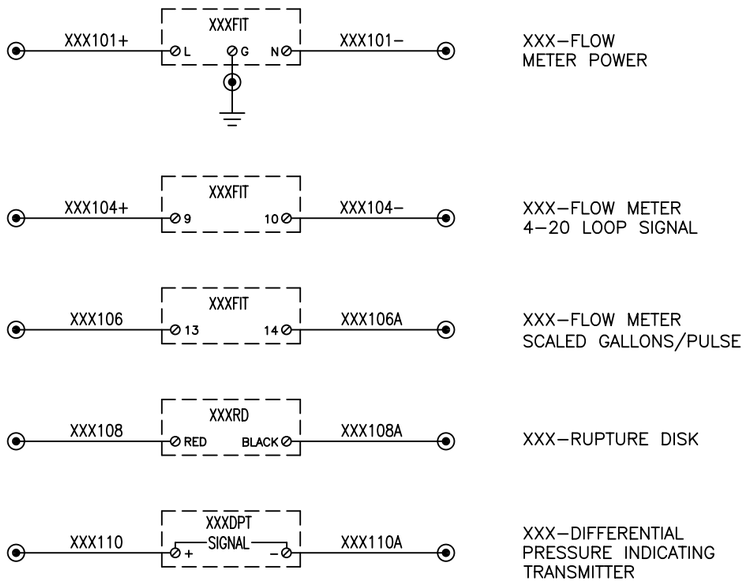
TITLE: MODEL 12 MODULAR ADSORBER SYS.
FILTER CELL CONTROL PANEL
GENERAL ARRANGEMENT

DWG. Size: D | SHEET No.: 1 OF 2 | SCALE: NTS

DWG. No.: 91085626 | REV.: A

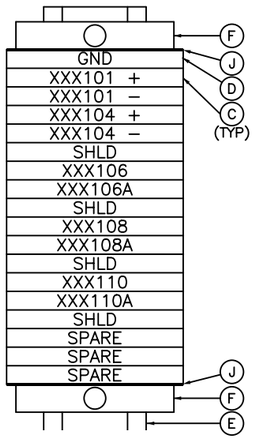
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JUNCTION BOX
ELECTRICAL SCHEMATIC



NOTE:

1. DASHED LINES INDICATED FIELD DEVICES.



TERMINAL BLOCK ARRANGEMENT
(TYPICAL FOR 9 PANELS)

NOTE:

TERMINAL BLOCKS TO HAVE MARKERS ON BOTH SIDES. TWO (2) PER TERMINAL AND PRINTED HORIZONTALLY.

FILTER CELL CONTROL PANELS

NAMEPLATE ENGRAVING				
ITEM	QTY	ENGRAVING LINE 1	ENGRAVING LINE 2	LETTER SIZE–BACKGROUND SIZE
NP1A	1	IX1 & IX2	FILTER CELL CONTROL PANEL	3/16" – 3/4" X 4"
NP1B	1	IX3 & IX4	FILTER CELL CONTROL PANEL	3/16" – 3/4" X 4"
NP1C	1	IX5 & IX6	FILTER CELL CONTROL PANEL	3/16" – 3/4" X 4"
NP1D	1	IX7 & IX8	FILTER CELL CONTROL PANEL	3/16" – 3/4" X 4"
NP1E	1	GAC1 & GAC2	FILTER CELL CONTROL PANEL	3/16" – 3/4" X 4"
NP1F	1	GAC3 & GAC4	FILTER CELL CONTROL PANEL	3/16" – 3/4" X 4"
NP1G	1	GAC5 & GAC6	FILTER CELL CONTROL PANEL	3/16" – 3/4" X 4"
NP1H	1	GAC7 & GAC8	FILTER CELL CONTROL PANEL	3/16" – 3/4" X 4"
NP1J	1	GAC9 & GAC10	FILTER CELL CONTROL PANEL	3/16" – 3/4" X 4"
NP2	1	TBIX1		5/32" – 1/2" X 2"
NP3	1	TBIX2		5/32" – 1/2" X 2"
NP4	1	TBIX3		5/32" – 1/2" X 2"
NP5	1	TBIX4		5/32" – 1/2" X 2"
NP6	1	TBIX5		5/32" – 1/2" X 2"
NP7	1	TBIX6		5/32" – 1/2" X 2"
NP8	1	TBIX7		5/32" – 1/2" X 2"
NP9	1	TBIX8		5/32" – 1/2" X 2"
NP10	1	TBGAC1		5/32" – 1/2" X 2"
NP11	1	TBGAC2		5/32" – 1/2" X 2"
NP12	1	TBGAC3		5/32" – 1/2" X 2"
NP13	1	TBGAC4		5/32" – 1/2" X 2"
NP14	1	TBGAC5		5/32" – 1/2" X 2"
NP15	1	TBGAC6		5/32" – 1/2" X 2"
NP16	1	TBGAC7		5/32" – 1/2" X 2"
NP17	1	TBGAC8		5/32" – 1/2" X 2"
NP18	1	TBGAC9		5/32" – 1/2" X 2"
NP19	1	TBGAC10		5/32" – 1/2" X 2"

NAMEPLATE NOTES:

1. NAMEPLATES TO BE LAMACOID WHITE BACKGROUND WITH ADHESIVE BACKING. LETTERS TO BE BLACK CENTERED VERTICALLY AND HORIZONTALLY.
2. FOR FRONT VIEW, SUBPANEL & BILL OF MATERIAL, SEE DWG. 91085626 SH. 1.

REV	DESCRIPTION	APP	DATE
A	ISSUED FOR SUBMITTAL	XXX	01/29/09

REVISIONS

TOLERANCES (unless otherwise specified)

ANGULAR	±0°30'	DECIMAL (2 PLACES)	±.010
FRACTIONAL	±1/16"	DECIMAL (3 PLACES)	±.005
DECIMAL (1 PLACE)	±.015	DECIMAL (4 PLACES)	±.0005

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	NAME	DATE
DRAFTER	DRC	01/21/09
DESIGNER	DRC	01/21/09
CHECKER	SJS	XX/XX/XX
APPROVAL		
PROJECT No.	IX–08089.MHLL	

CALGON CARBON CORPORATION

CLIENT: MONK HILLS WELLS
PASADENA, CA

TITLE: MODEL 12 MODULAR ADSORBER SYS.
FILTER CELL CONTROL PANEL
GENERAL ARRANGEMENT

DWG. Size: D | SHEET No.: 2 OF 2 | SCALE: NTS

DWG. No.: 91085626 | REV.: A

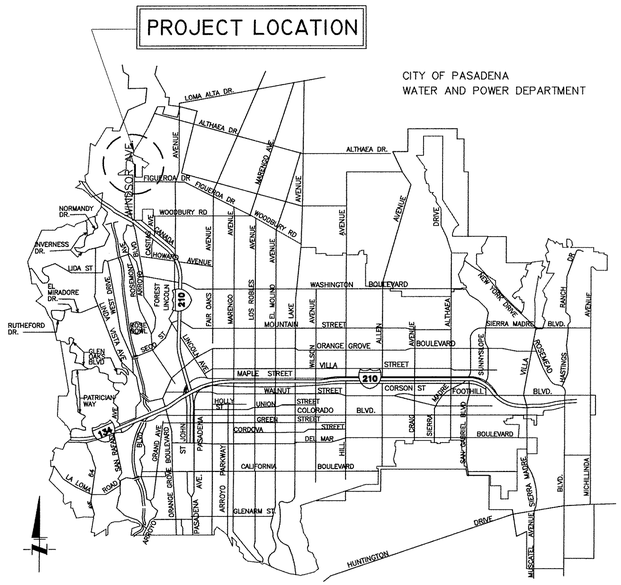
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APPENDIX O
Design Drawings

PASADENA WATER AND POWER

W.O.02557

MONK HILL TREATMENT SYSTEM



VICINITY MAP

NOT TO SCALE

GENERAL NOTES:

1---ALL WORK AND MATERIALS SHALL COMPLY WITH THE 2003 EDITION OF "STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION" (GREEN BOOK) AND SUPPLEMENTS, AND "SUPPLEMENTS AND MODIFICATIONS TO THE "GREEN BOOK" STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION" (PASADENA SUPPLEMENTS), UNLESS NOTED OTHERWISE.

2---NO STOCKPILING OF MATERIAL AND CONSTRUCTION EQUIPMENT IN OR ON PUBLIC STREETS OR SIDEWALKS WILL BE PERMITTED ON THIS PROJECT. MATERIAL AND EQUIPMENT PLACED IN OR ON PUBLIC STREETS, SIDEWALKS AND IN THE CONSTRUCTION AREAS SHALL BE USED THE SAME DAY.

3---THE WORK HOURS MUST COMPLY WITH PASADENA MUNICIPAL CODE CHAPTER 9.36. WORK IS NOT PERMITTED ON SATURDAY AND SUNDAY. THE CITY'S PUBLIC WORKS DEPT. AND/OR TRANSPORTATION MAY PLACE RESTRICTIONS ON WORK HOURS.

4---NOTIFY "UNDERGROUND SERVICE ALERT(USA)" OF SOUTHERN CALIFORNIA (1-800-422-4133) TWO FULL WORKING DAYS (48 HOURS MINIMUM) PRIOR TO BEGINNING ANY CONSTRUCTION ACTIVITIES, INCLUDING PAVEMENT REMOVAL, EXCAVATION AND AC OVERLAY WHICH COULD AFFECT ANY UNDERGROUND UTILITY.

5---NOTIFY ALL AFFECTED UTILITY COMPANIES AT LEAST TWO FULL WORKING DAYS (48) HOURS MINIMUM PRIOR TO BEGINNING ANY CONSTRUCTION IN THE VICINITY OF THEIR FACILITIES.

6---NOTIFY ALL BUSINESSES AND RESIDENTS TWO WEEKS PRIOR TO START OF CONSTRUCTION.

7---ALL TRAFFIC CONTROL MUST COMPLY WITH THE "MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES" (MUTCD 2003) PARTS 5 AND 6 AND THE "WORK AREA TRAFFIC CONTROL HANDBOOK", (WATCH HANDBOOK 10TH EDITION), AND THE CITY'S TRANSPORTATION DEPARTMENT.

8---DEFLECT MAIN AS REQUIRED TO MAINTAIN PIPE ALIGNMENT AS SHOWN.

9---MAINTAIN A MINIMUM OF 42" OF COVER OVER MAIN, UNLESS OTHERWISE SHOWN ON THE PLANS.

10--ESTABLISH DEPTH OF COVER TO TOP OF EXISTING UTILITIES AS REQUIRED.

11--PREPARE AND SUBMIT CONSTRUCTION AS BUILTS.

12--RESTORE A.C. PAVEMENT PER STANDARD DRAWING S-416 AND ANY CONCRETE PAVEMENT PER STANDARD DRAWING S-417.

13--REMOVE AND RECONSTRUCT PAVEMENT TO NEAREST LONGITUDINAL JOINT OR CRACK WITHIN 3-FEET OF EDGE OF TRENCH.

14--ALL JOINTS ON ALL FITTINGS TO BE RESTRAINED WITH MEGALUG GLANDS.

15--RECUT LOOP DETECTORS WHERE APPLICABLE AS NECESSARY. RESPONSIBILITY FOR REPLACEMENT AND COST IS PART OF THIS PROJECT.

16--STORM DRAIN-MAINTAIN 36" OF COVER OVER MAIN AS NECESSARY TO CLEAR STORM DRAIN BY 18" MINIMUM. OTHERWISE CONCRETE BLANKET OVER STORM DRAIN IS REQUIRED PER APWA STANDARD PLAN 225-1, UNLESS NOTED OTHERWISE.

17--TEMPORARILY PAVE STREET AND OPEN TO TRAFFIC AFTER INSTALLATION OF PIPE.

18--FINAL PAVEMENT RESTORATION SHALL BE COMPLETED WITHIN TWO WEEKS OF THE COMPLETION OF EACH PROJECT PHASE. UNLESS OTHERWISE APPROVED IN WRITING BY THE CITY ENGINEER.

19--ALL PAVEMENT MARKINGS, RAISED PAVEMENT AND TRAFFIC HUMPS TO BE REPLACED IN KIND.

~~20--DUCTILE IRON PIPE TO BE CLASS 52.~~

21--THE CONSTRUCTION OF THE MONK HILL TREATMENT DISINFECTION FACILITY WILL BE PERFORMED SIMULTANEOUSLY WITH THE CONSTRUCTION OF THE MONK HILL TREATMENT SYSTEM. THE CONTRACTOR FOR THE DISINFECTION SYSTEM IS TO COORDINATE ITS WORK EFFORTS WITH OTHER WORK ACTIVITIES BEING PERFORMED ON THE MONK HILL TREATMENT SYSTEM. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR COORDINATION OF ANY AND ALL OF ITS WORK ACTIVITIES DURING CONSTRUCTION. 1

22--THE CONTRACTOR IS REQUIRED TO PROTECT TREE IN PLACE PER CONDITIONS OF CONDITIONAL USE PERMIT #5057. THE PROJECT IS PROPOSING TO REMOVE TWO TREES, A QUERCUSILEX (HOLLY OAK) AND AN EUCALYPTUS SIDEROXYLON (RED BARK) ON THE CENTRAL PORTION OF THE PROJECT SITE TO ACCOMMODATE THE PROPOSED ACCESS ROAD WITH THE OWNER. THE REVIEW OF THESE TREES SHALL BE PERFORMED BY THE URBAN FORESTRY ADVISORY COMMITTEE.

23--THE CONTRACTOR IS REQUIRED TO PERFORM THE WORK IN ACCORDANCE WITH CONDITIONAL USE PERMIT #5057, THE REQUIREMENTS OF THE CONSOLIDATED DESIGN REVIEW DATED AUGUST 21, 2008 AND THE INITIAL STUDY ADOPTED BY THE CITY ON JULY 10, 2008, AND ANY CONDITIONS MANDATED BY THE BUILDING PERMIT.

~~24--ALL EARTHWORK SHALL BE DONE IN ACCORDANCE WITH SPECIFICATION 02900 AN THE ATTACHED SOIL REPORT~~

25--THE CONTRACTOR SHALL SECURE ALL LICENSES NECESSARY FOR THE EXECUTION AND COMPLETION OF THE WORK. THE CONTRACTOR SHALL PAY ALL SALES, CONSUMER, USE, AND OTHER TAXES AS REQUIRED BY LAW AND PROPERLY ASSESSED AGAINST HIS/HER EQUIPMENT OR PROPERTY USED IN CONNECTION WITH THE WORK.

26--STORAGE OF MATERIALS OR EQUIPMENT WITHIN PUBLIC RIGHT OF WAY WILL REQUIRE A PERMIT FROM THE CITY OF PASADENA DEPARTMENT OF PUBLIC WORKS.

STORM WATER POLLUTION PREVENTION NOTES 1

1. THE CONTRACTOR IS RESPONSIBLE TO INSTALL, MAINTAIN, AND INSPECT ALL NECESSARY STORM WATER POLLUTION PREVENTION DEVICES.
2. A STANDBY CREW FOR EMERGENCY WORK SHALL BE AVAILABLE AT ALL TIMES DURING THE RAINY SEASON (OCT. 1 TO APRIL 30). NECESSARY MATERIALS SHALL BE AVAILABLE ONSITE AND STOCKPILED AT CONVENIENT LOCATIONS TO FACILITATE RAPID CONSTRUCTION OF EMERGENCY DEVICES WHEN RAIN IS IMMINENT.
3. EROSION CONTROL DEVICES SHOW ON THIS PLAN MAY BE REMOVED WHEN APPROVED BY THE GRADING INSPECTOR IF THE GRADING OPERATION HAS PROGRESSED TO THE POINT WHERE THEY ARE NO LONGER REQUIRED.
4. ERODED SEDIMENTS AND OTHER POLLUTANTS MUST BE RETAINED ON SITE AND MAY NOT BE TRANSPORTED FROM THE SITE VIA SHEET FLOW, SWALES, AREA DRAINS, NATURAL DRAINAGE COURSES OR WIND
5. STOCK PILES OF EARTH AND OTHER CONSTRUCTION MATERIALS MUST BE PROTECTED FROM BEING TRANSPORTED FROM THE SITE BY THE FORCES OF WIND AND WATER FLOW.
6. OILS, SOLVENTS, AND OTHER TOXIC MATERIALS MUST BE STORED IN ACCORDANCE WITH THEIR LISTING SO AS TO NOT CONTAMINATE THE SOIL AND SURFACE WATERS. ALL APPROVED STORAGE CONTAINERS ARE TO BE PROTECTED FROM THE WEATHER. SPILLS MUST BE CLEANED UP IMMEDIATELY AND DISPOSED OF IN A PROPER MANNER. SPILLS MAY NOT BE WASHED INTO THE DRAINAGE SYSTEM, NOR BE ALLOWED TO SETTLE OR INFILTRATE INTO SOIL.
7. EXCESS OR WASTE CONCRETE MAY NOT BE WASHED INTO THE PUBLIC DRAIN OR ANY OTHER DRAINAGE SYSTEM. PROVISIONS SHALL BE MADE TO RETAIN CONCRETE WASTES ON SITE UNTIL THEY CAN BE DISPOSE OF CONCRETE SOLID WASTE AS SOON AS PRACTICAL.
8. TRASH AND CONSTRUCTION SOLID WASTES MUST BE DEPOSITED INTO A COVERED RECEPTACLE TO PREVENT CONTAMINATION OF RAINWATER AND DISPERSAL BY WIND.
9. SEDIMENTS AND OTHER MATERIALS SHALL NOT BE TRACKED FROM THE SITE BY VEHICLE TRAFFIC. THE CONSTRUCTION ENTRANCE ROADWAYS MUST BE STABILIZED SO AS TO INHIBIT SEDIMENTS FROM BEING DEPOSITED ONTO THE PUBLIC RIGHT OF WAY. ACCIDENTAL DEPOSITIONS MUST BE SWEPT UP IMMEDIATELY AND SHALL NOT BE WASHED DOWN BY RAIN OR OTHER MEANS.
10. ANY SLOPE WITH DISTURBED SOILS OR REMOVED VEGETATION MUST BE STABILIZED TO PROHIBIT EROSION BY WIND AND WATER.
11. EROSION CONTROL DEVICES WILL BE MODIFIED AS NEEDED AS THE PROJECT PROGRESSES, AT THE DIRECTION OF THE ENGINEER.
12. CONTRACTOR SHALL MAINTAIN DUST CONTROL AND DIRT TRACKING PREVENTION AT ALL TIMES BY SWEEPING PAVED AREAS. DUST FROM EXPOSED UNPAVED AREAS SHALL BE CONTROLLED BY WATERING. THE CONTRACTOR SHALL UTILIZE A BIO DEGRADABLE SOIL STABILIZER ADDITIVE TO DUST CONTROL WATER.

UNDERGROUND UTILITIES & STRUCTURES NOTES

- A. CONTRACTOR SHALL NOTIFY UNDERGROUND SERVICE ALERT (USA) TELEPHONE 1-800-422-4133, AND UTILITY REPRESENTATIVES A MINIMUM OF 48 HOURS PRIOR TO COMMENCING ANY WORK, AND REQUEST UTILITIES TO FIELD MARK ALL KNOWN FACILITIES.
- B. LOCATION OF UTILITY LINES AND SUBSTRUCTURES SHOWN ON THE PLANS ARE APPROXIMATE. QUANTITY AND LOCATION OF UNDERGROUND SERVICES IS BASED ON A DILIGENT SEARCH OF AVAILABLE RECORDS. CONTRACTOR SHALL VERIFY ALL LOCATIONS AND DEPTHS OF UTILITIES BY POT HOLING PRIOR TO THE START OF ANY WORK. IF ELEVATION OF EXISTING PIPELINES OR STRUCTURES WILL CAUSE CONFLICT WITH PROPOSED PIPELINES OR STRUCTURES WILL CAUSE CONFLICT WITH PROPOSED PIPELINE, CONTRACTOR SHALL NOTIFY THE ENGINEER FOR POSSIBLE REVISIONS TO PLANS.
- C. CONTRACTOR SHALL EXERCISE EXTREME CARE DURING EXCAVATION, TO PROTECT EXISTING UTILITY LINES, IRRIGATION LINES AND CONTROL WIRES, AND SERVICE CONNECTIONS TO EXISTING BUILDINGS.
- D. UNDERGROUND UTILITY LINES AND IRRIGATION SYSTEMS DAMAGED BY THE CONTRACTOR SHALL BE REPAIRED WITHIN 24 HOURS OF THE DAMAGE AT THE CONTRACTORS EXPENSE.
- E. NOT ALL EXISTING IRRIGATION SYSTEMS AND INDIVIDUAL SERVICES ARE SHOWN, THE CONTRACTOR IS RESPONSIBLE FOR LOCATING THESE IN THE FIELD.

UTILITY CONTACT

UNDERGROUND SERVICE ALERT	(800) 422-4133
SOUTHERN CALIFORNIA EDISON CO. JOHN WILLIAMS	(562) 981-8218
SOUTHERN CALIFORNIA GAS CO. RICHARD GIBSON	(714) 634-3159
VERIZON PETE MORALES	(714) 375-6719
VERIZON RAY ROUNDTREE	(562) 903-7915
CHARTER COMMUNICATIONS EVA HERRERA	(626) 430-3324
PASADENA WATER & POWER ROUMIANA VOUTCHKOVA	(626) 744-4005
CSDLAC VINCENT SMITH	(562) 699-7411 EXT. 1205

STEEL METAL BUILDING INFORMATION

OCCUPANCY= GROUP U
CONSTRUCTION TYPE= STEEL METAL
SPRINKLER= UNSPRINKLERED
OCCUPANT LOAD= 20 PSF + 240 PSF TRUCK LOAD.
FLOOR AREA= 532 SQ. FT.

CODES= 2007 CBC
ROOF LL= 20 PSF
WIND= 20 PSF
S_S= 2.574
S_{DS}= 1.716

(1-800-422-4133) UNDERGROUND SERVICE ALERT

DIG ALERT

PLAY IT SAFE. DIAL BEFORE YOU DIG! AT LEAST TWO WORKING DAYS PRIOR TO EXCAVATING

NOTICE TO CONTRACTORS

CONTRACTOR AGREES THAT HE SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS; THAT THE CONTRACTOR SHALL DEFEND, INDEMNIFY AND HOLD THE OWNER AND THE ENGINEER HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT.

G-101

REVISION

NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS.	01/05/09

REGISTERED PROFESSIONAL ENGINEER
CHRISTOPHER SHEM HAWES
69578
CIVIL
STATE OF CALIFORNIA
12/31/2010

APPROVED BY:
CHRISTOPHER SHEM HAWES RCE 69578 — 2/25/08 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

Battelle
The Business of Innovation

CITY OF PASADENA INCORPORATED JUNE 1886

D.S.-209 & 210A

DATE	SCALE		
FEBRUARY 2009	AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 1 OF 79 SHEETS
DRAWN BY CIVILTEC DESIGNED BY CIVILTEC CHECKED BY CIVILTEC SUBMITTED BY CIVILTEC		MONK HILL TREATMENT SYSTEM TITLE PAGE	WORK ORDER 02557 / FILE NUMBER E-1670
FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

X:\2007\27140-JP\ MONKHILL TREATMENT PLANT\DWG\SUBMITTAL\27140-G-101.DWG (03-07-09 8:40:53AM)

SYMBOLS

- A/V — AIR AND VACUUM VALVE
- B.O. — BLOW-OFF
- WM — WATER SERVICE METER
- REDUCER/ENLARGER
- END CAP
- TEE
- STREET LIGHT
- PULL BOX
- EXISTING FIRE HYDRANT
- OR — EXISTING VALVES
- SMH — EXISTING SEWER MANHOLE
- SMH — PROPOSED SEWER MANHOLE
- OR — THRUST BLOCK
- 3309 — ADDRESS – PROPERTY ADDRESS
- (1) - (4) - (5) — APN – ASSESSOR'S PARCEL NUMBER
- PRV — PRESSURE REGULATING VALVE
- EXISTING CONCRETE
- CONCRETE PAVING HEAVY DUTY (REF. SPECS. AND PAVEMENT LEGEND)
- CONCRETE PAVING LIGHT DUTY (REF. SPECS. AND PAVEMENT LEGEND)
- LANDSCAPE AREA (REF. SPECS. AND PAVEMENT LEGEND)
- PROPOSED FENCE
- EXISTING CHAIN LINK FENCE
- PROPOSED A.C. PAVEMENT
- RIGHT-OF-WAY
- CITY BOUNDARY
- DAYLIGHT
- EXISTING WATER MAIN
- EXISTING SEWER MAIN
- EXISTING GAS MAIN
- EXISTING ELECTRICAL LINE
- EXISTING CABLE TV LINE
- EXISTING TELEPHONE LINE
- PROPERTY LINE
- EXISTING STORM DRAIN
- EXISTING OIL PIPELINE
- PAINTED DIRECTIONAL ARROW
- PAINTED ACCESSIBILITY SYMBOL
- MASONRY FENCE
- EXISTING RETAINING WALL
- PROPOSED RETAINING WALL
- (930.00 FS) — EXISTING ELEVATION
- 930.00 FS — PROPOSED ELEVATION
- LIMITS OF GRADING AND PERMIT
- 250 — EXISTING CONTOUR
- 250 — PROPOSED CONTOUR
- (102.78) — EXISTING GRADE
- EDGE OF A. C. PAVEMENT

- CONCENTRATED FLOW LINE
- SHEET FLOW DRAINAGE
- G — PROPOSED GAS MAIN
- W — PROPOSED WATER MAIN
- S — PROPOSED SANITARY SEWER
- E — PROPOSED UNDERGROUND ELECTRICAL CONDUIT
- T — PROPOSED UNDERGROUND TELEPHONE CONDUIT
- CTV — PROPOSED UNDERGROUND CABLE TELEVISION CONDUIT
- SD — PROPOSED STORM DRAIN
- O — PROPOSED OIL PIPELINE
- PROPOSED CONDUIT
- STREET CENTERLINE (℄)
- SLOPE — DRAINAGE FLOW
- PROPOSED WATER LINES
- PROPOSED WATER LINES (UNDERGROUND)
- PROPOSED FLANGED GATE VALVE
- PROPOSED FLANGED PLUG VALVE
- PROPOSED FLANGED CHECK VALVE
- PROPOSED FLANGED BUTTERFLY VALVE
- TYPICAL STEEL-RING FLANGE
- EXISTING GATE VALVE

0 = PROPOSED WATER LINE CROSSES OVER EXISTING UTILITY. 1.0' MIN. SEPARATION, UNLESS OTHERWISE STATED ON THE PLANS.

U = PROPOSED WATER LINE CROSSES UNDER EXISTING UTILITY. 1.0' MIN. SEPARATION, UNLESS OTHERWISE STATED ON THE PLANS.

SECTION A/3 SCALE — A: SECTION LETTER; 3: DRAWING NUMBER FROM WHICH THE SECTION WAS TAKEN.

DETAIL 2/3 SCALE — 2: DETAIL NUMBER; 3: DRAWING NUMBER FROM WHICH THE DETAIL WAS TAKEN.

SEE DETAIL 2/3 — 2: DETAIL NUMBER; 3: DRAWING NUMBER FROM WHICH THE DETAIL APPEARS.

A/5 — A: SECTION LETTER; 5: DRAWING NUMBER WHICH THE SECTION APPEARS

PROFILE 2/3 SCALE — 2: PROFILE NUMBER; 3: DRAWING NUMBER FROM WHICH THE PROFILE WAS TAKEN.

SEE PROFILE 2/3 — 2: PROFILE NUMBER; 3: DRAWING NUMBER FROM WHICH THE PROFILE APPEARS.

- BOLLARD
- EX. BUILDING
- EX. TREES
- NEW CURB
- NEW GUTTER
- NEW BUILDING
- NEW VESSELS
- FIRE HYDRANT
- CUT AND PLUG

ABBREVIATIONS

ALT.	ALTERNATE
& OR ∔	AND
∢	ANGLE
∠	ANGLE (STRUCTURAL)
∢s	ANGLES
APPD. EQ.	APPROVED EQUAL
APPROX.	APPROXIMATE
A.C.P.	ASBESTOS-CEMENT PIPE
A.C.	ASPHALT CONCRETE
ASSY.	ASSEMBLY
ART.	ARTICLE
@	AT
AVE.	AVENUE
B.C.	BEGINNING OF CURVE
B.&S.	BELL AND SPIGOT
B.M.	BENCH MARK
B.C.	BOLT CIRCLE
BOT.	BOTTOM
BLVD.	BOULEVARD
BDRY.	BOUNDARY
BLDG.	BUILDING
B'FLY.	BUTTERFLY
B.V.	BUTTERFLY VALVE
BW	BACK OF WALK
CB	CATCH BASIN
C.I.	CAST IRON
C.I.P.	CAST IRON PIPE
℄ OR CL	CENTER LINE
CTR.	CENTER
C.L.F.	CHAIN LINK FENCE
CH'KD PL	CHECKERED PLATE
C.C.	CENTER TO CENTER
C.M.L.	CEMENT MORTAR LINED
CML & C	CEMENT MORTAR LINED & COATED
CML & P	CEMENT MORTAR LINED & PAINTED
C.M.C.	CEMENT MORTAR COATED
CL.	CLASS
COEF.	COEFFICIENT
COL.	COLUMN
CO.	COMPANY
CONC.	CONCRETE
CONST.	CONSTRUCTION
CONT.	CONTINUOUS
COORD.	COORDINATE
COR.	CORNER
CORP.	CORPORATION
CORR.	CORRUGATED
C.M.P.	CORRUGATED METAL PIPE
CPLG.	COUPLING
C.A.B.	CRUSHED AGGREGATE BASE
CU.	CUBIC
C.F.	CURB FACE
C.Y.	CUBIC YARD
CYL.	CYLINDER
CLRN.	CLEARANCE
° OR DEG.	DEGREE
∆	DELTA
DEPT.	DEPARTMENT
DET.	DETAIL
D, DIA., OR ø	DIAMETER
DWG.	DRAWING
DR.	DRIVE
D.I.	DUCTILE IRON
D.I.P.	DUCTILE IRON PIPE
EA.	EACH
E.F.	EACH FACE
E.W.	EACH WAY
E.W.E.F.	EACH WAY EACH FACE
E.	EAST
E/O	EAST OF
ECC.	ECCENTRIC
EP	EDGE OF PAVEMENT
EMH	ELECTRICAL MANHOLE
EL. OR ELEV.	ELEVATION
ELL.	ELBOW
E.C.	END OF CURVE
EQ. OR =	EQUAL
EXIST. OR EX.	EXISTING
FT.	FOOT OR FEET
FIG.	FIGURE
FIN.	FINISH
FF	FINISHED FLOOR
F.S.	FINISHED SURFACE
F.G.	FINISHED GRADE
FLG.	FLANGE
FLGD.	FLANGED
FE	FLANGED END
FH	FIRE HYDRANT
FL	FLOW LINE
GA.	GAGE OR GAUGE
GAL.	GALLON
GALV.	GALVANIZED
G.I.P.	GALV. IRON PIPE
G.M.	GAS METER
G.V.	GATE VALVE
G.B.	GRADE BREAK
GND.	GROUND
H.P.	HIGH POINT
HWY.	HIGHWAY
HORIZ.	HORIZONTAL
HP.	HORSE POWER
IN. OR "	INCH
INCL.	INCLUDING
I.D.	INSIDE DIAMETER
INST.	INSTALL
INC.	INCORPORATED
INT.	INTERIOR
INV.	INVERT
I.P.S.	IRON PIPE SIZE

LN.	LANE
LAT.	LATITUDE
LT.	LEFT
LG.	LENGTH
L.F.	LINEAR FOOT
LG.	LONG
LONG.	LONGITUDINAL
LL	LOT LINE
LP	LOW POINT
LUB.	LUBRICATED
M.H.	MANHOLE
MHR	MANHOLE RIM
MFR.	MANUFACTURER
MAX.	MAXIMUM
M.S.L.	MEAN SEA LEVEL
M.J.	MECHANICAL JOINTS
MID.	MIDDLE
MI.	MILE
MIN.	MINIMUM
' OR MIN.	MINUTE
MISC.	MISCELLANEOUS
MON.	MONUMENT
NEG.	NEGATIVE
N.	NORTH
N/O	NORTH OF
N.I.C.	NOT IN CONTRACT
N.T.S.	NOT TO SCALE
NO. OR #	NUMBER
NOS.	NUMBERS
O.C.	ON CENTER
O.A.E.	OR APPROVED EQUAL
O.D.	OUTSIDE DIAMETER
PVMT.	PAVEMENT
P.E.	PAD ELEVATION
PLT.	PLATE
PE	PLAIN END
P.A.	PLANTER AREA
P.C.C.	POINT OF COMPOUND CURVE OR PORTLAND CEMENT CONCRETE
P.C.	POINT OF CURVE
P.I.	POINT OF INTERSECTION
P.O.S.	POINT OF SLOPE
P.T.	POINT OF TANGENCY
PT.	POINT
P.V.C.	POLYVINYL CHLORIDE
POS.	POSITIVE
LB.	POUND
P.S.I.	POUND PER SQUARE INCH
P.P.	POWER POLE
PVT.	PRIVATE
PROJ.	PROJECT
ℙ	PROPERTY LINE
R. OR RAD.	RADIUS
RL	RIDGELINE
R.R.	RAILROAD
R.G.	ROUGH GRADE
RY.	RAILWAY
REF.	REFERENCE
REINF.	REINFORCING
R.C.P.	REINFORCED CONC. PIPE
RES.	RESERVOIR
R.W.C.V.	RESILIENT WEDGE GATE VALVE
REV.	REVISION
RT.	RIGHT
R/W	RIGHT-OF-WAY
RD.	ROAD
RS4	SINGLE FAMILY RESIDENCE
" OR SEC.	SECOND
SD	STORM DRAIN
SECT.	SECTION
SMH	SEWER MANHOLE
SHT.	SHEET
S.	SOUTH
S/O	SOUTH OF
SPEC'S.	SPECIFICATIONS
SQ.	SQUARE
SS	SANITARY SEWER
STD.	STANDARD
STA.	STATION
STL.	STEEL
S.C.C.P.	STL. CYL. CONC. PIPE
SDMH	STORM DRAIN MANHOLE
ST.	STREET
ST. LT.	STREET LIGHT
STR.	STRUCTURAL
S1S1E	SURFACED 1 SIDE & 1 EDGE
S2S1E	" 2 SIDES & 1 EDGE
S1S2E	" 1 SIDE & 2 EDGES
S1E	" 1 EDGE
S1S	" 1 SIDE
S2E	" 2 EDGES
S4S	" 4 SIDES
SYM.	SYMMETRICAL
TMH	TELEPHONE MANHOLE
T.P.	TELEPHONE POLE
TEMP.	TEMPERATURE
TERR.	TERRACE
THD.	THREAD
TOE	TOE OF SLOPE
TC	TOP OF CURB
TF	TOP OF FOOTING
T.G.	TOP OF GRATE
TOP	TOP OF SLOPE
T.P.	TOP OF PLATFORM
T.V.	TOP OF VAULT
TW	TOP OF WALL
TRANS.	TRANSITION
TYP.	TYPICAL
TJ	TYTON JOINT
VERT.	VERTICAL
V.C.P.	VITRIFIED CLAY PIPE
WM	WATER METER
WV	WATER VALVE
WT.	WEIGHT
W.	WEST
W/O	WEST OF
W/	WITH
YD.	YARD

SHEET INDEX

NO	DRAWING NO.	SHEET'S TITLE
1	G-101	TITLE PAGE
2	G-102	SHEET/INDEX/SYMBOLS/ABBREVIATIONS
3	G-103	START UP PROCESS FLOW DIAGRAM
4	G-104	HYDRAULIC PROFILE
5	C-101	GENERAL SITE PLAN
6	C-102	TREATMENT SYSTEM – SITE PLAN/YARD PIPING
7	C-103	ARROYO – SITE PLAN/YARD PIPING
8	C-104	VENTURA WELL – SITE PLAN/YARD PIPING
9	C-105	YARD PIPING CONNECTIONS
10	C-106	YARD PIPING CONNECTIONS
11	C-107	PIPING PROFILES
12	C-108	PIPING PROFILES
13	C-109	30" RCP PROFILE
14	C-110	PRECISE GRADING PLAN
15	C-111	PRECISE GRADING SECTIONS/DETAILS
16	C-112	CIVIL DETAILS
17	–	NOT USED – SEE STREET IMPROVEMENT PLANS
18	–	NOT USED – SEE STREET IMPROVEMENT PLANS
19	–	NOT USED – SEE STREET IMPROVEMENT PLANS
20	–	NOT USED – SEE STREET IMPROVEMENT PLANS
21	–	NOT USED – SEE STREET IMPROVEMENT PLANS
22	–	NOT USED – SEE STREET IMPROVEMENT PLANS
23	–	NOT USED – SEE STREET IMPROVEMENT PLANS
24	TPS-101	TREATMENT PAD PLAN
25	TPS-102	CONCRETE PAD SECTIONS
26	TPM-101	VESSELS PLAN
27	TPM-102	VESSELS ELEVATIONS
28	TPM-103	VESSELS ELEVATIONS
29	TPM-104	BACKWASH FILTER
30	TPM-105	STAIRS, GUARDRAIL & HANDRAIL PLAN
31	VWA-101	VENTURA WELL ARCHITECTURAL PLAN
32	VWA-102	VENTURA WELL ARCHITECTURAL ELEVATIONS
33	VWA-103	VENTURA WELL ARCHITECTURAL BUILDING SECTIONS
34	VWA-104	VENTURA WELL ARCHITECTURAL BUILDING DETAILS
35	VWA-105	VENTURA WELL ARCHITECTURAL DETAILS
36	VWS-101	VENTURA WELL STRUCTURAL PLAN
37	VWS-102	VENTURA WELL STRUCTURAL DETAILS
38	VWM-101	VENTURA WELL MECHANICAL PIPING PLAN
39	VWM-102	VENTURA WELL STRUCTURAL SECTIONS
40	SCH-101	VALVE SCHEDULE
41	SCH-102	VALVE SCHEDULE
42	SCH-103	PUMP AND MECHANICAL SCHEDULE
43	SCH-104	INSTRUMENTATION SCHEDULE
44	DT-101	GENERAL DETAILS
45	DT-102	GENERAL DETAILS
46	DT-103	GENERAL DETAILS
47	DT-104	GENERAL DETAILS
48	DT-105	GENERAL DETAILS
49	DT-106	GENERAL DETAILS
50	DT-107	GENERAL DETAILS
51	DT-108	GENERAL DETAILS

NO	DRAWING NO.	SHEET'S TITLE
52	PID-101	LEGEND/SYMBOLS/ABBREVIATIONS
53	PID-102	BOOSTER STATION AND INFLUENT FILTERS
54	PID-103	ION EXCHANGE TANKS
55	PID-104	ION EXCHANGE TANKS
56	PID-105	LGAC TANKS
57	PID-106	LGAC TANKS
58	PID-107	LGAC TANKS
59	PID-108	LGAC TANKS
60	E-100	GENERAL NOTES, SYMBOLS AND ABBREVIATIONS
61	E-101	WINDSOR WELL-SINGLE LINE DIAGRAM, ELEVATIONS AND SCHEDULE
62	E-102	WINDSOR WELL-SITE AND BUILDING PLAN-ELECTRICAL
63	E-103	WINDSOR WELL-PUMP CONTROL SCHEMATIC
64	E-104	WINDSOR WELL-PLC INPUT/OUTPUT DIAGRAM
65	E-201	WELL 52-SINGLE LINE DIAGRAM, ELEVATIONS AND SCHEDULE
66	E-202	WELL 52-SITE AND BUILDING PLAN-ELECTRICAL
67	E-203	WELL 52-PUMP CONTROL SCHEMATIC
68	E-204	WELL 52-PLC INPUT/OUTPUT DIAGRAM
69	E-301	ARROYO WELL-SINGLE LINE DIAGRAM, ELEVATIONS AND SCHEDULE
70	E-302	ARROYO WELL-SITE AND BUILDING PLAN-ELECTRICAL
71	E-303	ARROYO WELL-PUMP CONTROL SCHEMATIC
72	E-304	ARROYO WELL-BOOSTER PUMP CONTROL SCHEMATIC
73	E-305	ARROYO WELL-PLC INPUT/OUTPUT DIAGRAM
74	E-401	VENTURA WELL-SINGLE LINE DIAGRAM, ELEVATIONS AND SCHEDULE
75	E-402	VENTURA WELL-BUILDING PLAN-ELECTRICAL
76	E-403	VENTURA WELL-PUMP CONTROL SCHEMATIC
77	E-404	VENTURA WELL-BOOSTER PUMP CONTROL SCHEMATIC
78	E-405	VENTURA WELL-PLC INPUT/OUTPUT DIAGRAM
79	E-501	MISCELLANEOUS ELECTRICAL DETAILS

G-102

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — 6/30/2010 — CIVIL — STATE OF CALIFORNIA

APPROVED BY: C. Shem Hawes 69578 2/25/08
CHRISTOPHER SHEM HAWES RCE DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

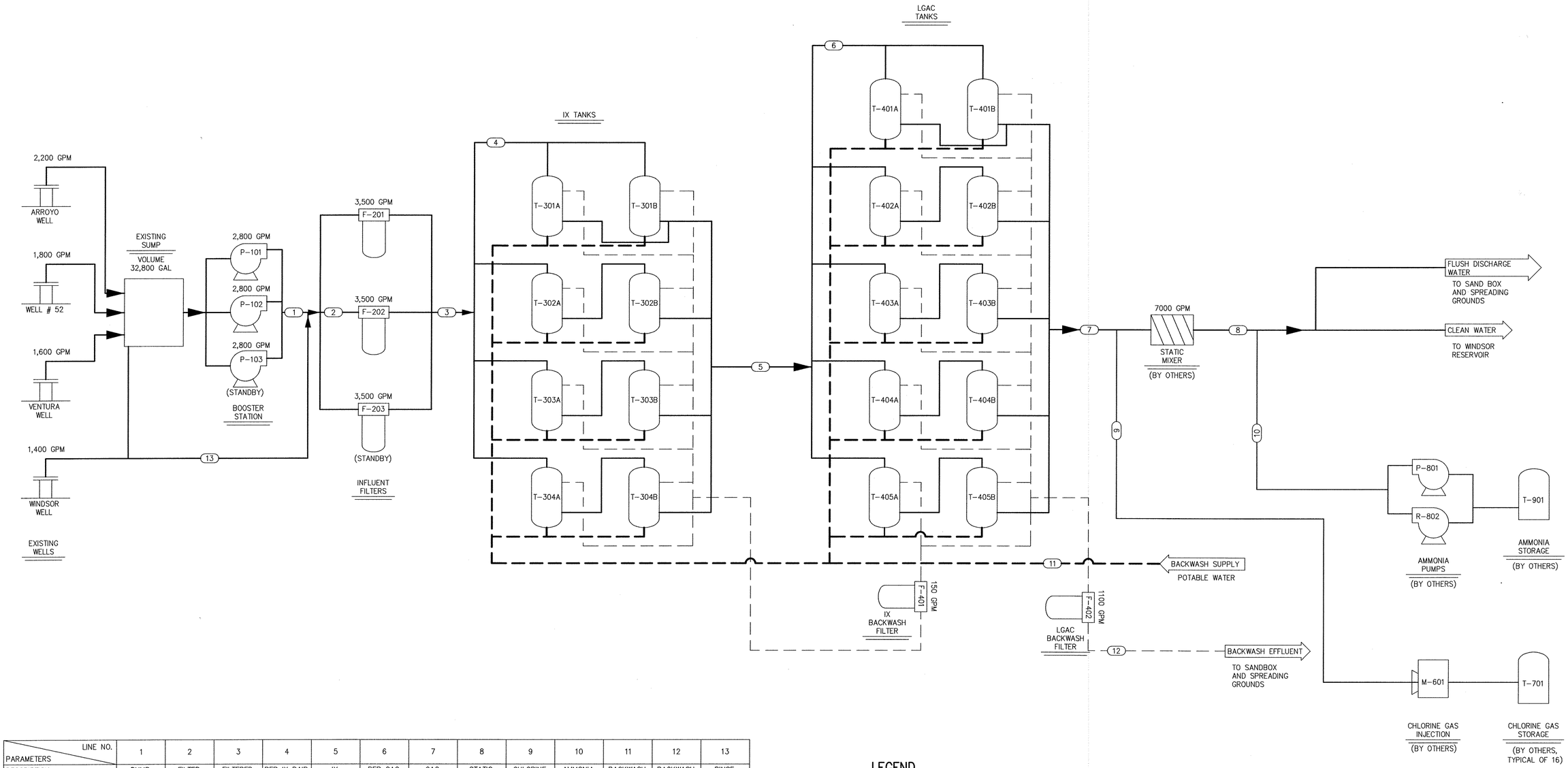
Battelle
The Business of Innovation

CITY OF PASADENA — INCORPORATED JUNE, 1886

D.S.-209 & 210A

DATE: FEBRUARY 2009	SCALE: AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 2 OF 79 SHEETS
DRAWN BY: CIVILTEC DESIGNED BY: CIVILTEC CHECKED BY: CIVILTEC SUBMITTED BY: CIVILTEC		MONK HILL TREATMENT SYSTEM SHEET/INDEX/SYMBOLS/ABBREVIATIONS	WORK ORDER 02557 / FILE NUMBER E-1670
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED / REVISION

V:\2007\27140-JP_MONHILL TREATMENT PLANT\DWGS\SUBMITTALS\FINAL SUBMITTAL\27140-G-102.DWG (02-27-09 10:50:29AM)



LINE NO. / PARAMETERS	1	2	3	4	5	6	7	8	9	10	11	12	13
DESCRIPTION	PUMP DISCHARGE	FILTER INFLUENT PER FILTER	FILTERED INFLUENT	PER IX PAIR	IX EFFLUENT	PER GAC PAIR	GAC EFFLUENT	STATIC MIXER EFFLUENT	CHLORINE	AMMONIA	BACKWASH SUPPLY (IX/GAC)	BACKWASH DISCHARGE (IX/GAC)	RINSE
FLOW (GPM)	5,600	3,500	7,000	1,750	7,000	1,400	7,000	7,000	252 (lb/day)	50 (lb/day)	150/1,100	150/1,100	1,400
PRESSURE (PSIG) WORKING	114	70	56	52	34	30	20	21	21*	15*	132/118	100/85	73
ClO4 (PPB)	45	45	45	45	< 4	< 4	< 4	< 4	–	–	–	–	–
TCE (PPB)	3.2	3.2	3.2	3.2	3.2	3.2	< 0.5	< 0.5	–	–	–	–	–
PCE (PPB)	0.59	0.59	0.59	0.59	0.59	0.59	< 0.5	< 0.5	–	–	–	–	–
1,2-DCA (PPB)	0.46	0.46	0.46	0.46	0.46	0.46	< 0.5	< 0.5	–	–	–	–	–
CCl4 (PPB)	2.7	2.7	2.7	2.7	2.7	2.7	< 0.5	< 0.5	–	–	–	–	–
1,2,3-TCP (PPB)	0.02	0.02	0.02	0.02	0.02	0.02	< 0.005	< 0.005	–	–	–	–	–
NITRATE (PPM)	24	24	24	24	24	24	< 36	< 36	–	–	–	–	–
SULFATE (PPM)	55	55	55	55	55	55	< 60	< 60	–	–	–	–	–
BICARBONATE	230	230	230	230	N/A	N/A	N/A	N/A	–	–	–	–	–
CHLORIDE	53	53	53	53	53	53	< 60	< 60	–	–	–	–	–

* DENOTES PIPELINE BACKPRESSURE AT INJECTION POINT

LEGEND

- MAIN PROCESS PIPING
- BACKWASH SUPPLY
- BACKWASH DISCHARGE
- CHEMICAL SUPPLY

G-103

REVISION		
NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — 1/30/2010 — CIVIL — STATE OF CALIFORNIA

APPROVED BY: CHRISTOPHER SHEM HAWES 69578 RCE — 2/25/08 DATE

APPROVED: _____ DATE

APPROVED: _____ DATE

PLANS PREPARED BY:

CIVILTEC engineering inc.

General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying

118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

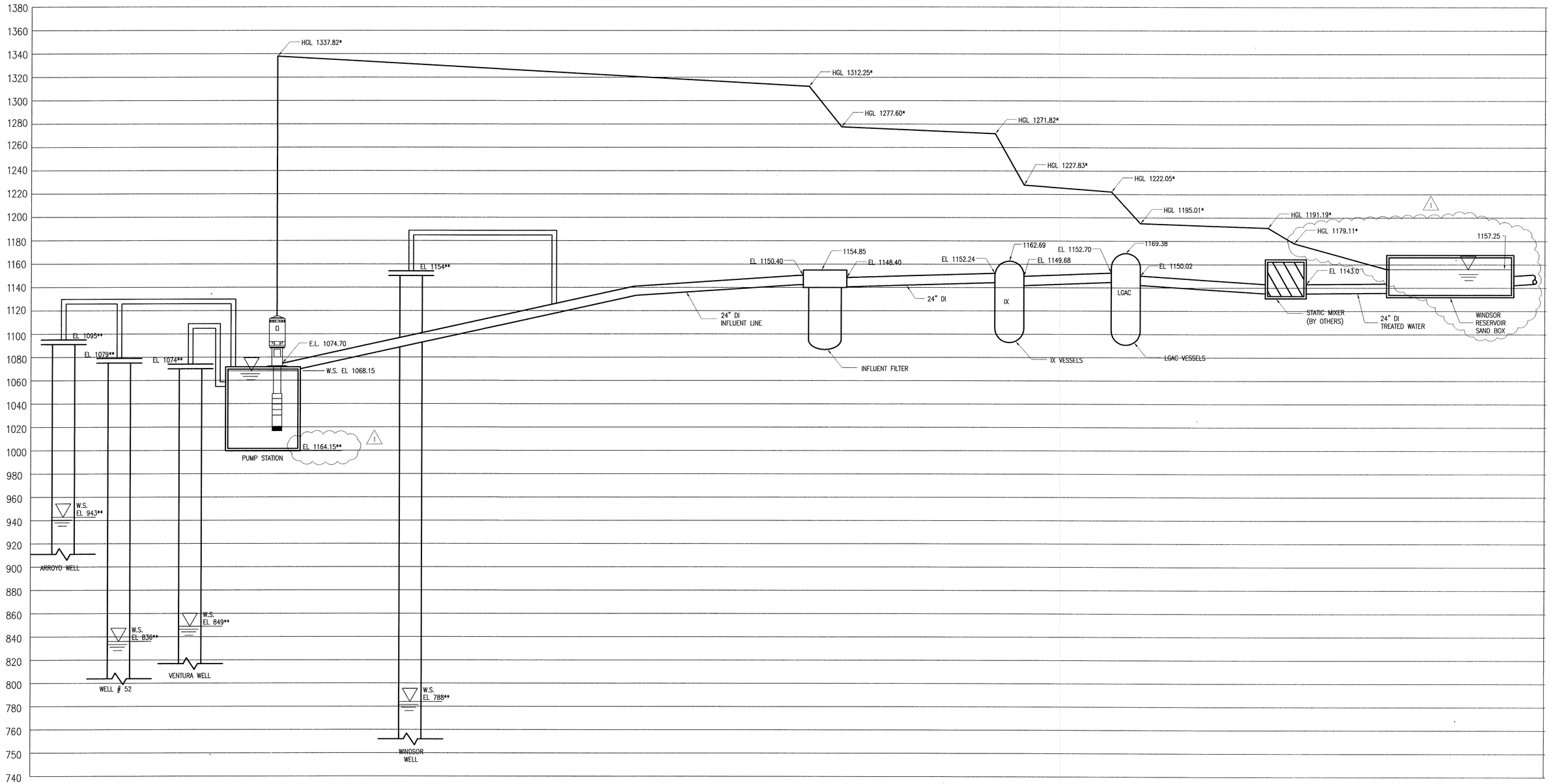
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The Business of Innovation

CITY OF PASADENA — INCORPORATED JUNE 1886

D.S.-209 & 210A

DATE	SCALE	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 3 OF 79 SHEETS
FEBRUARY 2009	AS SHOWN		
DRAWN BY CIVILTEC DESIGNED BY CIVILTEC CHECKED BY CIVILTEC SUBMITTED BY CIVILTEC		MONK HILL TREATMENT SYSTEM START UP PROCESS FLOW DIAGRAM	WORK ORDER 02557 / FILE NUMBER E-1670
FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

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* HYDRAULIC GRADE LINE AT 7000 GPM
** FACILITY AND WATER SURFACE ELEVATIONS SHOWN FOR CLARITY
*** MINIMUM OPERATING DEPTH

G-104

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — 10/30/2010 — CIVIL — STATE OF CALIFORNIA

APPROVED BY:
CHRISTOPHER SHEM HAWES 69578 RCE — 2/25/08 DATE
APPROVED: — DATE
APPROVED: — DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

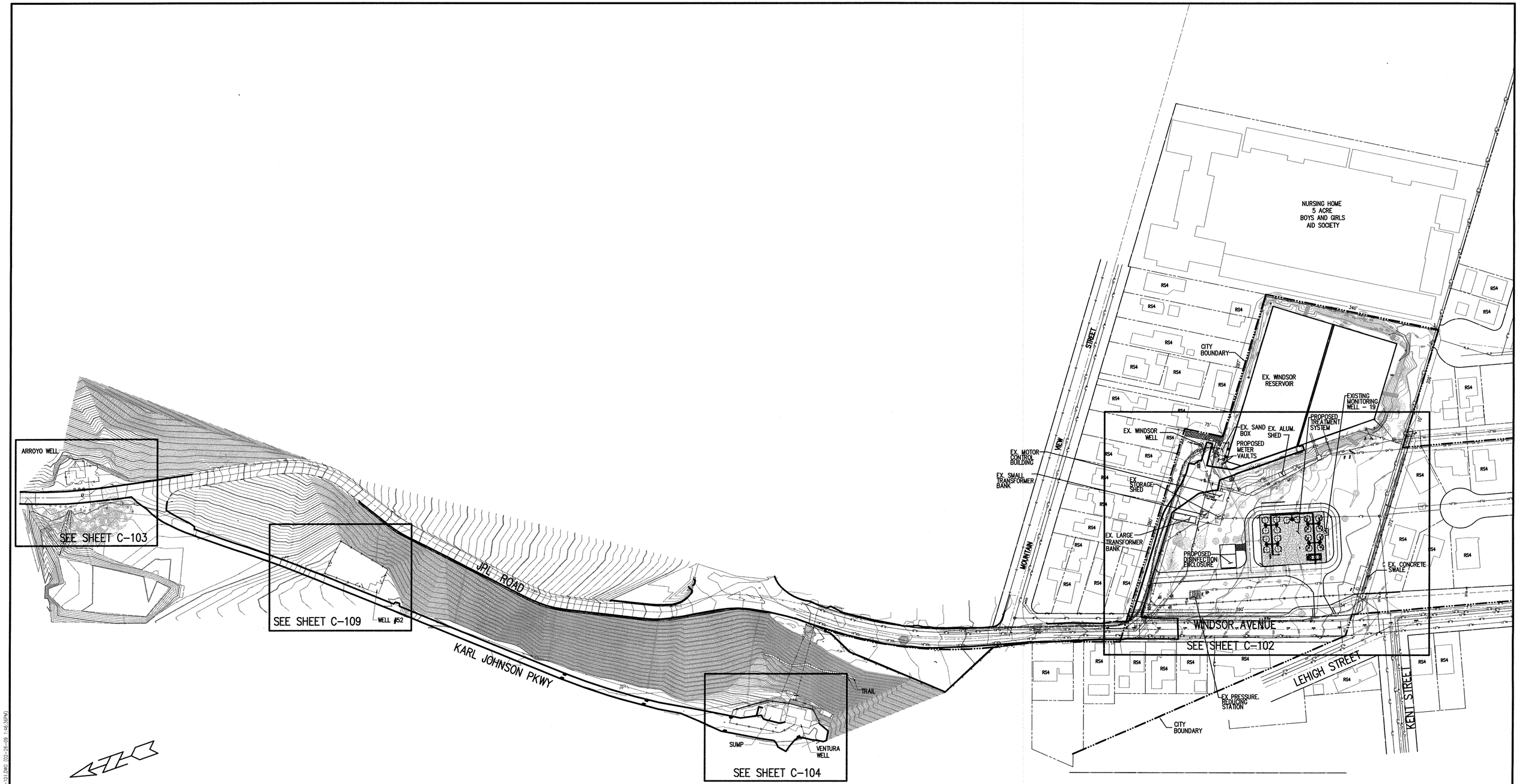
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CITY OF PASADENA * INCORPORATED JUNE 1886 *

D.S.–209 & 210A

DATE: FEBRUARY 2009	SCALE: AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 4 OF 79 SHEETS
DRAWN BY: CIVILTEC DESIGNED BY: CIVILTEC CHECKED BY: CIVILTEC SUBMITTED BY: CIVILTEC		MONK HILL TREATMENT SYSTEM HYDRAULIC PROFILE	WORK ORDER: 02557 FILE NUMBER: E-1670
FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

J:\2007\27145-JR, MONKHILL TREATMENT PLANT\DWG\SUBMITTALS\FINAL SUBMITTAL\27145-G-104.DWG (02-26-09 14:24:24PM)



C-101

REVISION		
NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER
CHRISTOPHER SHEM HAWES
69578
6/30/2010
CIVIL
STATE OF CALIFORNIA

APPROVED BY:
CHRISTOPHER SHEM HAWES 69578 RCE — 2/25/08 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
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CITY OF PASADENA INCORPORATED JUNE, 1886

D.S.–209 & 210A

DATE	SCALE	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 5 OF 79 SHEETS
FEBRUARY 2009	AS SHOWN		
DRAWN BY CIVILTEC		MONK HILL TREATMENT SYSTEM GENERAL SITE PLAN	WORK ORDER 02557 / FILE NUMBER E-1670
DESIGNED BY CIVILTEC			
CHECKED BY CIVILTEC			
SUBMITTED BY CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

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SCALE 1"=20'

EXISTING WINDSOR RESERVOIR

EX. 8" TEMPORARY ABOVE GROUND FLUSH LINE

WINDSOR WELL

EX. CLOSED VALVE

EX. SANDBOX

SAND BOX SEE DETAIL 1/C-112

24" DIP PLANT EFFLUENT SEE PROFILE 3/C-107

METER VAULT SEE DETAIL 1/C-106

METER VAULT SEE DETAIL 1/C-106 SIM.

CITY BOUNDARY

N 1892123.92
E 6510998.10

EFFLUENT TO WASTE

24" DIP PLANT EFFLUENT SEE PROFILE 2/C-107

30" RCP SEE PROFILE 6/C-106

10" DIP BACKWASH DISCHARGE SEE PROFILE 5/C-106

DEMOLISH EX. CHAIN LINK FENCE, AND GATE. REMOVE EX. TRANSFORMER

INSTALL NEW TYPE II FENCE 10' HIGH AND GATE 8'x9'H PER DETAIL 1/DT-106

12'x14' CONC. PAD FF=1152.50

N= 1892155.37
E=6510905.45

AMMONIA SAMPLING VAULT (BY OTHERS)

TREE TO BE REMOVED

AMMONIA INJECTION VAULT (BY OTHERS)

AQUA AMMONIA STORAGE AREA (BY OTHERS)

CHLORINE GAS STORAGE AREA (BY OTHERS)

CHLORINE INJECTION VAULT (BY OTHERS)

4" PVC DRAIN (BY OTHERS)

NEW TREATMENT VESSELS SEE SHEET TPM-101

EX. MW-19

TREATMENT PAD SEE TPS-101

PIPE CONNECTION SEE DETAIL 4/C-105 1/TPM-101

24" DIP PLANT EFFLUENT SEE PROFILE 2/C-107

TREE TO BE REMOVED

PIPE CONNECTION SEE DETAIL 1/C-105 N 1892254.4097 E 6510830.3761

24" DIP PLANT INFLUENT SEE PROFILE 1/C-107

PIPE CONNECTION SEE DETAIL 2/C-105

PIPE CONNECTION SEE DETAIL 2/C-106

10" DIP BACKWASH SUPPLY SEE PROFILE 4/C-106

4" GSP FIRE SERVICE (BY OTHERS)

4" PVC FIRE SERVICE (BY OTHERS)

PIPE CONNECTION SEE DETAIL 3/C-105

10" DIP BACKWASH DISCHARGE SEE PROFILE 5/C-106

2" GSP UTILITY WATER (BY OTHERS)

8" DIP FIRE SERVICE (BY OTHERS)

24" DIP PLANT INFLUENT SEE PROFILE 1/C-107

PIPE CONNECTION SEE DETAIL 4/C-105

EX. CONCRETE DRAINAGE SWALE

CITY BOUNDARY

LA COUNTY

WINDSOR AVENUE

4+50 5+00 5+50 6+00 6+50 7+00 8+00 8+50 9+00 9+50 10+00

TRANSF. SLAB LINE DATA TABLE

	BEARING	DISTANCE
1	N66°23'22"W	14 FT
2	N23°36'38"E	12 FT
3	N66°23'22"W	14 FT
4	N23°36'38"E	12 FT

YARD PIPING CONSTRUCTION NOTES FOR THE WINDSOR SITE:

1. 10" 22.5° DI ELBOW MJxMJ MEGALUG RESTRAINED.
2. 10" 45° DI ELBOW MJxMJ MEGALUG RESTRAINED.
3. 10" 90° DI ELBOW MJxMJ MEGALUG RESTRAINED.
4. 12" 45° DI ELBOW MJxMJ MEGALUG RESTRAINED.
5. 24" 22.5° DI ELBOW MJxMJ MEGALUG RESTRAINED.
6. 24" 45° DI ELBOW MJxMJ MEGALUG RESTRAINED.
7. 24" 90° DI ELBOW MJxMJ MEGALUG RESTRAINED.
8. 24x24x24 DI WYE
9. 20" 45° DI ELBOW MJxMJ MEGALUG RESTRAINED.
10. 24"x20" DI REDUCER FExFE.

TREE PROTECTION NOTES:

1. CONTRACTOR SHALL COMPLY WITH THE CITY'S TREE PROTECTION ORDINANCE AND THE "DESIGN GUIDELINES FOR PROTECTION OF TREES DURING CONSTRUCTION" AT HTTP:\\WWW.CI.PASADENA.CA.US/PUBLICWORKS/PRN/TREEORDINANCE.DEFAULT.ASP.
2. PASADENA WATER AND POWER WILL COORDINATE WITH THE CONTRACTOR FOR OBTAINING WRITTEN APPROVAL FROM THE CITY'S URBAN FORESTRY ADVISORY COUNCIL FOR THE REMOVAL OF UP TO 2 TREES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR IMPLEMENTING AND MANAGING THE UFAC REQUIREMENTS AND THE CITY'S TREE PROTECTION ORDINANCE FOR COMPLYING WITH THE PERMIT. SEE DRAWING FOR THE 2 TREES THAT WILL BE REMOVED. CONTRACTOR SHALL NOT REMOVE ANY ADDITIONAL TREES WITHOUT FIRST CONSULTING WITH PASADENA WATER AND POWER. SEE ALSO IRRIGATION AND MONITORING PROGRAM FOR TREE PROTECTION.

C-102

REVISION NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — CIVIL — STATE OF CALIFORNIA — 6/30/2010

APPROVED BY: CHRISTOPHER SHEM HAWES RCE 69578 — 2/25/08 DATE

APPROVED: _____ DATE

APPROVED: _____ DATE

PLANS PREPARED BY:

CIVILTEC engineering inc.

General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying

118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

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CITY OF PASADENA INCORPORATED JUNE 1886

D.S.-209 & 210A

DATE	SCALE
FEBRUARY 2009	AS SHOWN

DRAWN BY CIVILTEC
DESIGNED BY CIVILTEC
CHECKED BY CIVILTEC
SUBMITTED BY CIVILTEC

FIELD BOOKS | CALC BOOKS | APPROVED | APPROVED

PASADENA WATER & POWER
CITY OF PASADENA

MONK HILL TREATMENT SYSTEM
TREATMENT SYSTEM- SITE PLAN/YARD PIPING

SHEET NO 6 OF 79 SHEETS

WORK ORDER 02557 | FILE NUMBER E-1670

REVISION

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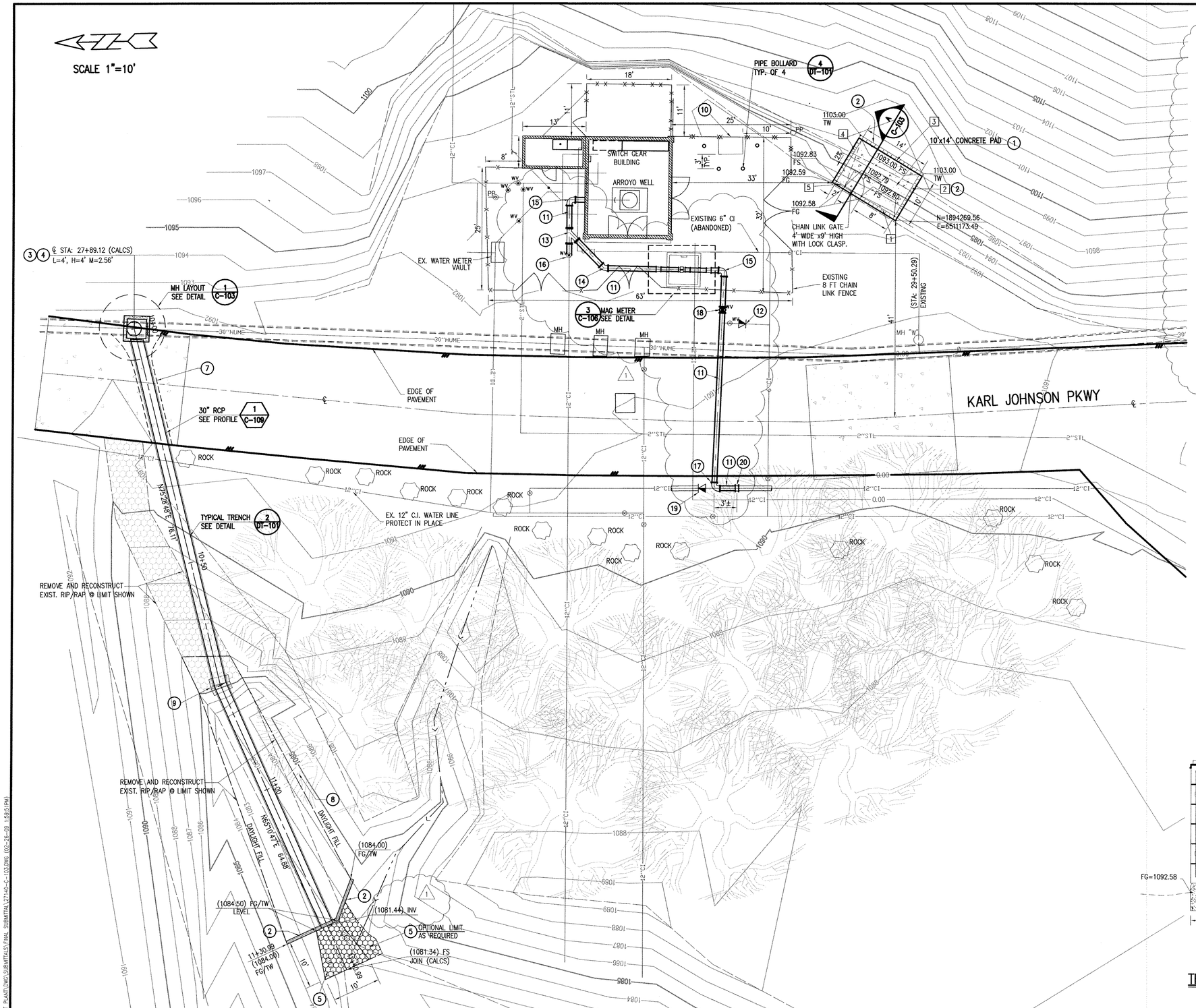
SCALE 1"=10'

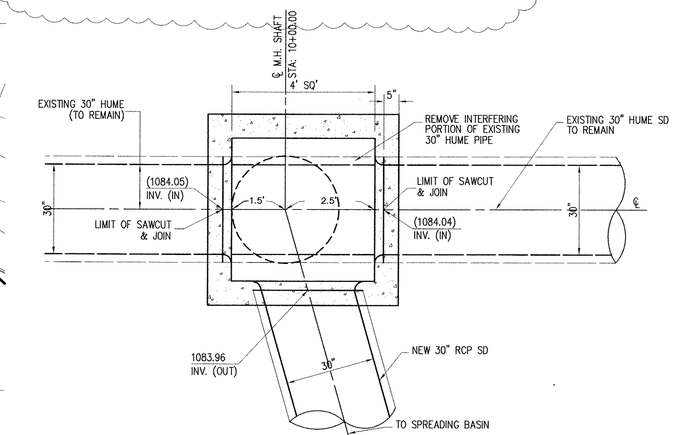
GENERAL NOTES:

1. FOR TREE PROTECTION (SEE SHEET C-102 NOTE 1)
2. THE CONTRACTORS ATTENTION IS BROUGHT TO THE REQUIREMENTS OF CUP #5057 REGARDING NESTING AND MIGRATORY SEASON REQUIREMENTS.
3. TRAFFIC CONTROL AND WORK ACTIVITIES IN KARL JOHNSON PKWY SHALL BE PERFORMED IN ACCORDANCE WITH THE APPROVED CONSTRUCTION STAGING AND TRAFFIC MANAGEMENT PLAN.

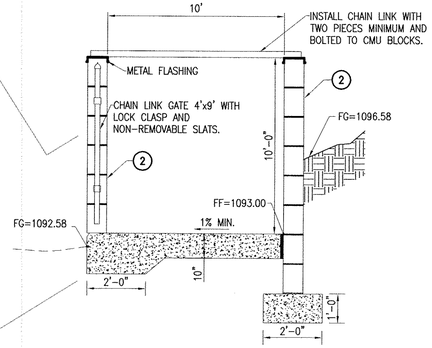
CONSTRUCTION NOTES FOR ARROYO WELL SITE:

1. CONSTRUCT PCC TRANSFORMER PAD PER SECTION A THIS SHEET AND PER DETAIL 2 ON SHEET DT-107.
2. CONSTRUCT FREESTANDING CMU WALL PER DETAIL 2 & 3 ON SHEET DT-107.
3. CONSTRUCT MANHOLE PER SPPWC STANDARD PLAN 321-1 MODIFIED PER PLAN.
4. INSTALL PRESSURE MANHOLE SHAFT AND PRESSURE PLATE PER SPPWC STD. PLAN 329-1.
5. UNGROUTED RIP RAP SWALE. DIMENSION PER PLAN RECONSTRUCT EXISTING RIP RAP AND MATCH GRADES PER PLAN, MAIN ROCK DIAMETER=8".
6. NOT USED
7. SAWCUT, REMOVE AND REPLACE KIND.
8. CONTRACTOR TO USE CAUTION WHEN WORKING NEAR TREES.
9. CONCRETE COLLAR PER SPPWC STANDARD PLAN 380-3.
10. ELECTRICAL SWITCH BOARD EQUIPMENT, SEE ELECTRICAL PLANS FOR DETAILS.
11. REPLACE EX. 12" CAST IRON PIPE WITH 12" DUCTILE IRON PIPE CLASS 52.
12. REMOVE EX. VALVE AND CAP EX. 6" CI PIPE.
13. REPLACE EX. 12" WYE, MJxMJxMJ, MEGALUG RESTRAIN ALL JOINTS, IN KIND
14. REPLACE EX. 12" 45° BEND WITH 12" DI 45°, MJxMJ, MEGALUG RESTRAIN ALL JOINTS, IN KIND
15. REPLACE EX. 12" 90° BEND WITH 90° DI 45°, MJxMJ, MEGALUG RESTRAIN ALL JOINTS, IN KIND
16. RECONNECT TO EX. 12" GATE VALVE, MEGALUG RESTRAIN ALL JOINTS
17. RECONNECT TO EX. 12" 90° DI BEND, MEGALUG RESTRAIN ALL JOINTS
18. REMOVE EX. 12" GATE VALVE.
19. REMOVE INTERFERING PORTIONS OF EX. 12" CI PIPE AND CAP.
20. INSTALL 12" TRANSITION COUPLING





M.H. LAY-OUT DETAIL (1 C-103)
NOT TO SCALE



TRANSFORMER PAD (A C-103)
NOT TO SCALE

RET. WALL LINE DATA TABLE		
☐	BEARING	LENGTH
1	N30°17'14"E	8.00'
2	N59°42'46"W	10.67'
3	N30°17'14"E	15.33'
4	N59°42'46"W	10..67'
5	N30°17'14"E	2.00'

C-103

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — 6/20/2010 — CIVIL — STATE OF CALIFORNIA

APPROVED BY:
CHRISTOPHER SHEM HAWES 69578 RCE — 2/25/08 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

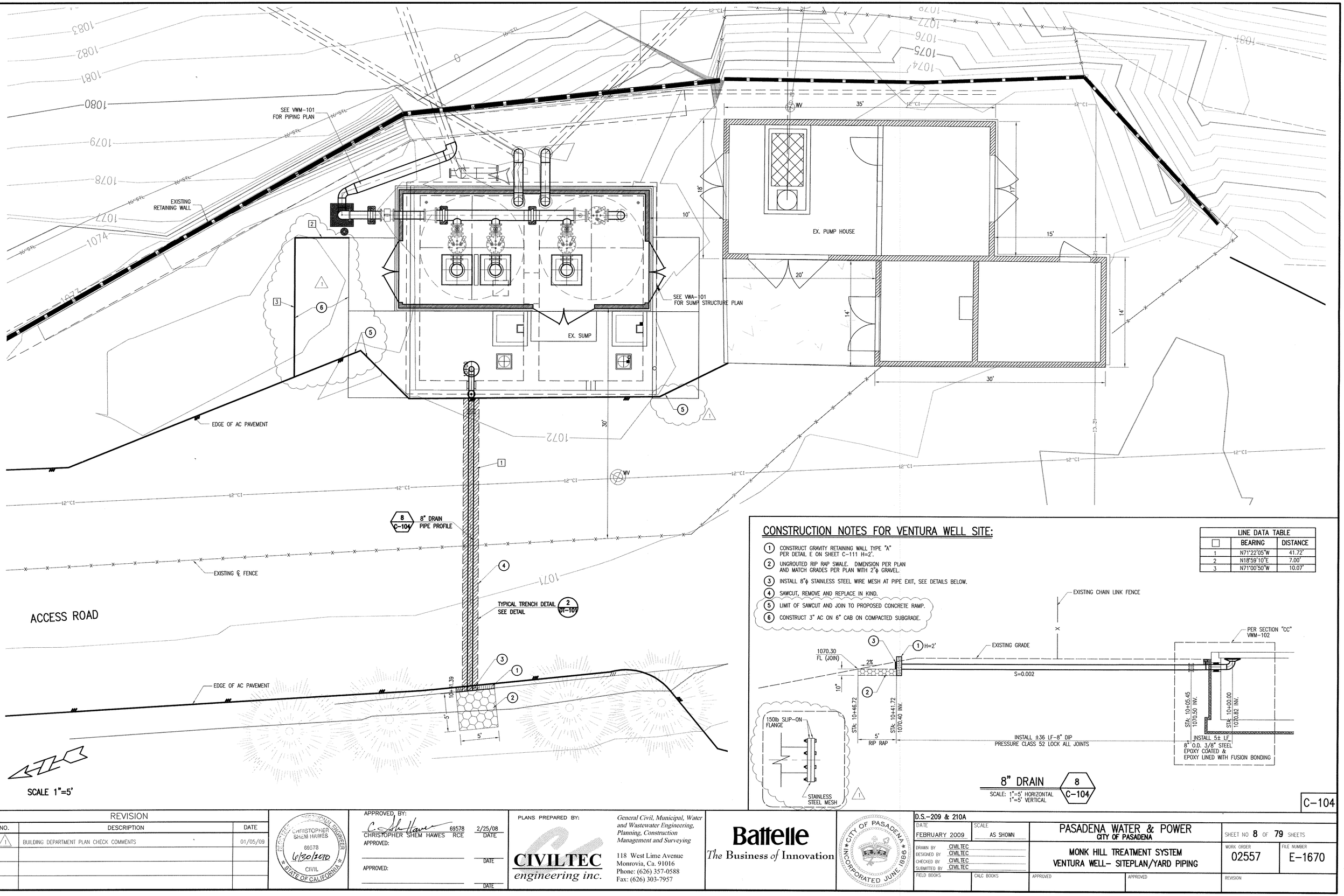
Battelle
The Business of Innovation

CITY OF PASADENA * INCORPORATED JUNE 1886 *

D.S.-209 & 210A

DATE	SCALE	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 7 OF 79 SHEETS
FEBRUARY 2009	AS SHOWN		
DRAWN BY CIVILTEC		MONK HILL TREATMENT SYSTEM ARROYO- SITE PLAN/YARD PIPING	WORK ORDER 02557 / FILE NUMBER E-1670
DESIGNED BY CIVILTEC			
CHECKED BY CIVILTEC			
SUBMITTED BY CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

K:\2007\07140-JR_MONKHILL TREATMENT PLANT\DWGS\SUBMITTALS\FINAL SUBMITTAL\07140-C-103.DWG (02-26-09 11:53 PM)



CONSTRUCTION NOTES FOR VENTURA WELL SITE:

1. CONSTRUCT GRAVITY RETAINING WALL TYPE "A" PER DETAIL E ON SHEET C-111 H=2'.
2. UNGROUTED RIP RAP SWALE. DIMENSION PER PLAN AND MATCH GRADES PER PLAN WITH 2"ϕ GRAVEL.
3. INSTALL 8"ϕ STAINLESS STEEL WIRE MESH AT PIPE EXIT, SEE DETAILS BELOW.
4. SAWCUT, REMOVE AND REPLACE IN KIND.
5. LIMIT OF SAWCUT AND JOIN TO PROPOSED CONCRETE RAMP.
6. CONSTRUCT 3" AC ON 6" CAB ON COMPACTED SUBGRADE.

LINE DATA TABLE		
	BEARING	DISTANCE
1	N71°22'05"W	41.72'
2	N18°59'10"E	7.00'
3	N71°00'50"W	10.07'

8" DRAIN (8 / C-104)
SCALE: 1"=5' HORIZONTAL
1"=5' VERTICAL

C-104

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER
CHRISTOPHER SHEM HAWES
69578
6/30/2010
CIVIL
STATE OF CALIFORNIA

APPROVED BY:
CHRISTOPHER SHEM HAWES RCE 69578 — 2/25/08 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

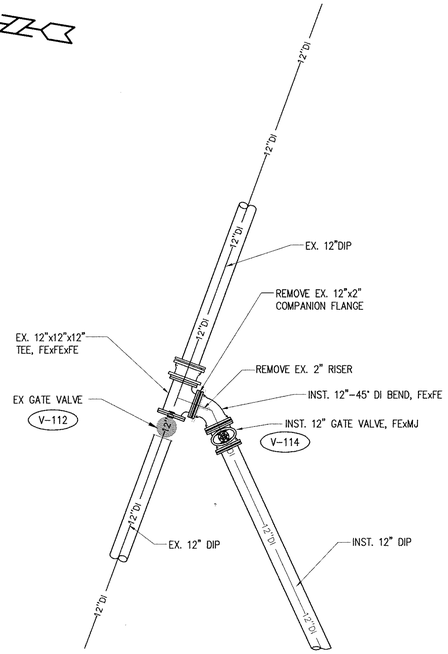
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The Business of Innovation

CITY OF PASADENA INCORPORATED JUNE, 1886

D.S.-209 & 210A

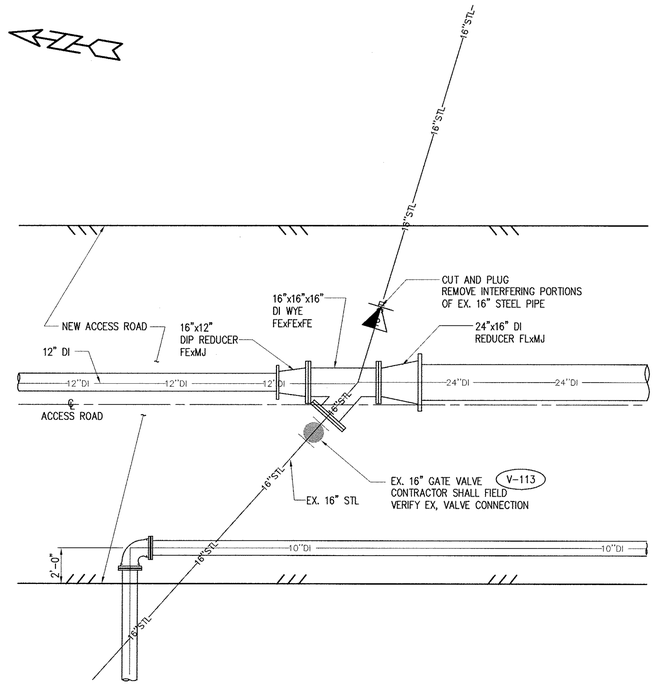
DATE	SCALE	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 8 OF 79 SHEETS
FEBRUARY 2009	AS SHOWN		
DRAWN BY CIVILTEC		MONK HILL TREATMENT SYSTEM	WORK ORDER 02557
DESIGNED BY CIVILTEC		VENTURA WELL- SITEPLAN/YARD PIPING	FILE NUMBER E-1670
CHECKED BY CIVILTEC			
SUBMITTED BY CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED / REVISION

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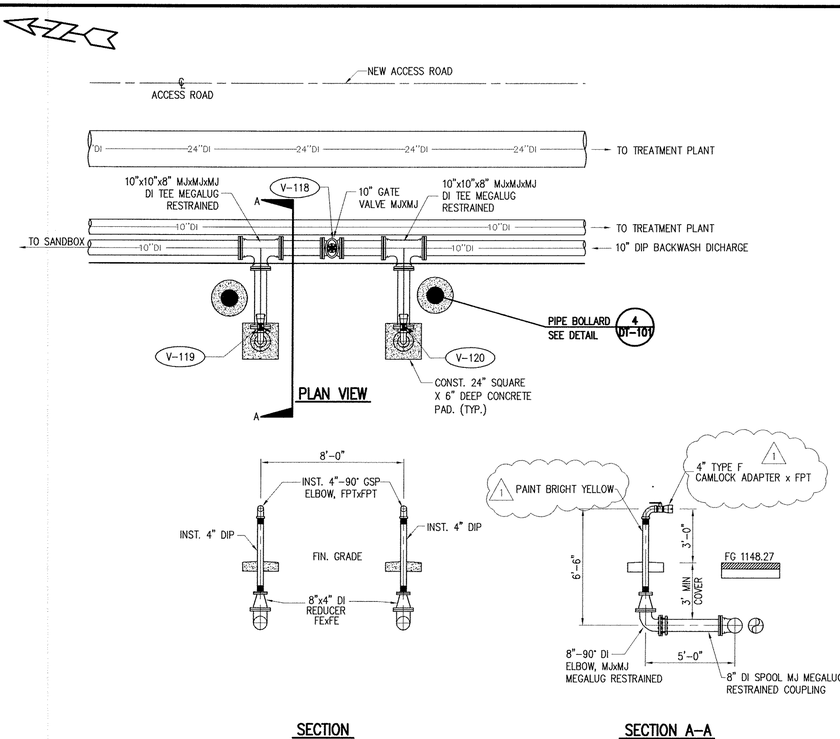
PLAN VIEW

PIPE CONNECTION 1
1/4"=1' SCALE C-102



PLAN VIEW

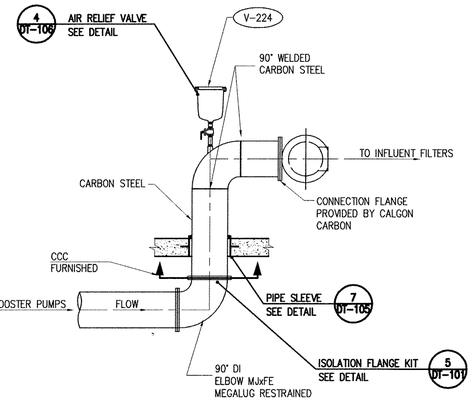
PIPE CONNECTION 2
1/4"=1' SCALE C-102



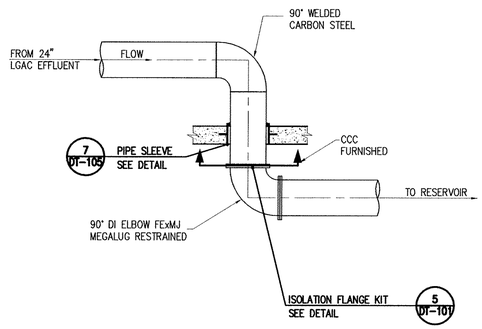
SECTION

SECTION A-A

PIPE CONNECTION 3
SCALE: 1/4"=1'-0" C-102



SECTION
INFLUENT LINE



SECTION
EFFLUENT LINE

PIPE CONNECTION 4
1/4"=1' SCALE C-102

C-105

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER
CHRISTOPHER SHEM HAWES
69578
6/20/2010
CIVIL
STATE OF CALIFORNIA

APPROVED BY:
CHRISTOPHER SHEM HAWES RCE 69578 2/25/08 DATE
APPROVED: DATE
APPROVED: DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

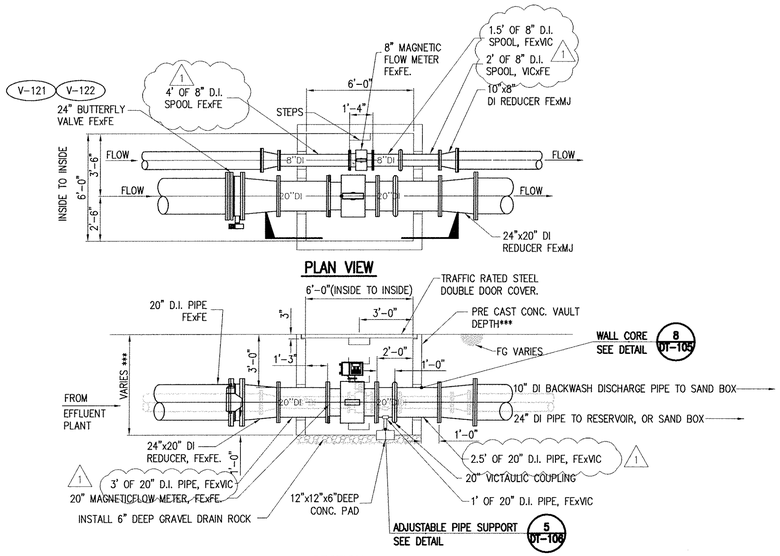
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CITY OF PASADENA INCORPORATED JUNE 1886

D.S.-209 & 210A

DATE	SCALE	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO. 9 OF 79 SHEETS
FEBRUARY 2009	AS SHOWN		
DRAWN BY CIVILTEC		MONK HILL TREATMENT SYSTEM YARD PIPING CONNECTIONS	WORK ORDER 02557 / FILE NUMBER E-1670
DESIGNED BY CIVILTEC			
CHECKED BY CIVILTEC			
SUBMITTED BY CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

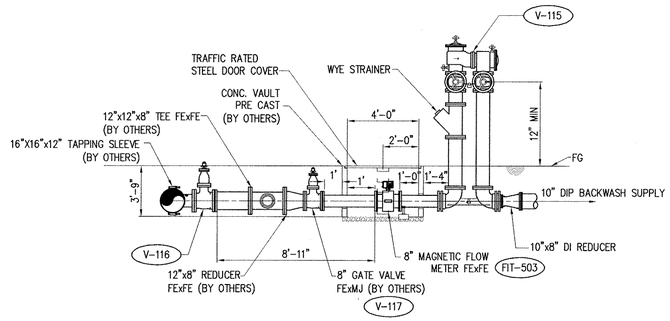
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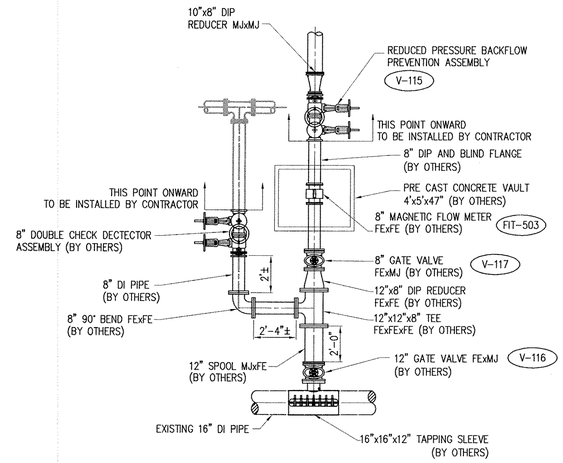


*** PROVIDED VAULT DEPTH FROM FINISHED GRADE TO GRAVEL BED. DEPTH TO SAND BOX METERING STATION = ±6'-6", DEPTH TO RESERVOIR METERING STATION = ±7'-0"

FLOW METER AND VAULT DETAIL 1 / C-102

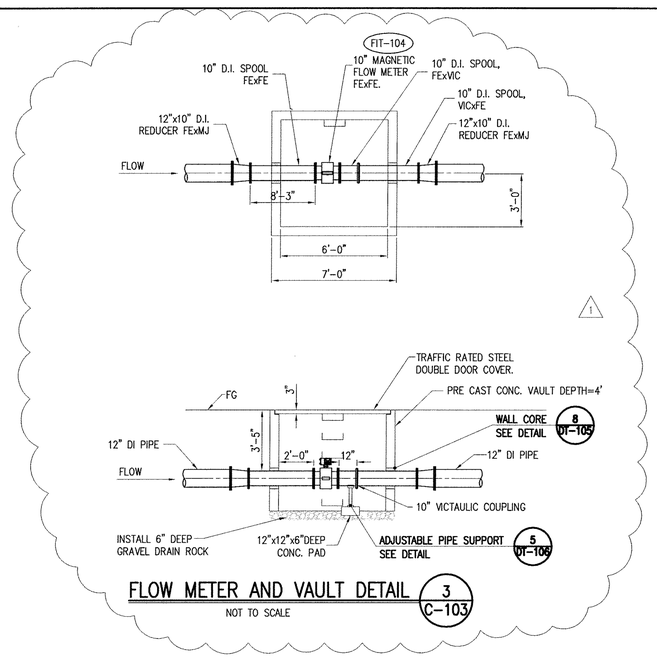
NOT TO SCALE





PIPE CONNECTION 2 / C-102

1/4"=1' SCALE



FLOW METER AND VAULT DETAIL 3 / C-103

NOT TO SCALE

C-106

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — 6/30/2010 — CIVIL — STATE OF CALIFORNIA

APPROVED BY: C. Shem Hawes 69578 CHRISTOPHER SHEM HAWES RCE — 2/25/08 DATE

APPROVED: _____ DATE

APPROVED: _____ DATE

PLANS PREPARED BY:

CIVILTEC engineering inc.

General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying

118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

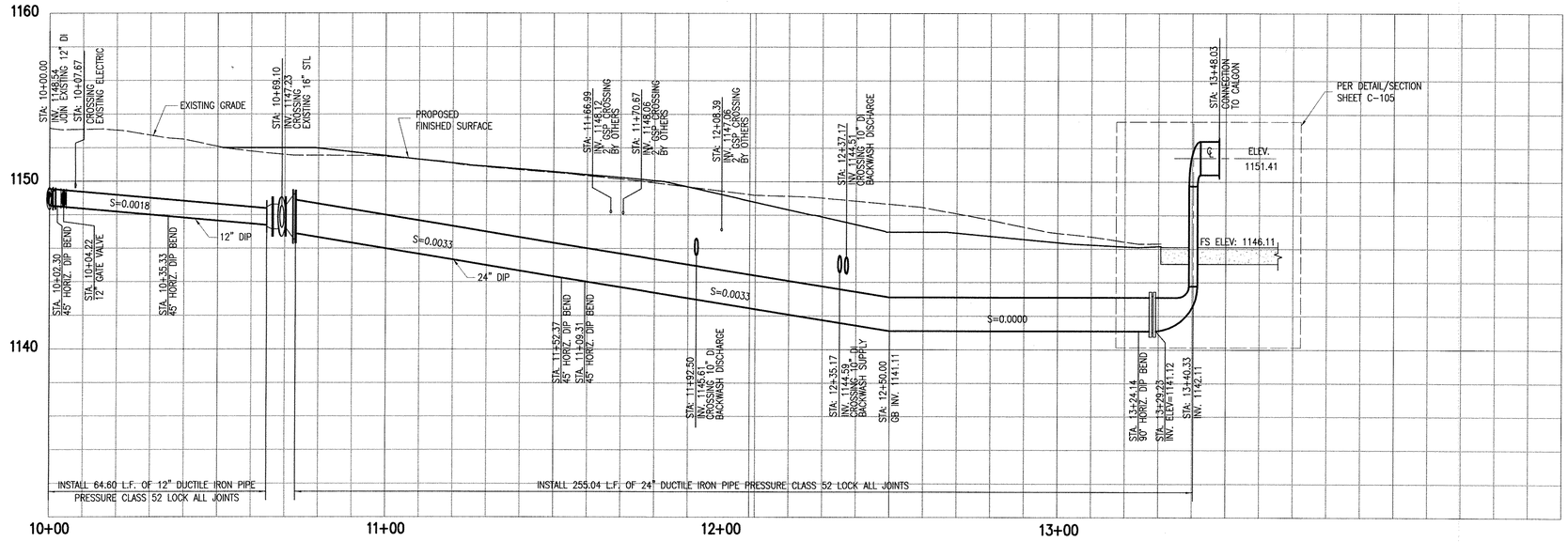
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CITY OF PASADENA INCORPORATED JUNE 1886

D.S.-209 & 210A

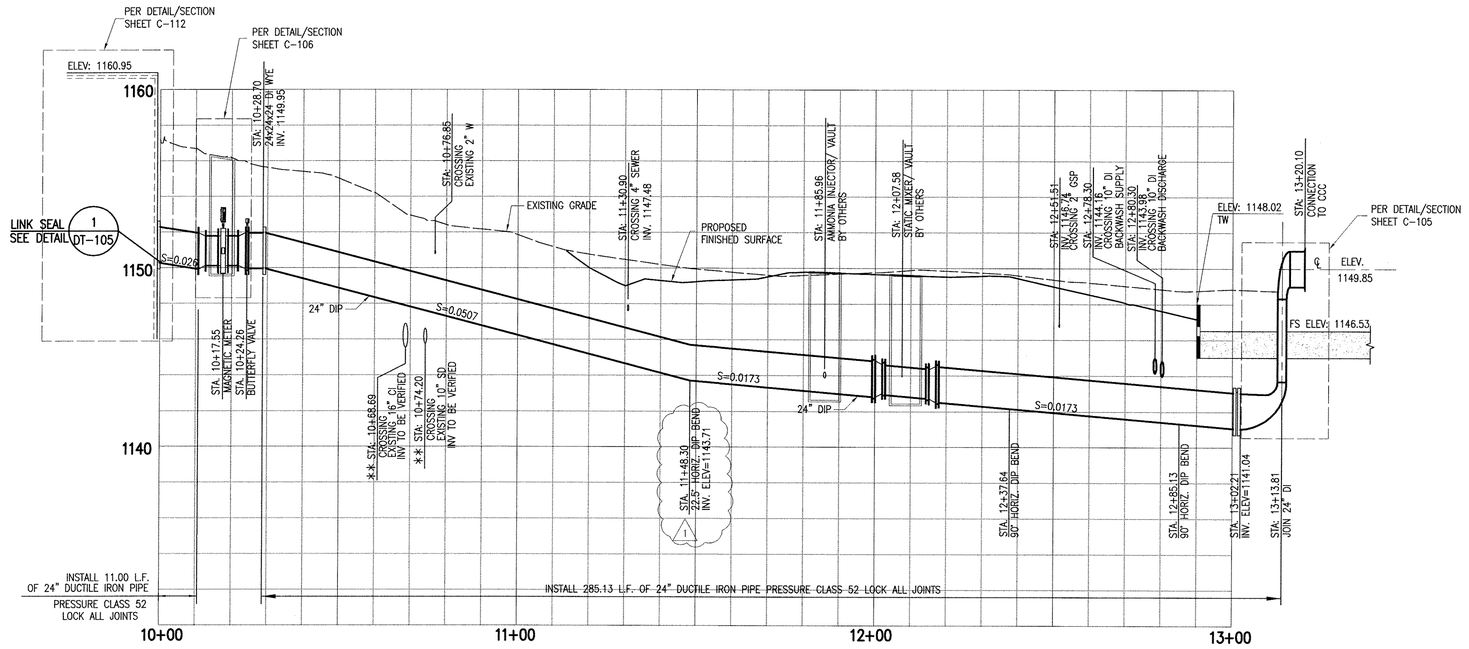
DATE	SCALE		
FEBRUARY 2009	AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 10 OF 79 SHEETS
DRAWN BY CIVILTEC			
DESIGNED BY CIVILTEC			
CHECKED BY CIVILTEC		MONK HILL TREATMENT SYSTEM YARD PIPING CONNECTIONS	WORK ORDER 02557 / FILE NUMBER E-1670
SUBMITTED BY CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

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INFLUENT LINE (1 / C-102)

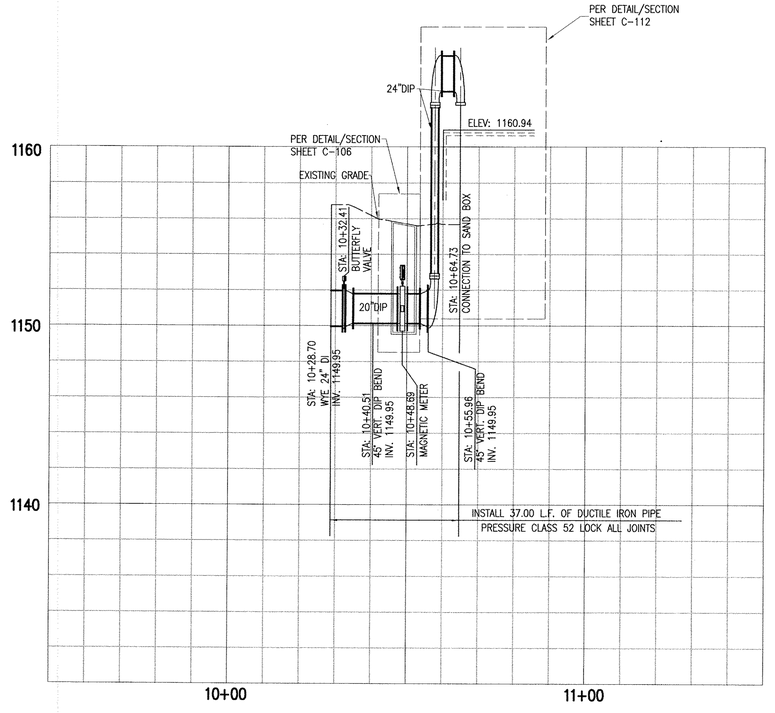
SCALE: HORIZ 1"=20'
VERT 1"=4'



** INVERTS OF EXISTING CROSSING PIPE LINES TO BE VERIFIED.

EFFLUENT LINE TO RESERVOIR (2 / C-102)

SCALE: HORIZ 1"=20'
VERT 1"=4'



EFFLUENT LINE TO SAND BOX (3 / C-102)

SCALE: HORIZ 1"=20'
VERT 1"=4'

C-107

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER
CHRISTOPHER SHEM HAWES
69578
6/30/2010
CIVIL
STATE OF CALIFORNIA

APPROVED BY:
CHRISTOPHER SHEM HAWES RCE 69578 — 2/25/08 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

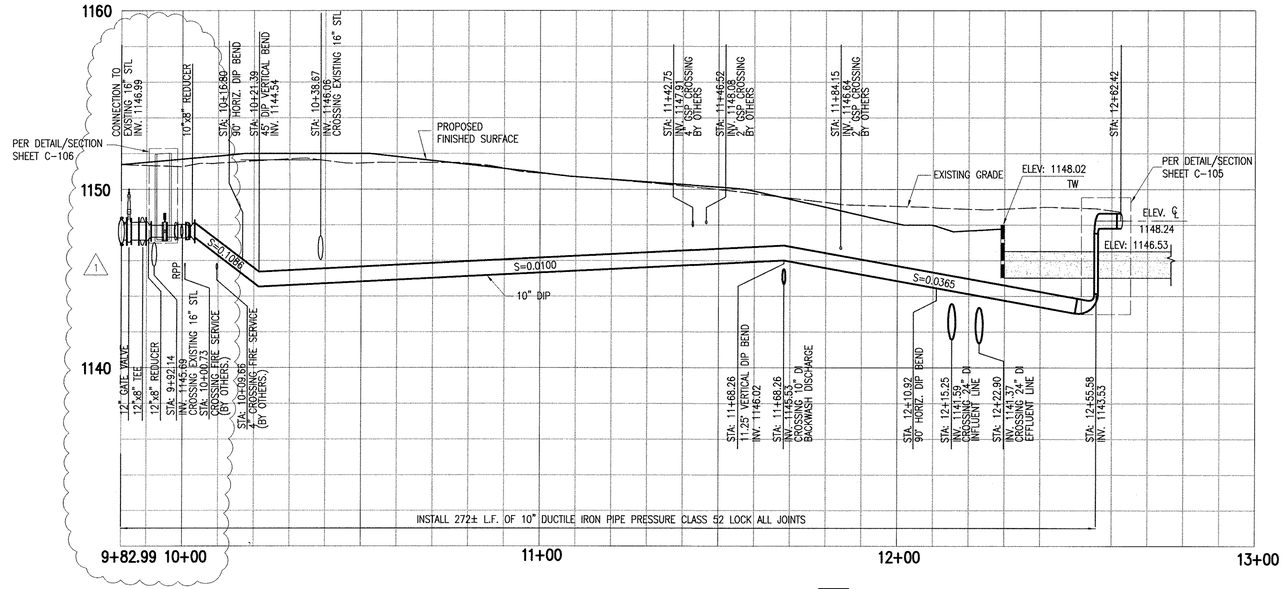
Battelle
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CITY OF PASADENA INCORPORATED JUNE 1886

D.S.-209 & 210A

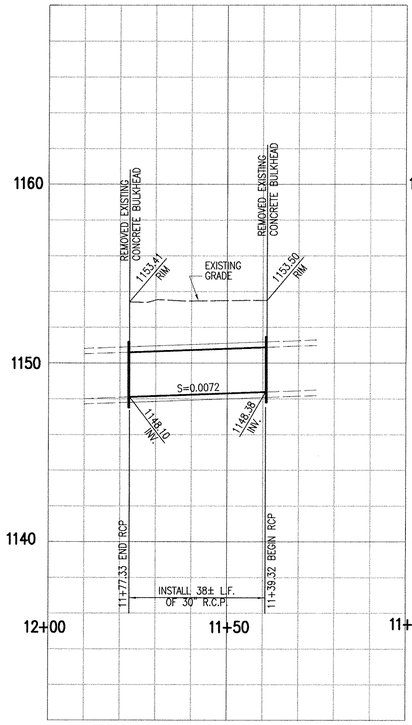
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DRAWN BY CIVILTEC DESIGNED BY CIVILTEC CHECKED BY CIVILTEC SUBMITTED BY CIVILTEC		MONK HILL TREATMENT SYSTEM PIPING PROFILES	WORK ORDER 02557 / FILE NUMBER E-1670
FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

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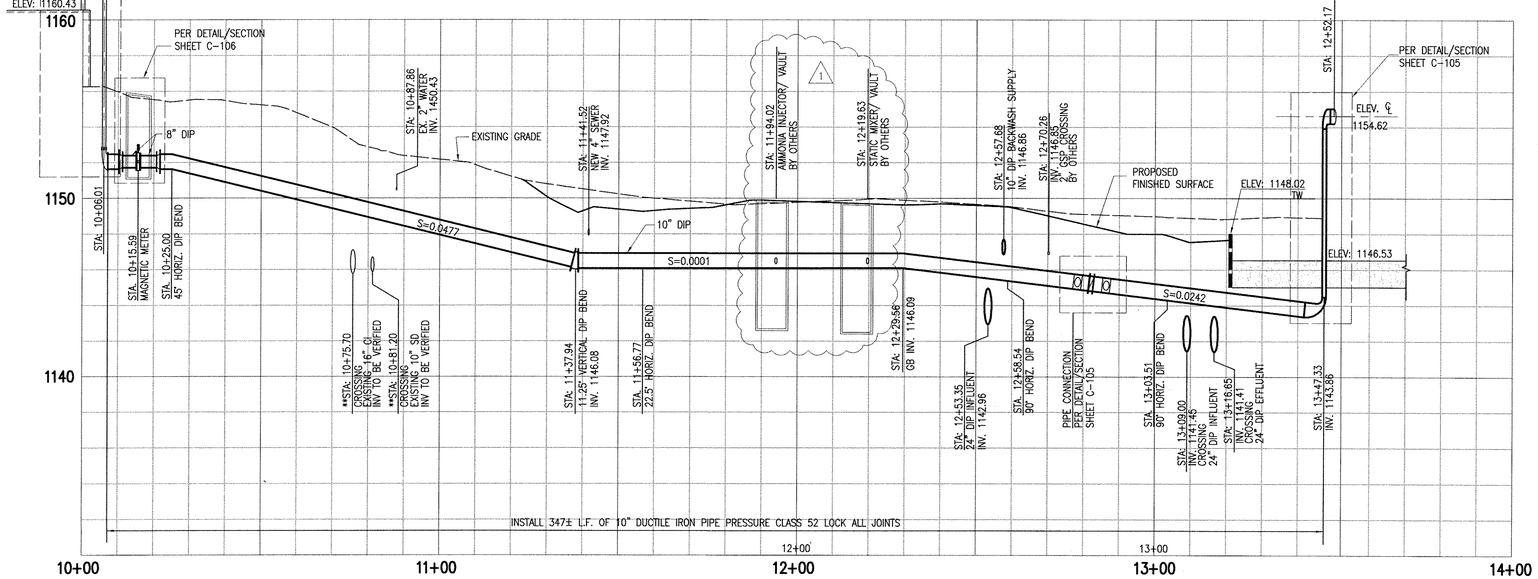
BACKWASH SUPPLY 4 C-102

SCALE: HORIZ 1"=20'
VERT 1"=4'



30" RCP RECONNECT 6 C-102

SCALE: HORIZ 1"=20'
VERT 1"=4'



1 ** INVERTS OF EXISTING CROSSING PIPE LINES TO BE VERIFIED.

BACKWASH DISCHARGE 5 C-102

SCALE: HORIZ 1"=20'
VERT 1"=4'

C-108

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

CHRISTOPHER SHEM HAWES — REGISTERED PROFESSIONAL ENGINEER — 69578 — 6/30/2010 — CIVIL — STATE OF CALIFORNIA

APPROVED BY: CHRISTOPHER SHEM HAWES RCE 69578 — 2/25/08 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

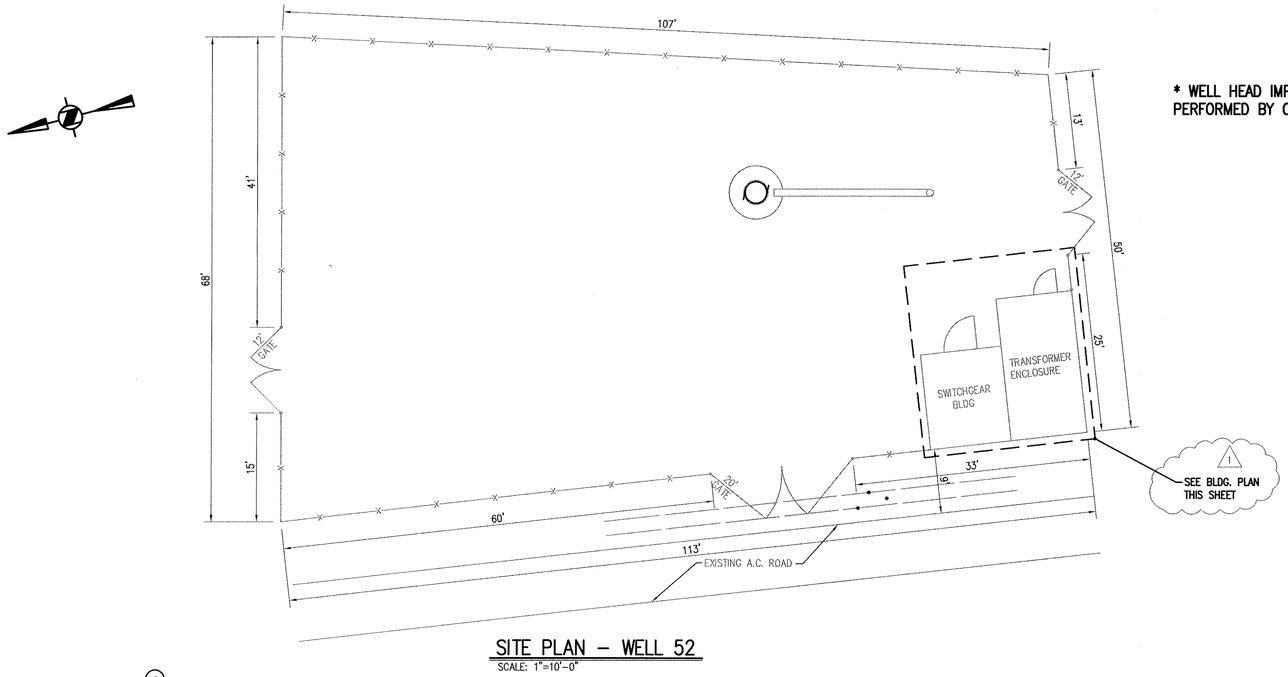
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CITY OF PASADENA — INCORPORATED JUNE 1886

D.S.-209 & 210A

DATE: FEBRUARY 2009	SCALE: AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 12 OF 79 SHEETS
DRAWN BY: CIVILTEC DESIGNED BY: CIVILTEC CHECKED BY: CIVILTEC SUBMITTED BY: CIVILTEC		MONK HILL TREATMENT SYSTEM PIPING PROFILES	WORK ORDER 02557 — FILE NUMBER E-1670
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED — REVISION

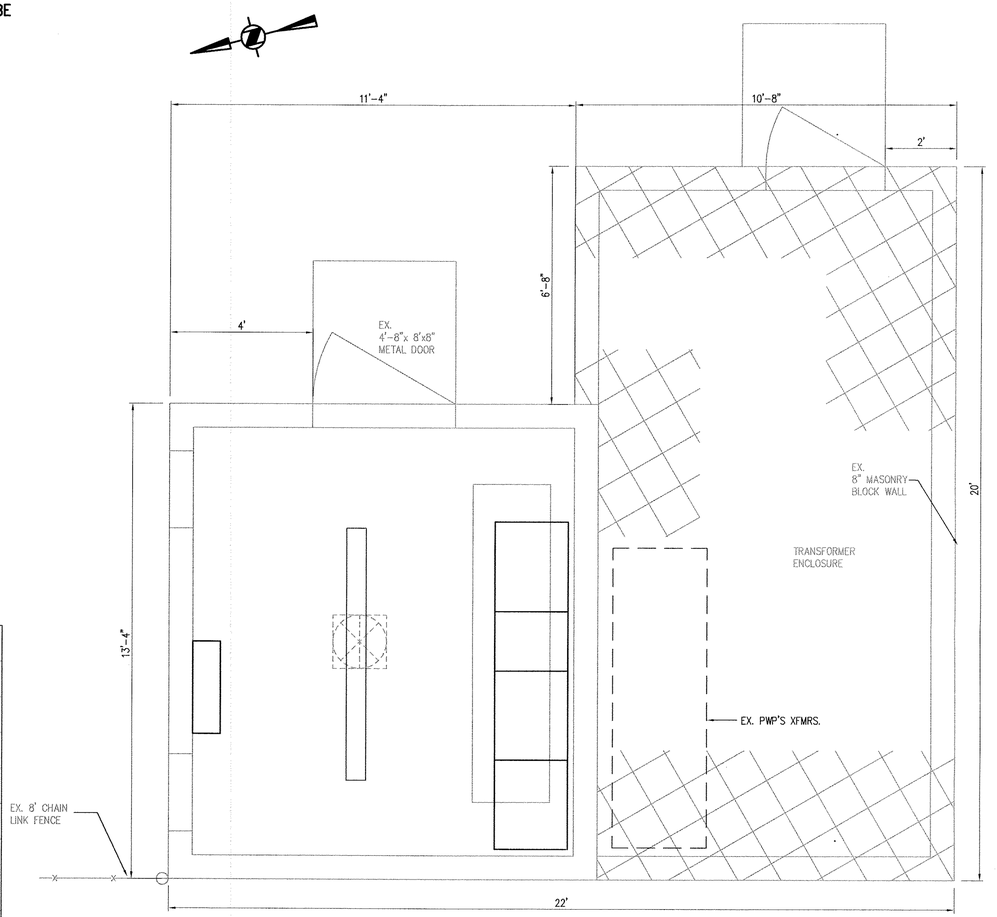
X:\2007\27140-JR_MONKHILL_TREATMENT_PLANT\DWG\SUBMITTALS\FINAL SUBMITTAL\27140-C-108.DWG (02-26-09 2:04:58PM)



* WELL HEAD IMPROVEMENTS TO BE PERFORMED BY OTHERS.

SITE PLAN – WELL 52

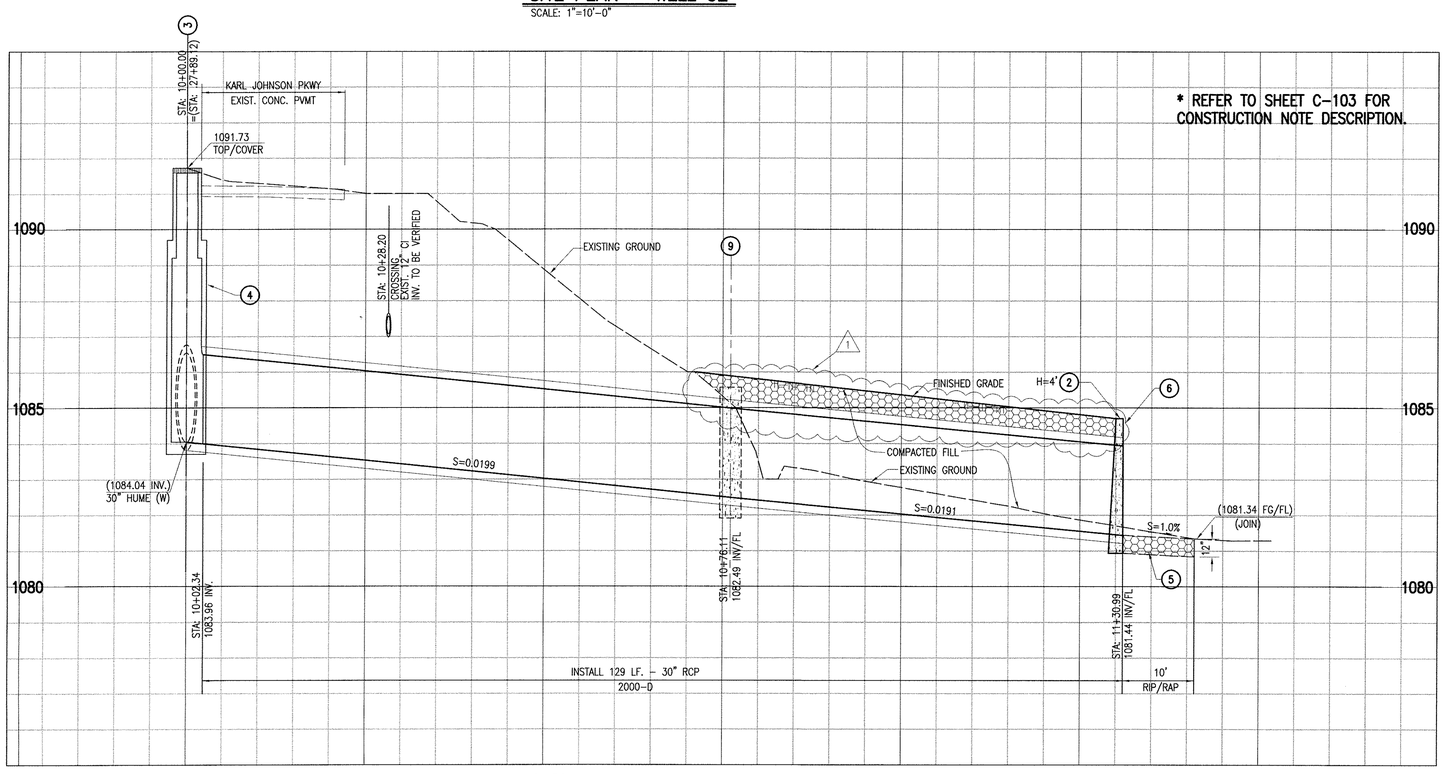
SCALE: 1"=10'-0"



* SEE ELECTRICAL PLANS FOR DETAILS

WELL 52 BLDG PLAN

SCALE: 1/2"=1'-0"



* REFER TO SHEET C-103 FOR CONSTRUCTION NOTE DESCRIPTION.

30" RCP PROFILE

SCALE: 1"=10' HORIZONTAL, 1"=4' VERTICAL

1 / C-103

C-109

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

CHRISTOPHER SHEM HAWES 69578 REGISTERED PROFESSIONAL ENGINEER CIVIL STATE OF CALIFORNIA 6/30/2010

APPROVED BY: CHRISTOPHER SHEM HAWES RCE 69578 — 2/25/08 DATE

APPROVED: _____ DATE

APPROVED: _____ DATE

PLANS PREPARED BY:

CIVILTEC engineering inc.

General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying

118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

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CITY OF PASADENA INCORPORATED JUNE 1886

D.S.-209 & 210A

DATE: FEBRUARY 2009	SCALE: AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 13 OF 79 SHEETS
DRAWN BY: CIVILTEC		MONK HILL TREATMENT SYSTEM 30" RCP PROFILES/ WELL 52 PLAN	WORK ORDER: 02557
DESIGNED BY: CIVILTEC			FILE NUMBER: E-1670
CHECKED BY: CIVILTEC			
SUBMITTED BY: CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED / REVISION

X:\2007\2714\C-dR_MONKHILL TREATMENT PLANT\DWGS\SUBMITTALS\FINAL SUBMITTAL\27140-C-109.DWG (02-26-09 2:06:10PM)

SCALE 1"=20'

GRADING CONSTRUCTION NOTES:

1. CONSTRUCT DRIVEWAY–DUSTPAN TYPE (COMMERCIAL) PER CITY OF PASADENA STD. PLAN S–403. (MODIFIED PER PLAN) REF: STREET PLAN.
1B. LIMIT OF SAWCUT AND JOIN. REF: STREET PLAN.
2. CONSTRUCT CURB AND GUTTER PER CITY OF PASADENA STD. PLAN S–406. – 8"CF. REF: STREET PLAN.
3. RESTORATION OF ASPHALT STREET EXCAVATION, PER CITY OF PASADENA STD. PLAN S–416. REF: STREET PLAN.
4. CONSTRUCT PCC SIDEWALK PER CITY OF PASADENA STD. PLAN S–421, W=PER PLAN. REF: STREET PLAN.
5. CONSTRUCT 3"AC ON 6" CAB ON COMPACTED SUBGRADE.
6. UNGROUTED RIP RAP SWALE. DIMENSION PER PLAN, MAX ROCK DIAMETER = 8"
7. GRADED SWALE WITH GRAVEL BED. SEE DETAIL D ON SHT.C–111
8. CONSTRUCT GRAVITY RETAINING WALL (TYPE PER PLAN). SEE DETAIL E ON SHT. C–111
9. PARKWAY DRAIN PER SPPWC STD. PLAN 151–1 S=4', WITH INLET TYPE 2.
10. EXISTING MONITORING WELL TO BE PROTECTED IN PLACE.
11. PROVIDE CALTRANS APPROVED FLEXIBLE EDGE DELINEATORS. 1

NOTE: **
EXERCISE EXTRA CAUTION WHEN GRADING NEAR AND WITHIN THE TREE CANOPIES. HAND GRADING IS REQUIRED.

EARTHWORK CALCULATIONS:
(RAW DIRT ONLY:)

FILL VOL = 260 CY
CUT VOL = 1,005 CY

LONG = 745* CY
*TO BALANCE ON SITE GRADING MUST BE COMPACTED 90% MIN. 1

*QUANTITIES ARE FOR PERMIT FEE ESTABLISHMENT ONLY THE CONTRACTOR IS RESPONSIBLE FOR HIS OWN YARDAGE CALCULATIONS, FOR HIS OWN BID PURPOSE.

LINE DATA TABLE		
	BEARING	LENGTH
1	N01°34'13"E	8.01'
2	N19°03'13"W	26.70'
3	N01°34'13"E	68.35'
4	N40°10'01"W	3.33'
5	N04°49'59"E	242.24'
6	N04°49'51"E	12.65'
7	N07°18'02"W	74.90'
8	N04°49'58"E	325.47'
9	N88°27'28"W	7.67'
10	S88°28'16"E	67.01'
11	N01°32'31"E	114.98'
12	N88°27'20"W	61.99'
13	S01°32'49"W	252.66'
14	S01°32'36"W	116.98'
15	S03°40'57"E	10.38'
16	N46°31'11"E	10.58'
17	N65°27'27"E	39.79'
18	N88°26'25"W	41.50'
19	N01°32'48"W	150.43'

REF. STREET PLAN

CURVE DATA TABLE				
	Δ	R	L	T
1	20°34'13"	25.00'	9.00'	4.55'
2	41°44'14"	25.00'	18.21'	9.53'
3	45°00'00"	25.00'	19.63'	10.36'
4	45°00'00"	10.00'	7.85'	4.14'
5	44°11'54"	9.30'	7.17'	3.78'
6	52°29'29"	30.00'	26.44'	14.15'
7	41°43'18"	30.00'	21.85'	11.43'
8	12°08'01"	100.00'	21.18'	10.63'
9	72°42'22"	20.00'	25.38'	14.72'
10	72°42'11"	35.00'	44.41'	25.76'
11	90°00'05"	20.00'	31.42'	20.00'
12	89°59'53"	35.00'	54.98'	35.00'
13	89°58'19"	20.00'	31.41'	19.99'
14	89°59'53"	35.00'	54.98'	35.00'
15	89°59'52"	20.00'	31.42'	20.00'
16	90°00'08"	20.00'	31.42'	20.00'
17	89°59'52"	20.00'	31.42'	20.00'
18	90°00'28"	73.55'	64.19'	34.30'

REF. STREET PLAN

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — CIVIL — STATE OF CALIFORNIA — 6/30/2010

APPROVED BY: CHRISTOPHER SHEM HAWES 69578 RCE 2/25/08 DATE
APPROVED: DATE
APPROVED: DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

Battelle
The Business of Innovation

CITY OF PASADENA INCORPORATED JUNE 1886

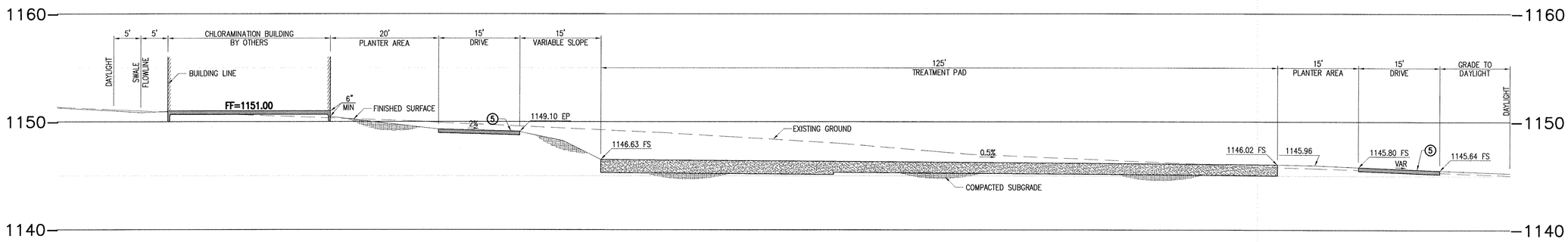
D.S.–209 & 210A
DATE: FEBRUARY 2009 | SCALE: AS SHOWN
DRAWN BY CIVILTEC
DESIGNED BY CIVILTEC
CHECKED BY CIVILTEC
SUBMITTED BY CIVILTEC
FIELD BOOKS | CALC BOOKS | APPROVED | APPROVED

PASADENA WATER & POWER
CITY OF PASADENA
MONK HILL TREATMENT SYSTEM
PRECISE GRADING PLAN

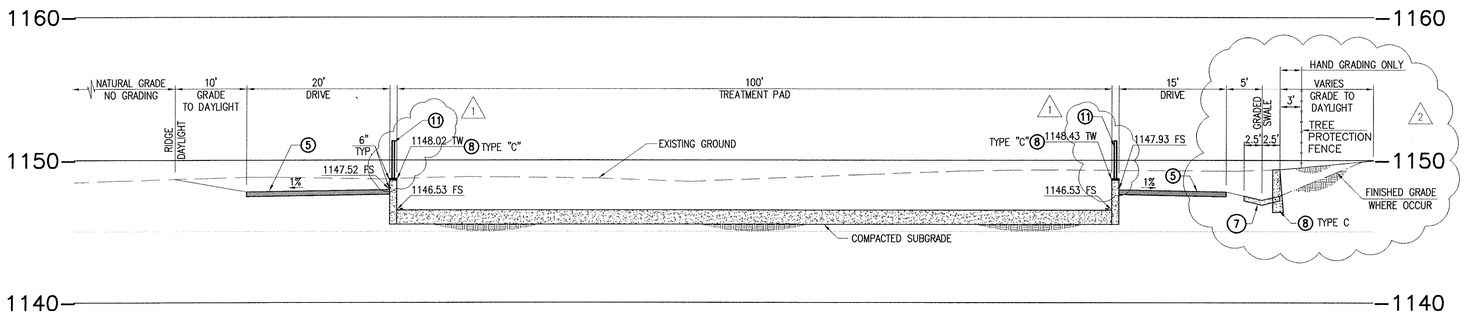
SHEET NO 14 OF 79 SHEETS
WORK ORDER 02557 | FILE NUMBER E–1670
REVISION

C–110

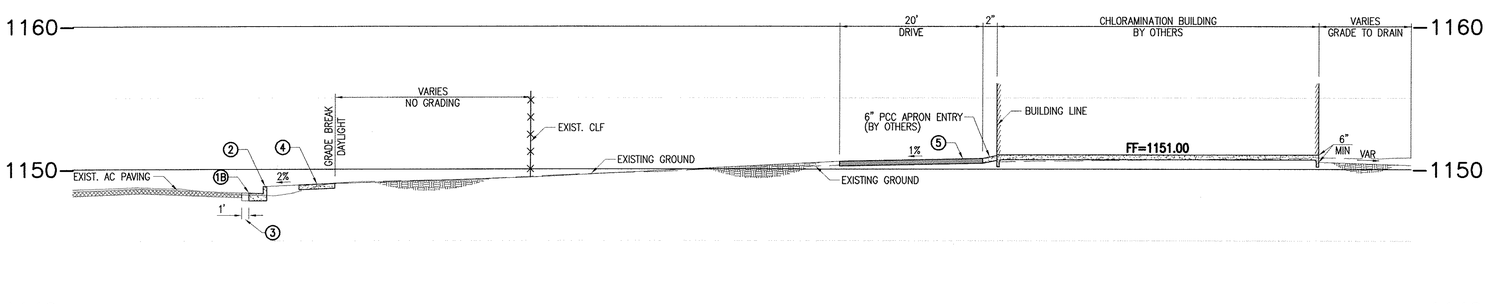
M:\2007\27149–PL MONHILL TREATMENT PLANT\DWG\SUBMITTALS\27149–C–110.DWG 02–26–09 2:07:12PM



TYPICAL SECTION A
SCALE: 1" = 10' HORIZONTAL
1" = 5' VERTICAL
C-110



TYPICAL SECTION B
SCALE: 1" = 10' HORIZONTAL
1" = 5' VERTICAL
C-110



TYPICAL SECTION C
SCALE: 1" = 10' HORIZONTAL
1" = 5' VERTICAL
C-110

GRADING CONSTRUCTION NOTES:

1B LIMIT OF SAWCUT AND JOIN.

2 CONSTRUCT CURB AND GUTTER PER CITY OF PASADENA STD. PLAN S-406. – 8"CF. REF. STREET PLANS.

3 RESTORATION OF ASPHALT STREET EXCAVATION, PER CITY OF PASADENA STD. PLAN S-416. REF. STREET PLANS.

4 CONSTRUCT PCC SIDEWALK PER CITY OF PASADENA STD. PLAN S-421, W=PER PLAN. REF. STREET PLANS.

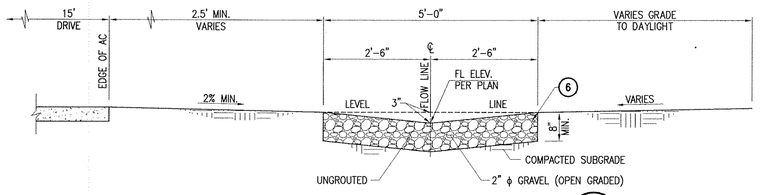
5 CONSTRUCT 3"AC ON 6" CAB ON COMPACTED SUBGRADE.

6 UNGROUTED RIP RAP SWALE. DIMENSION PER PLAN, MAX ROCK DIAMETER = 8"

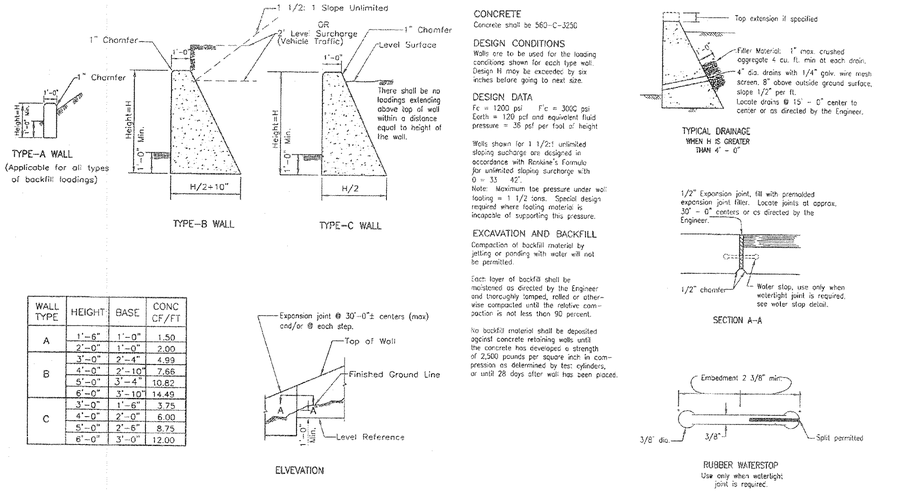
7 GRADED SWALE WITH GRAVEL BED. SEE DETAIL D ON SHT.C-111

8 CONSTRUCT GRAVITY RETAINING WALL (TYPE PER PLAN). SEE DETAIL B ON SHT. C-111

11 PROVIDE CALTRANS APPROVED FLEXIBLE EDGE DELINEATORS. 1



GRADED SWALE SECTION D
NOT TO SCALE
C-110



WALL TYPE	HEIGHT	BASE	CONC CF/FT
A	1'-6"	1'-0"	1.50
	2'-0"	1'-0"	2.00
B	3'-0"	2'-4"	4.92
	4'-0"	2'-10"	7.66
	5'-0"	3'-4"	10.82
	6'-0"	3'-10"	14.49
C	3'-0"	1'-6"	3.75
	4'-0"	2'-0"	6.00
	5'-0"	2'-6"	8.75
	6'-0"	3'-0"	12.00

ELVEVATION

GRAVITY RETAINING WALL DETAIL E
NOT TO SCALE
C-110

C-111

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09
2	ADD GRAVITY WALL/TREE PROTECTION REQUIREMENTS	02/24/09

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — CIVIL — STATE OF CALIFORNIA

APPROVED BY: CHRISTOPHER SHEM HAWES RCE 69578 — 2/25/08 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

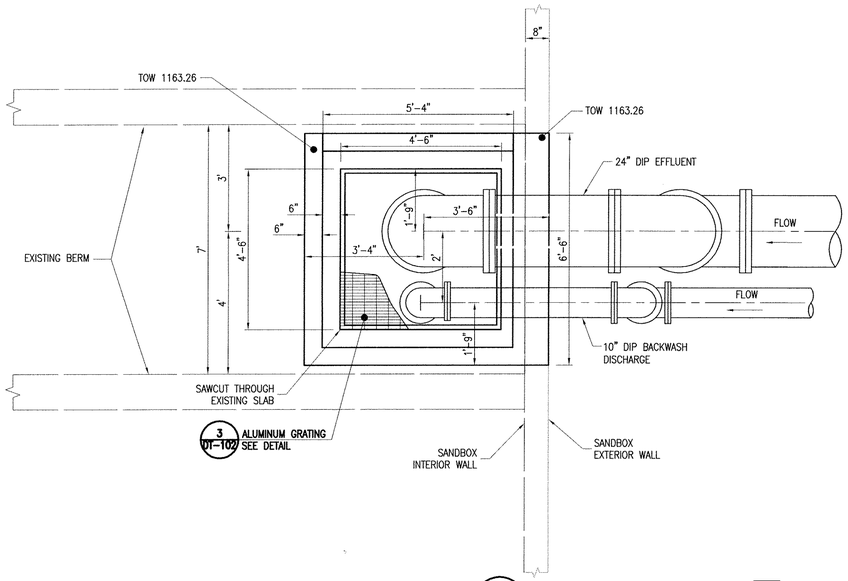
Battelle
The Business of Innovation

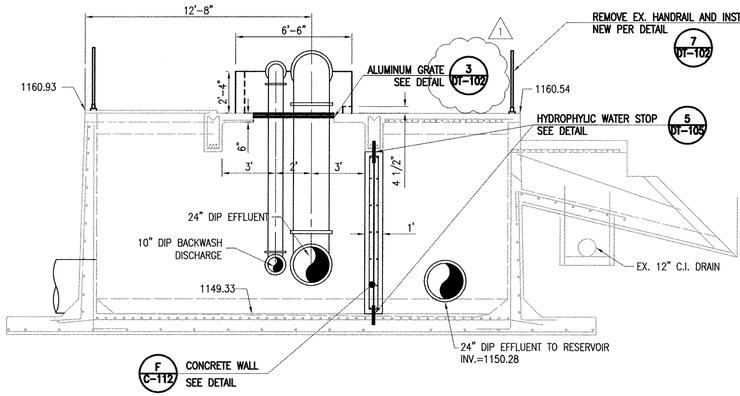
CITY OF PASADENA INCORPORATED JUNE 1886

D.S.-209 & 210A

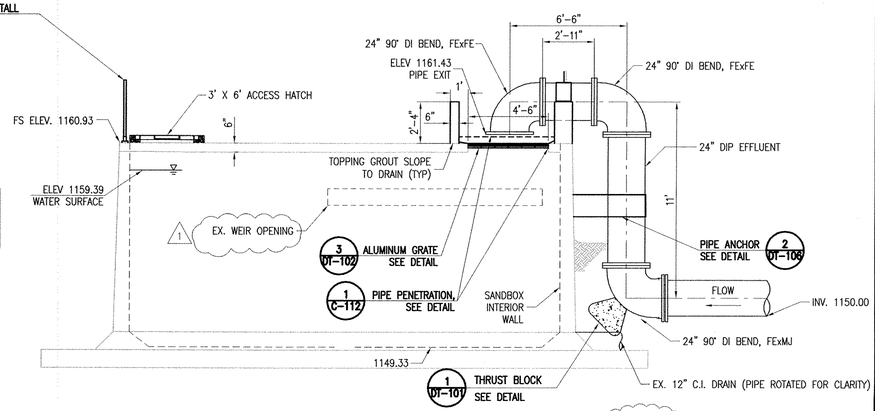
DATE: FEBRUARY 2009	SCALE: AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 15 OF 79 SHEETS
DRAWN BY: CIVILTEC DESIGNED BY: CIVILTEC CHECKED BY: CIVILTEC SUBMITTED BY: CIVILTEC		MONK HILL TREATMENT SYSTEM PRECISE GRADING SECTIONS/DETAILS	WORK ORDER 02557 / FILE NUMBER E-1670
FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

N:\2007\27140-ch_MONKHILL TREATMENT PLANT\DWG\SUBMITTALS\FINAL SUBMITTAL\27140-c-111.DWG (02-26-09 2:07:57PM)



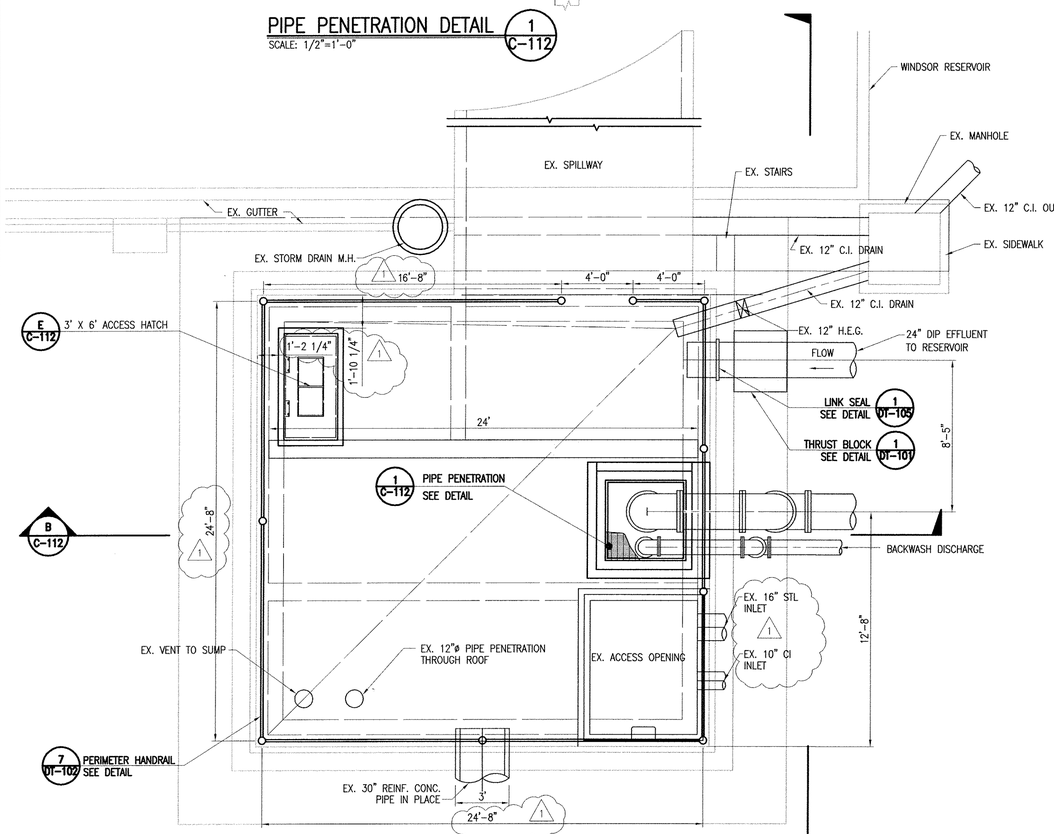


SECTION A C-112
SCALE: 1/4"=1'-0"

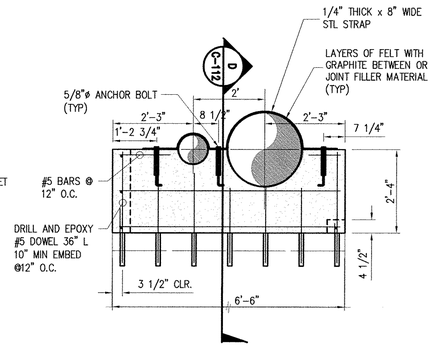


SECTION B C-112
SCALE: 1/4"=1'-0"

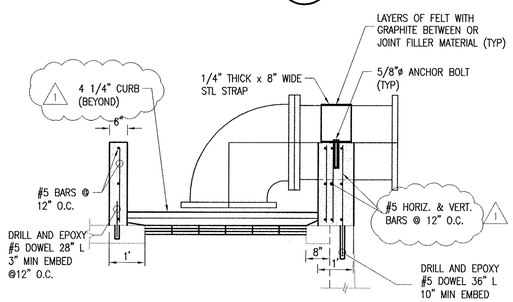
PIPE PENETRATION DETAIL 1 C-112
SCALE: 1/2"=1'-0"



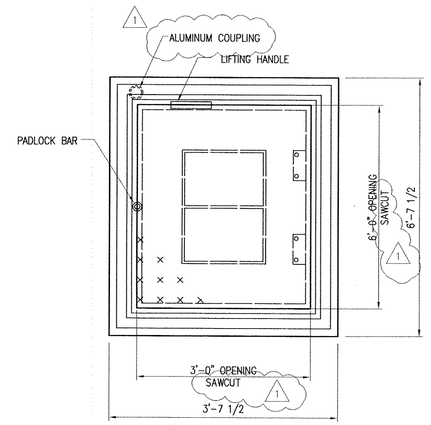
SAND BOX PLAN 2 C-102
SCALE: 1/4"=1'-0"



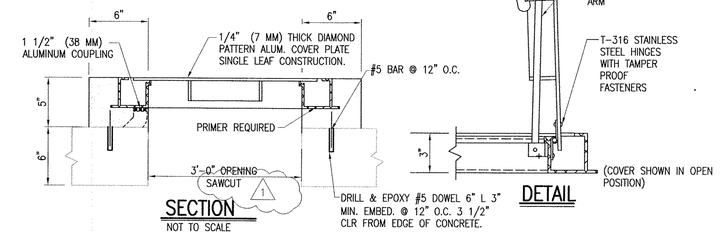
SECTION C C-112
SCALE: 1/2"=1'-0"



SECTION D C-112
SCALE: 1/2"=1'-0"



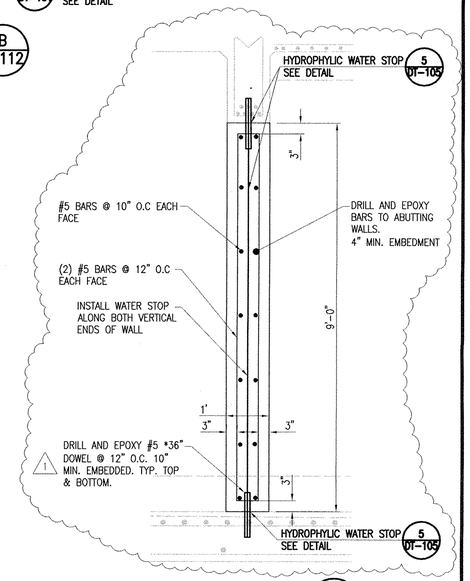
PLAN
NOT TO SCALE



SECTION
NOT TO SCALE

DETAIL

ACCESS HATCH E C-112
NOT TO SCALE



CONCRETE WALL F C-112
SCALE: 1"=20'-0"

C-112

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER CHRISTOPHER SHEM HAWES 69578 6/30/2010 CIVIL STATE OF CALIFORNIA

APPROVED BY: CHRISTOPHER SHEM HAWES RCE 69578 2/25/08 DATE
APPROVED: DATE
APPROVED: DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

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CITY OF PASADENA INCORPORATED JUNE 1886

D.S.-209 & 210A

DATE	SCALE	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 16 OF 79 SHEETS
FEBRUARY 2009	AS SHOWN		
DRAWN BY CIVILTEC		MONK HILL TREATMENT SYSTEM CIVIL DETAILS	WORK ORDER 02557 / FILE NUMBER E-1670
DESIGNED BY CIVILTEC			
CHECKED BY CIVILTEC			
SUBMITTED BY CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED
			REVISION

X:\2007\27140-JP- MONHILL TREATMENT PLANT\DWGS\SUBMITTAL\27140-C-112.DWG (02-26-09 2:08:15PM)

CITY OF PASADENA
DEPARTMENT OF PUBLIC WORKS
WINDSOR AVENUE IMPROVEMENTS
FROM LEHIGH STREET TO 550 FEET NORTH

SUBMITTED	APPROVED
	DANIEL A. RIX — DATE CITY ENGINEER REGISTERED CIVIL ENGINEER NO. C38689 REGISTRATION EXPIRES MARCH 31, 2009

GRADING CONSTRUCTION NOTES:

(1) CONSTRUCT 8" PCC CURB AND 2' GUTTER PCC PER CITY OF PASADENA STD. PLAN S-406.

(4) CONSTRUCT 4" PCC SIDEWALK PER CITY OF PASADENA STD. PLAN S-421.

(5) CONSTRUCT 8" THICK PCC DRIVEWAY-DUSTPAN TYPE (COMMERCIAL) PER CITY OF PASADENA STD. PLAN S-403. (MODIFIED PER PLAN)

(6) CONSTRUCT PARKWAY DRAIN PER SPPWC STD. PLAN 151-1 S=4', WITH INLET TYPE 2.

(7) CONSTRUCT 6" THICK (0.12' THICK C20PG 64-10 ON 0.38' THICK B-PG 64-10) ASPHALT CONCRETE PAVEMENT.

(8) COLD PLANE EXISTING AC PAVEMENT TO A DEPTH OF 0.10-FOOT AND CONSTRUCT CLASS C2-AR-4000 AC SURFACE COURSE. EXACT LIMITS OF OVERLAY SUBJECT TO FIELD ADJUSTMENT BY THE ENGINEER.

(9) CONSTRUCT 4" THICK CRUSHED AGGREGATE BASE.

(10) AC STREET RESURFACING, REMOVAL AND RECONSTRUCTION AND COLD MILLING PER CITY OF PASADENA STANDARD PLAN S-415.

(13) ADJUST WATER VALVE, SLEEVE, FRAME AND COVER TO GRADE.

REMOVAL & DEMOLITION NOTES:

[1] CONCRETE EXCAVATION

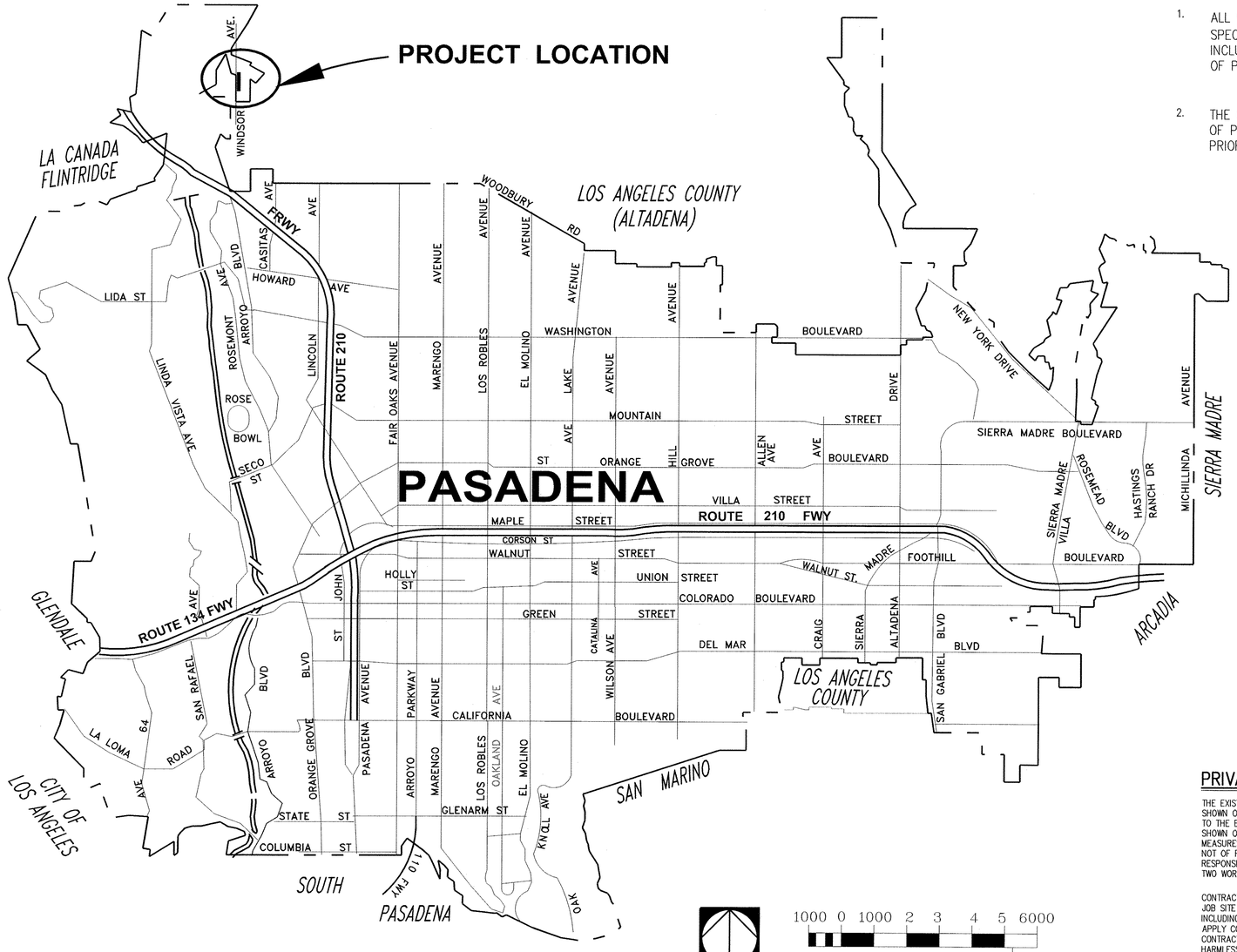
[2] ROADWAY AND UNCLASSIFIED EXCAVATION

[3] VEGETATION REMOVAL

(8) ABOVE THE LINE REFERS TO TYPE OF STANDARD OR THICKNESS OF SURFACE MATERIAL IN INCHES

LEGEND AND ABBREVIATIONS:

	MANHOLE	E.P.	EDGE OF PAVEMENT
	VALVE	E.G.	EDGE OF GUTTER
	VAULT	EXIST.	EXISTING
	FIRE HYDRANT	F.F.	FINISHED FLOOR
	WATER METER	F.G.	FINISHED GRADE
	GAS METER	F.L.	FLOWLINE
	PULLBOX	F.S.	FINISHED SURFACE
	EXISTING MAST ARM LIGHT	G.B.	GRADE BREAK
	EXISTING TRAFFIC SIGNAL	H.P.	HIGH POINT
	SIGNAL CONTROL BOX	INV.	INVERT
	SIGN	L.P.	LOW POINT
	TREE	P.A.	PLANTER AREA
	PALM	P.C.C.	PORTLAND CEMENT CONCRETE
	SPRINKLER HEAD	P.E.	PAD ELEVATION
	FENCE	R.C.P.	REINFORCED CONCRETE PIPE
	SHRUB	R	RIDGELINE
	EXISTING POST TOP LIGHT	S.D.	STORM DRAIN
	R.R. CROSSING POST	S.M.H.	SEWER MANHOLE
	VENT	S.S.	SANITARY SEWER
1151	CONTOUR (ELEVATION IN FEET)	STD.	STANDARD
		T.C.	TOP OF CURB
A.C.	ASPHALTIC CONCRETE	T.E.	TRASH ENCLOSURE
B.W.	BACK OF WALK	T.F.	TOP OF FOOTING
C.B.	CATCH BASIN	T.G.	TOP OF GRATE
C.F.	CURB FACE	T.M.H.	TOP OF MANHOLE
C.L./℄	CENTER LINE	T.W.	TOP OF WALL
C.L.F.	CHAIN LINK FENCE		



INDEX OF SHEETS

SHEET NO.	TITLE
1	TITLE SHEET
2	STREET PLAN AND PROFILE
3	STANDARD LEGEND AND GENERAL NOTES
4	STREET LIGHTING PLAN
5	CHANNELIZATION AND SIGNING PLAN
6	IRRIGATION PLAN
7	LANDSCAPING PLAN
8	IRRIGATION AND PLANTING DETAILS

GENERAL NOTES

1. ALL WORK TO BE DONE IN ACCORDANCE WITH THE " STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION," 2003 EDITION, INCLUDING ANY SUPPLEMENTS, THE LATEST EDITION OF THE CITY OF PASADENA SUPPLEMENTS AND MODIFICATIONS TO THE ABOVE.

2. THE CONTRACTOR SHALL OBTAIN A PERMIT FROM THE DEPARTMENT OF PUBLIC WORKS AT 100 NORTH GARFIELD AVENUE, ROOM N-140 PRIOR TO BEGINNING WORK.

PRIVATE ENGINEER'S NOTICE TO CONTRACTOR

THE EXISTENCE AND LOCATION OF ANY UNDERGROUND UTILITY PIPES OR STRUCTURES SHOWN ON THESE PLANS ARE OBTAINED BY A SEARCH OF THE AVAILABLE RECORDS. TO THE BEST OF OUR KNOWLEDGE THERE ARE NO EXISTING UTILITIES EXCEPT AS SHOWN ON THESE PLANS. THE CONTRACTOR IS REQUIRED TO TAKE DUE PRECAUTIONARY MEASURES TO PROTECT THE UTILITY LINES SHOWN AND ANY OTHER LINES NOT OF RECORD OR NOT SHOWN ON THESE PLANS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING "UNDERGROUND SERVICE ALERT" AT 1-800-442-4133 TWO WORKING DAYS PRIOR TO ANY EXCAVATION OR CONSTRUCTION.

CONTRACTOR AGREES THAT HE SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS; AND THAT THE CONTRACTOR SHALL DEFEND, INDEMNIFY, AND HOLD THE CITY, AND THE ENGINEER HARMLESS FROM ANY AND ALL LIABILITY REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING FOR LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE CITY OR THE ENGINEER.

IMPORTANT NOTICE

Section 4216/4217 of the Government Code requires a Dig Alert Identification Number be issued before a "Permit to Excavate" will be valid For your Dig Alert I.D. Number Call Underground Service Alert TOLL FREE-1-800-422-4133 Two working days before you dig.

1000 0 1000 2 3 4 5 6000
ONE MILE
SCALE IN FEET

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — 6/30/2010 — CIVIL — STATE OF CALIFORNIA

PLANS PREPARED BY:
CIVILTEC engineering, inc.
CHRISTOPHER SHEM HAWES
DATE 6/30/10

General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying

118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

DRAWN BY (PRIVATE)
DESIGNED BY (PRIVATE)
CHECKED BY JO

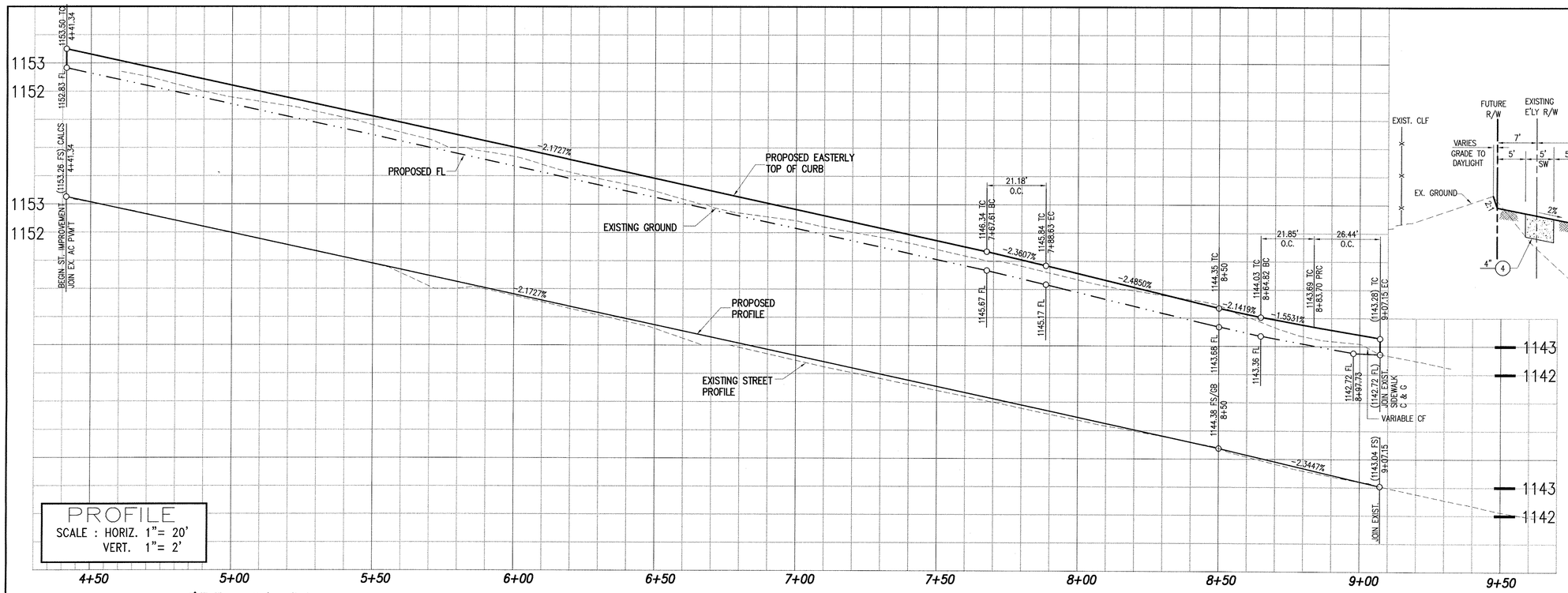
REVISIONS					
MARK	DATE	DESCRIPTION	BY	CHKD.	APPROVED
		AS BUILT			

CITY OF PASADENA-DEPARTMENT OF PUBLIC WORKS

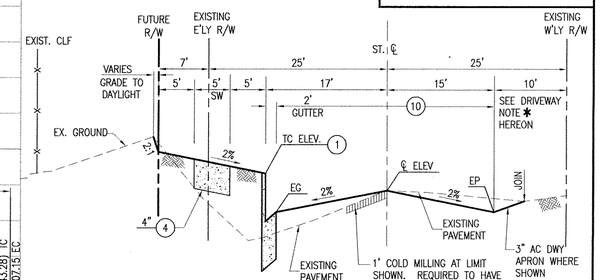
PROJECT WINDSOR AVENUE IMPROVEMENT
LIMITS FROM LEHIGH STREET TO 550' NORTH
SCALE AS SHOWN
ACCOUNT NUMBER 881000
SHEET 1 OF 8
DWG. NO. 5859

X:\2007\32740-JR, MONKHILL TREATMENT PLANT\DWG\SUBMITTALS\COP DEP OF PUBLIC WORK PLAN\32740-SHT-01.DWG (03-02-09 8:46:57AM)

SUBMITTED



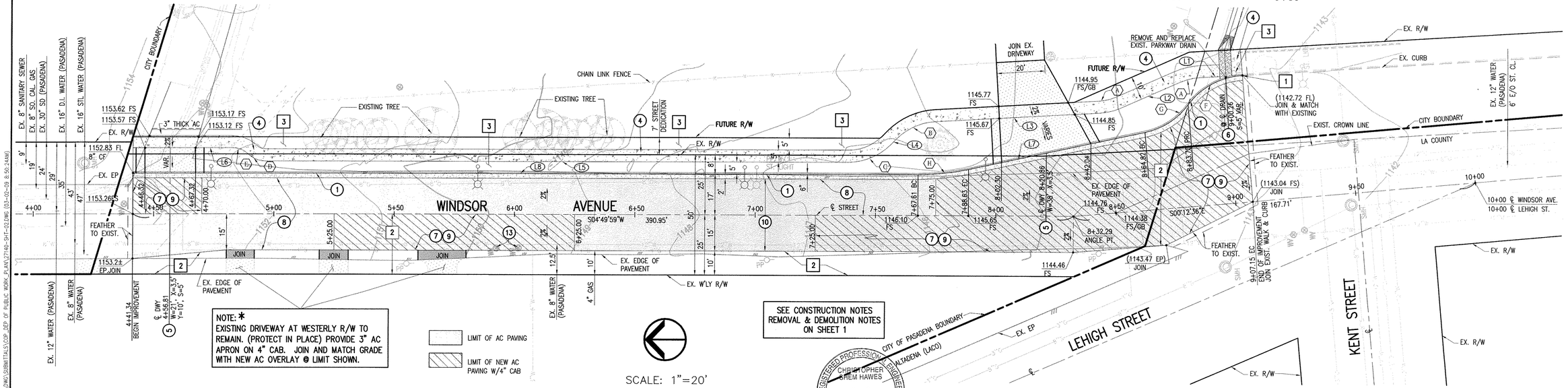
PROFILE
SCALE : HORIZ. 1"= 20'
VERT. 1"= 2'



TC = ℄+0.24'
EG/EP = ℄-0.3'

TYPICAL SECTION

NOT TO SCALE



NOTE: ✱
EXISTING DRIVEWAY AT WESTERLY R/W TO REMAIN. (PROTECT IN PLACE) PROVIDE 3" AC APRON ON 4" CAB. JOIN AND MATCH GRADE WITH NEW AC OVERLAY @ LIMIT SHOWN.

LIMIT OF AC PAVING

LIMIT OF NEW AC PAVING W/4" CAB

SCALE: 1"=20'

0 20 40 60 80 100

SCALE IN FEET

SEE CONSTRUCTION NOTES REMOVAL & DEMOLITION NOTES ON SHEET 1

REGISTERED PROFESSIONAL ENGINEER
CHRISTOPHER BREM HAWES
69578
6/30/2010
CIVIL
STATE OF CALIFORNIA

LINE TABLE			
⬭	BEARING	LENGTH	REMARKS
L1	N01°34'13"E	8.01'	SIDEWALK
L2	N19°03'13"W	26.70'	SIDEWALK
L3	N01°34'13"E	68.35'	SIDEWALK
L4	N40°10'01"W	3.33'	SIDEWALK
L5	N04°49'59"E	242.24'	SIDEWALK
L6	N04°49'51"E	12.65'	SIDEWALK
L7	N07°18'02"W	74.90'	CURB
L8	N04°49'58"E	325.47'	CURB

CURVE TABLE					
⬡	Δ	RADIUS	LENGTH	TANGENT	REMARKS
A	20°34'13"	25.00'	9.00'	4.55'	SIDEWALK
B	41°44'14"	25.00'	18.21'	9.53'	SIDEWALK
C	45°00'00"	25.00'	19.63'	10.36'	SIDEWALK
D	45°00'00"	10.00'	7.85'	4.14'	SIDEWALK
E	44°11'54"	9.30'	7.17'	3.78'	SIDEWALK
F	50°29'29"	30.00'	26.44'	14.15'	CURB
G	41°43'18"	30.00'	21.85'	11.43'	CURB
H	12°08'01"	100.00'	21.18'	10.63'	CURB

BENCH MARKS

L&BR IN E CB WINDSOR AVE. (14.5M) 47.572' E/O C/L PROD KENT
ELEV. (348.183M) 1142.329 FEET BM NUMBER Y 11250
LACO DPW TAG IN N CB KENT ST (400M) 1312.336' W/O BCR (6M) 19.685' N/O C/L & (22M) 72.178' W/O C/L WINDSOR AVE.
ELEV. (348.139M) 1142.185 FEET BM NUMBER Y 11251

PROJECT ENGINEER
C. Chris Hawes
DATE 2/25/2007
FIELD BOOK NO. NONE

DRAWN BY (PRIVATE)
DESIGNED BY (PRIVATE)
CHECKED BY JO

REVISIONS					
MARK	DATE	DESCRIPTION	BY	CHKD.	APPROVED
			KHR		
		AS BUILT			

CITY OF PASADENA—DEPARTMENT OF PUBLIC WORKS

PROJECT **WINDSOR AVENUE IMPROVEMENTS**
LIMITS FROM LEHIGH STREET TO 550' NORTH
SCALE AS SHOWN
ACCOUNT NUMBER 881000
SHEET 2 OF 8
DWG. NO. 5859

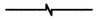
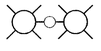
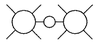
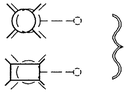
STREET PLAN AND PROFILE

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STANDARD LEGEND & GENERAL NOTES
FOR
TRAFFIC SIGNAL & STREET LIGHT DRAWINGS

SUBMITTED

Legend: (UNLESS OTHERWISE SPECIFIED)

PROPOSED	EXISTING	
		EXISTING 3-SECTION TRAFFIC SIGNAL HEAD WITHOUT BACKPLATE. 8" RED, YELLOW, GREEN.
		3-SECTION TRAFFIC SIGNAL HEAD WITH BACKPLATE. 8" RED, YELLOW, GREEN.
		3-SECTION TRAFFIC SIGNAL HEAD WITH BACKPLATE ON TRAFFIC SIGNAL MAST ARM. 12" RED, YELLOW, GREEN.
		3-SECTION TRAFFIC SIGNAL HEAD WITH BACKPLATE. 12" RED, YELLOW, AND GREEN DIRECTIONAL ARROW.
		4-SECTION TRAFFIC SIGNAL HEAD WITH BACKPLATE. 8" RED, YELLOW, GREEN. 12" GREEN DIRECTIONAL ARROW.
		4-SECTION TRAFFIC SIGNAL HEAD WITH BACKPLATE ON TRAFFIC SIGNAL MAST ARM. 12" RED, YELLOW, GREEN. 12" GREEN DIRECTIONAL ARROW.
		5-SECTION TRAFFIC SIGNAL HEAD WITH BACKPLATE. 8" RED, YELLOW, GREEN. 12" YELLOW AND GREEN DIRECTIONAL ARROWS.
		5-SECTION TRAFFIC SIGNAL HEAD WITH BACKPLATE ON TRAFFIC SIGNAL MAST ARM. 12" RED, YELLOW, GREEN. 12" YELLOW AND GREEN DIRECTIONAL ARROWS.
		TRAFFIC SIGNAL CONTROLLER. DOOR SWINGS AS SHOWN.
		"INTERNATIONAL DISPLAY" PEDESTRIAN SIGNAL. (EXISTING"WALK-DON'T WALK" PEDESTRIAN SIGNAL.)
○ PPB	◌ ppb	PEDESTRIAN PUSH BUTTON ON POST OR STANDARD AS INDICATED OR NOTED.
 XXXX	 XXXX	6' DIAMETER INDUCTIVE LOOP DETECTOR UNLESS OTHERWISE SHOWN ON PLANS. (xxxx REFERS TO LOOP DETECTOR AMPLIFIER).
TS SL	TS SL	NO. 2 TRAFFIC SIGNAL/STREET LIGHT PULL BOX PER CITY OF PASADENA PUBLIC WORKS DEPARTMENT STANDARD DRAWING S-973.
		TRAFFIC SIGNAL CONDUIT.
		STREET LIGHT CONDUIT.
ELECTROLIER STD. DWG. | MOUNTING HEIGHT | LUMINAIRE STATION	( )	ELECTROLIER INFORMATION.
		ELECTROLIER, POST TOP TYPE.
		ELECTROLIER, POST TOP TYPE WITH DOUBLE MAST ARM & LUMINAIRE.
		ELECTROLIER, MAST ARM TYPE WITH HORIZONTAL BURNING LUMINAIRE (STD. DWG. S-950).
		ELECTROLIER, MAST ARM TYPE WITH HORIZONTAL BURNING LUMINAIRE (STD. DWG. S-951).
		LUMINAIRE WITH MAST ARM ON EXISTING POLE.
		VIDEO DETECTION CAMERA
		CLOSED CIRCUIT TELEVISION CAMERA (CCTV)
		RADIO FREQUENCY ANTENNA
		EMERGENCY PRE-EMPTION DEVICE

Notes: (UNLESS OTHERWISE SPECIFIED)

1. ALL TRAFFIC SIGNAL WORK SHALL CONFORM TO THIS PLAN AND THE LATEST SPECIFICATIONS AND STANDARD PLANS OF THE STATE OF CALIFORNIA, BUSINESS AND TRANSPORTATION AGENCY, DEPARTMENT OF TRANSPORTATION.
2. LOCATE ALL TRAFFIC SIGNAL AND STREET LIGHT STANDARDS PER CITY OF PASADENA PUBLIC WORKS DEPARTMENT STANDARD DRAWING S-970.
3. TRAFFIC SIGNAL AND STREET LIGHT PULL BOXES SHALL NOT BE INSTALLED WITHIN DRIVEWAY APPROACHES OR SIDEWALK AREAS DESIGNATED AS WHEELCHAIR RAMPS.
4. CONDUIT MINIMUM COVER SHALL BE IN ACCORDANCE WITH SECTION 307-2.5 OF THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION. ALL CONDUIT RUNS IN STREET AND FEED RUNS SHALL BE 2" GALVANIZED STEEL. ALL OTHER CONDUIT SHALL BE 1½" UNLESS OTHERWISE NOTED.
5. N.I.C. = NOT IN CONTRACT.
6. CONTRACTOR SHALL SALVAGE ALL SIGNS FROM EXISTING TRAFFIC SIGNAL AND STREET LIGHT STANDARDS BEING REMOVED, OR SALVAGED.
7. CONTRACTOR SHALL REMOVE FOUNDATIONS OF TRAFFIC SIGNAL OR STREET LIGHT EQUIPMENT TO BE REMOVED, RELOCATED, OR SALVAGED.
8. FOR STREET LIGHT CIRCUIT DIAGRAMS NOT SHOWN ON THE PLANS, SEE CITY OF PASADENA PUBLIC WORKS DEPARTMENT STANDARD S-971 AND S-975, IF APPLICABLE.
9. CONTRACTOR TO NOTIFY PUBLIC WORKS STREET LIGHT SUPERVISOR (626-744-4158), 72 HOURS PRIOR TO ANY WORK ON EXISTING STREET STREET LIGHT SYSTEMS.
10. POWER FEED POINTS FOR TRAFFIC SIGNALS AND STREET LIGHTS:
    A. ALL WORK AND CONNECTIONS IN THE DEPARTMENT OF WATER AND POWER UNDERGROUND DISTRIBUTION VAULTS SHALL BE DONE BY CITY FORCES. (NOTIFY 626-744-4467 48 HOURS IN ADVANCE.)
    B. WHERE FEED POINTS ARE FROM POWER POLES, THE CONTRACTOR SHALL TURN FEED CONDUIT UP BASE OF POWER POLE A MINIMUM OF TEN FEET, AS DIRECTED BY THE ENGINEER, AND SHALL FURNISHED THE REQUIRED CONDUCTORS TO THE CITY FEED POINT OF CONNECTION ON THE POLE. THE CITY WILL FURNISH AND INSTALL THE REMAINING CONDUIT RISER ON THE POLE AND CONNECT THE CONDUCTORS TO THE FEED POINT.
11. ALL FEED POINT CONNECTIONS, CIRCUIT CUTS AND CLOSURES ON POWER POLES OR IN VAULTS SHALL BE DONE BY THE CITY AT NO EXPENSE TO THE CONTRACTOR.
12. BEFORE BEGINNING EXCAVATIONS NEAR POWER POLES, THE CONTRACTOR SHALL NOTIFY THE POWER DIVISION (626-744-4467) AT LEAST FIVE (5) WORKING DAYS IN ADVANCE SO THAT CITY FORCES CAN PROVIDE ADDITIONAL POLE SUPPORT IF NECESSARY. (THIS WORK WILL BE DONE AT NO EXPENSE TO THE CONTRACTOR.)
13. ALL MOUNTING FRAMEWORK FOR NEW OR RELOCATED TRAFFIC SIGNAL EQUIPMENT SHALL BE INSTALLED PER STANDARD DRAWING S-962. FRAMEWORK SHALL BE MODIFIED AS NECESSARY OR INSTALLED NEW. PLUG UNUSED OPENINGS.
14. THESE DRAWINGS SHOW NO DEPTHS AND ONLY APPROXIMATE LOCATIONS OF EXISTING TRAFFIC SIGNAL AND STREET LIGHTING CONDUITS. CAUTION AND DUE CARE MUST BE EXERCISED DURING ALL EXCAVATIONS TO AVOID THESE FACILITIES. PROPOSED TRAFFIC SIGNAL AND STREET LIGHT CONDUITS AND PULL BOX LOCATIONS ARE SHOWN SCHEMATICALLY ONLY.
15. THE MINIMUM CLEARANCE BETWEEN AN OPEN TRENCH AND A STREET TREE SHALL BE ONE (1) FOOT OR SIX (6) INCHES FOR EACH INCH OF TRUNK DIAMETER MEASURED AT 4.5 FEET ABOVE EXISTING GRADE IF THIS METHOD DEFINES A LARGER DISTANCE. THE MAXIMUM CLEARANCE SHALL BE TEN (10) FEET.

    THE CONTRACTOR SHALL CONFORM TO THESE PROVISIONS UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
16. CONTRACTOR SHALL PAINT ALL EXISTING AND RELOCATED TRAFFIC SIGNAL/STREET LIGHT STANDARDS AND TRAFFIC SIGNAL EQUIPMENT. SEE PROJECT SPECIFICATIONS FOR DETAILS.
17. EXCEPT AT SIGNALIZED INTERSECTIONS, ALL EXISTING STREET LIGHT CONDUCTORS AND FUSES SHALL BE REPLACED WITH NEW CONDUCTORS AND FUSES. SEE PROJECT SPECIFICATIONS FOR DETAILS.

AB	ABANDON. IF APPLIED TO CONDUIT, REMOVE CONDUCTORS.
BC	INSTALL PULL BOX IN EXISTING CONDUIT RUN.
CB	INSTALL CONDUIT INTO EXISTING PULL BOX.
CC	CONNECT NEW AND EXISTING CONDUIT. REMOVE EXISTING CONDUCTORS AND INSTALL CONDUCTORS AS INDICATED.
CF	CONDUIT TO REMAIN FOR FUTURE USE. REMOVE CONDUCTORS. INSTALL PULL WIRE OR ROPE.
MF	MODIFY FOUNDATION TO CLEAR UNDERGROUND UTILITY AS DIRECTED BY THE ENGINEER.
RB	REMOVE AND REPLACE PULL BOX. INSTALL CONDUIT INTO NEW PULL BOX.
RC	EQUIPMENT TO BE REMOVED AND BECOME PROPERTY OF THE CONTRACTOR.
RR	REMOVE AND REUSE EQUIPMENT.
RT	REMOVE TREE AND STUMP.
RS	REMOVE AND SALVAGE EQUIPMENT.
RP	REMOVE AND RELOCATE PALM TREE.
SC	SPLICE NEW TO EXISTING CONDUCTORS.
TT	TRIM TREE (BY OTHERS).
CO	INSTALL CONDUIT ONLY.
PM	MODIFY PEDESTRIAN SIGNAL HEAD TO INTERNATIONAL SYMBOL.

LEGEND:



CONCRETE STANDARD – CONCRETE STANDARD SHALL CONFORM TO PASADENA STANDARD PLAN No. S-923.

LUMINAIRES – 100 WATT HPS LUMINAIRES SHALL CONFORM TO PASADENA STANDARD PLAN No. S-950.

FOUNDATION – THE ELECTROLIER FOUNDATION SHALL CONFORM TO PASADENA STANDARD PLAN No. S-972 SHEETS 1 AND 2.

STREET LIGHT LOCATION – THE PROPOSED STREET LIGHT LOCATION SHALL CONFORM TO PASADENA STANDARD PLAN No. S-970.

FUSE CONNECTORS – FUSE CONNECTOR FOR 5 TO 30 AMPERE CARTRIDGE TYPE FUSES SHALL BE TRON STYLE HEB OR APPROVED EQUAL. FUSE CONNECTORS FOR 35 TO 60 AMPERE CARTRIDGE TYPE SHALL BE TRON STYLE HEJ OR APPROVED EQUAL.

BONDING AND GROUNDING – BONDING AND GROUNDING SHALL CONFORM TO PASADENA STANDARD PLAN No. S-906.

REGISTERED PROFESSIONAL ENGINEER
CHRISTOPHER SHEM HAWES
69578
06/30/2010
CIVIL
STATE OF CALIFORNIA

PLANS PREPARED BY:
CIVILTEC engineering inc.
CHRISTOPHER SHEM HAWES DATE 2/25/09 06/30/10

General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

DRAWN BY (PRIVATE)
DESIGNED BY (PRIVATE)
CHECKED BY JO

REVISIONS					
MARK	DATE	DESCRIPTION	BY	CHKD.	APPROVED
		AS BUILT			

CITY OF PASADENA – DEPARTMENT OF PUBLIC WORKS

STANDARD LEGEND AND GENERAL NOTES

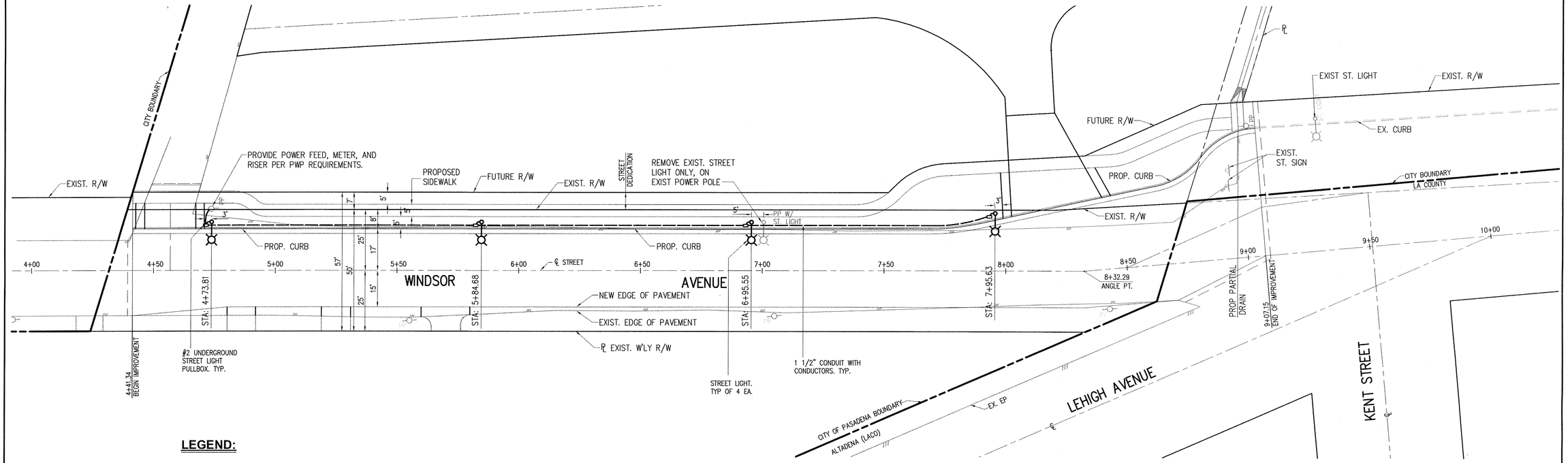
SHEET 3 OF 8

PROJECT WINDSOR AVENUE IMPROVEMENTS

DWG. NO. 5859

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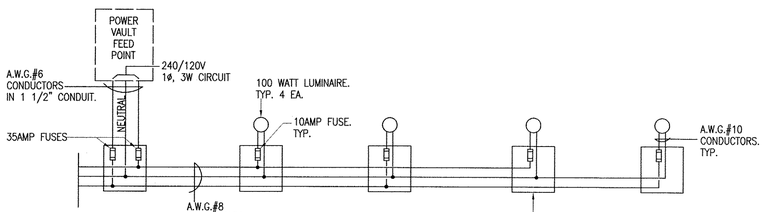
LEGEND:

NO.2 STREET LIGHT PULL BOX PER CITY OF PASADENA PUBLIC WORKS DEPARTMENT STANDARD DRAWING S-904.

NEW HIGHMAST STREET LIGHT. PROVIDE PUMCO 1023K CONCRETE MARBELITE STD. W/ 100WATT HIGH PRESSURE SODIUM 120 V.H.B. LUMINAIRE.

CONSTRUCTION NOTES

1. SET ALL STREET LIGHT STANDARDS (UNLESS OTHERWISE NOTED):
   A, 2'-6" BACK OF CURB FACE.
   B, 2'-0" INSIDE B.C.R. (BEGINING OF CURB RETURN).
   C, MINIMUM 5'-0" CLEAR OF TOP OF DRIVEWAY "X".
2. CONDUIT MINIMUM COVER SHALL BE 15" IN PARKWAY AND 30" IN STREET BEGINNING AT GUTTER FLOW LINE.
3. CONTRACTOR SHALL VERIFY ALL LENGTHS OF CONDUIT, CONDUCTORS, AND CABLE TO BE INSTALLED AT THE JOB SITE.
4. CONTRACTOR TO VERIFY THE NUMBER OF CONDUCTORS IN EACH CONDUIT RUN.
5. POWER FEED POINT FOR THE STREET LIGHTS:
   ALL WORK AND CONNECTIONS IN THE DEPARTMENT OF WATER AND POWER UNDERGROUND DISTRIBUTION VAULTS SHALL BE DONE CITY FORCES.
   (NOTIFY 577-4476, 48 HOURS IN ADVANCE)
6. STREET LIGHT PULLBOX SHALL NOT BE INSTALLED WITHIN DRIVEWAY APPROACHES OR SIDEWALK AREAS DESIGNATED AS WHEELCHAIR RAMPS.
7. CONTRACTOR TO NOTIFY PUBLIC WORK STREET LIGHT SUPERVISOR AT 577-4148 72 HOURS PRIOR TO ANY WORK ON EXISTING STREET LIGHT SYSTEMS.
8. UNDERGROUND VAULTS TO BE INSTALLED BY OTHERS.
9. ALL WORK INCLUDING RESTORATION OF EXISTING IMPROVEMENTS SHALL BE IN ACCORDANCE WITH THE LATEST EDITION OF THE "STANDARD SPECIFICATION FOR PUBLIC WORKS CONSTRUCTION" INCLUDING SUPPLEMENTS, AND THE SPECIFICATIONS FOR THE "INSTALLATION AND MODIFICATION OF STREET LIGHTING AND TRAFFIC SIGNALS IN THE CITY OF PASADENA, CALIFORNIA", AVAILABLE IN DEPARTMENT OF PUBLIC WORKS, ROOM 215, CITY HALL.



STREET LIGHT CIRCUIT DIAGRAM

120VOLT MULTIPLE CIRCUITS, NO SCALE

SCALE: 1"=20'

0 20 40 60 80 100

SCALE IN FEET

REGISTERED PROFESSIONAL ENGINEER
CHRISTOPHER SHEM HAWES
69578
CIVIL
STATE OF CALIFORNIA
06/30/2010

AVERAGE MAINTAINED ILLUMINATION (ULT.) = 0.44 F.C.

STREET LIGHTING

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957
CHRISTOPHER SHEM HAWES DATE 06/30/10

WATER AND POWER DEPARTMENT
DATE
FIELD BOOK NO. NONE

PROJECT ENGINEER
DATE
TRANSPORTATION ADMINISTRATOR
DATE

DRAWN BY (PRIVATE)
DESIGNED BY (PRIVATE)
CHECKED BY JIM VALENTINE

REVISIONS					
MARK	DATE	DESCRIPTION	BY	CHKD.	APPROVED
		AS BUILT			

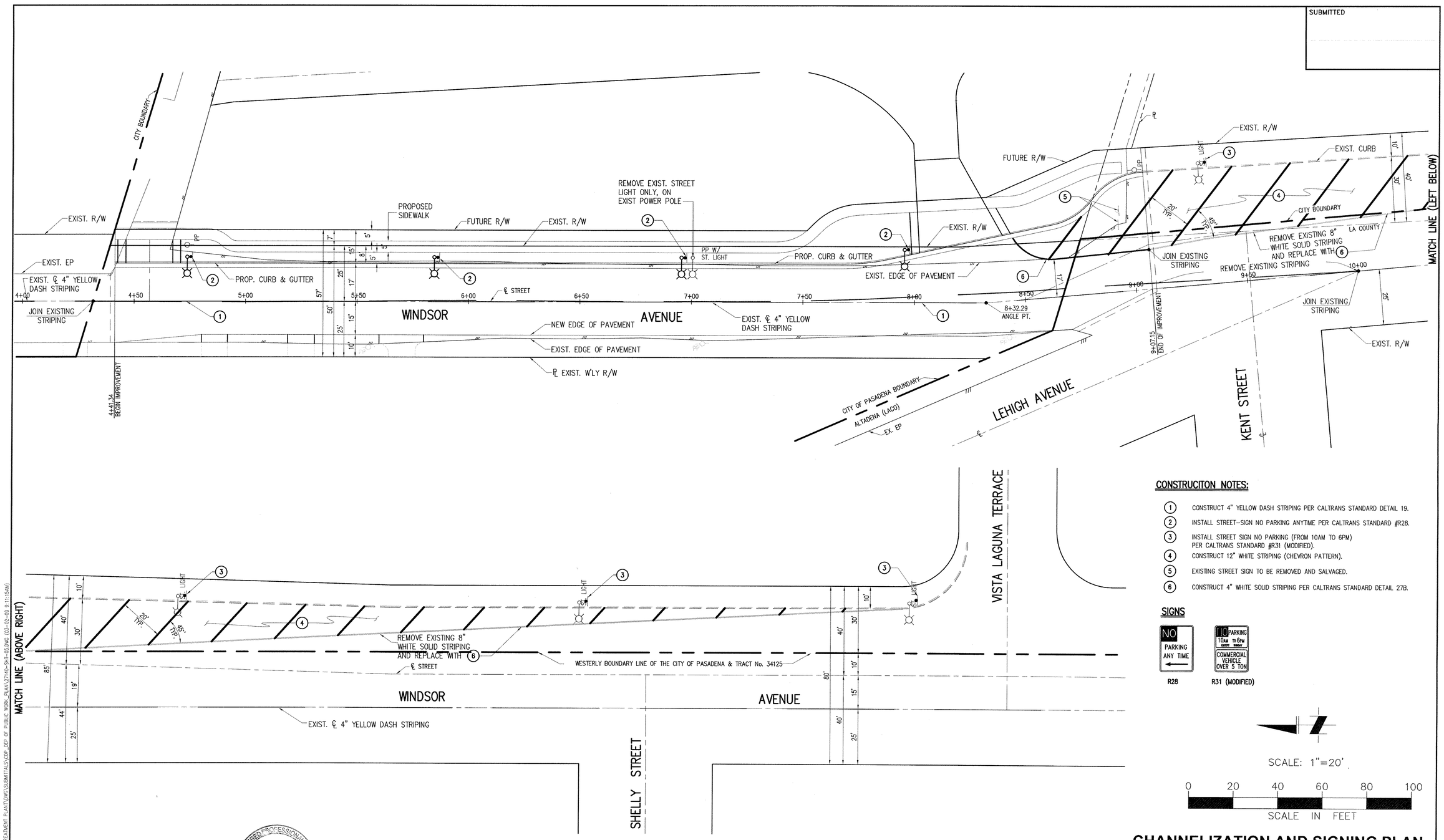
CITY OF PASADENA – DEPARTMENT OF PUBLIC WORKS

PROJECT **WINDSOR AVENUE IMPROVEMENT**
LIMITS FROM LEHIGH STREET TO 550' NORTH
SCALE 1" = 20' ACCOUNT NUMBER 881000

SHEET 4 OF 8
DWG. NO. 5859

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SUBMITTED



CONSTRUCITON NOTES:

1. CONSTRUCT 4" YELLOW DASH STRIPING PER CALTRANS STANDARD DETAIL 19.
2. INSTALL STREET-SIGN NO PARKING ANYTIME PER CALTRANS STANDARD #R28.
3. INSTALL STREET SIGN NO PARKING (FROM 10AM TO 6PM) PER CALTRANS STANDARD #R31 (MODIFIED).
4. CONSTRUCT 12" WHITE STRIPING (CHEVRON PATTERN).
5. EXISTING STREET SIGN TO BE REMOVED AND SALVAGED.
6. CONSTRUCT 4" WHITE SOLID STRIPING PER CALTRANS STANDARD DETAIL 27B.

SIGNS

R28

R31 (MODIFIED)

SCALE: 1"=20'

0 20 40 60 80 100

SCALE IN FEET

CHANNELIZATION AND SIGNING PLAN

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 59578 — 4/30/2010 — CIVIL — STATE OF CALIFORNIA

PLANS PREPARED BY: CIVILTEC engineering inc. — *General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying* — 118 West Lime Avenue, Monrovia, Ca. 91016, Phone: (626) 357-0588, Fax: (626) 303-7957 — CHRISTOPHER SHEM HAWES DATE 2/25/09 06/30/10

WATER AND POWER DEPARTMENT — DATE

FIELD BOOK NO. NONE

PROJECT ENGINEER — DATE

TRANSPORTATION ADMINISTRATOR — DATE

DRAWN BY (PRIVATE)
DESIGNED BY (PRIVATE)
CHECKED BY JIM VALENTINE

REVISIONS					
MARK	DATE	DESCRIPTION	BY	CHKD.	APPROVED
		AS BUILT			

CITY OF PASADENA – DEPARTMENT OF PUBLIC WORKS

PROJECT **WINDSOR AVENUE IMPROVEMENT**
LIMITS FROM LEHIGH STREET TO 550' NORTH
SCALE 1" = 20' ACCOUNT NUMBER 881000

SHEET 5 OF 8
DWG. NO. 5859

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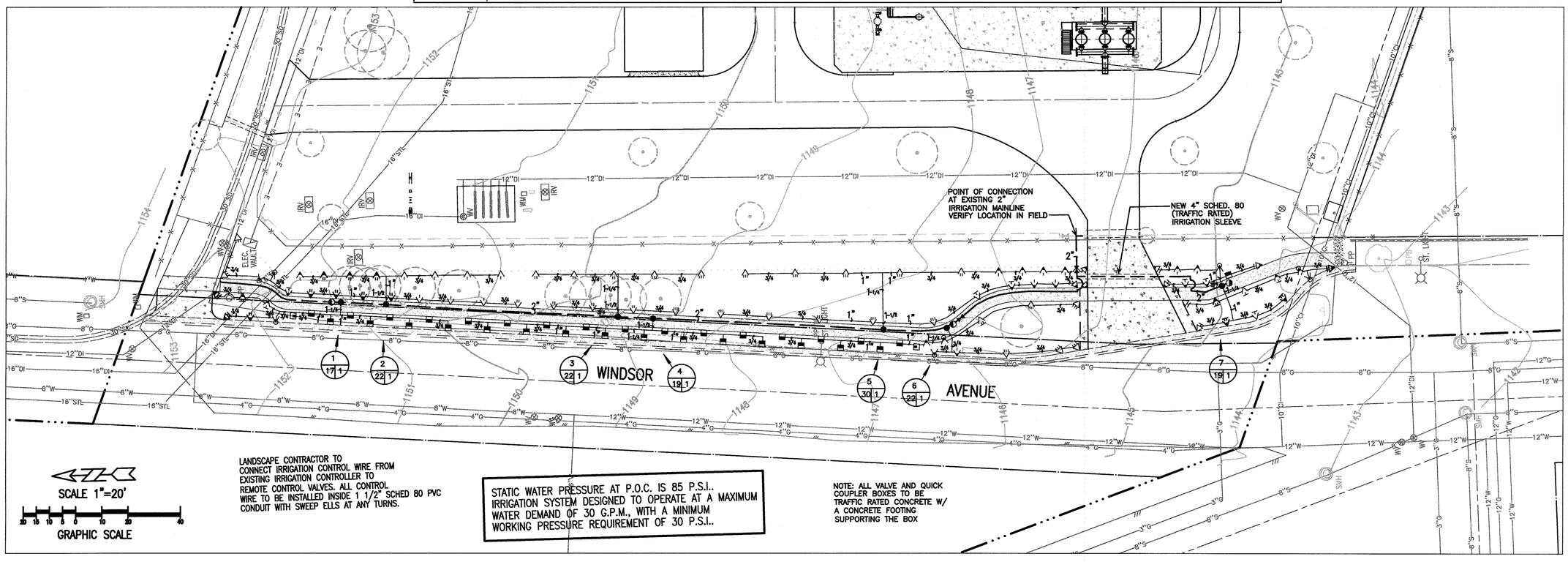
IRRIGATION NOTES

1. Check and verify all site conditions, utilities, and services prior to trenching.
2. Where trees, light standards, utilities, etc., obstruct spray pattern, adjust and/or relocate piping and sprinkler heads as necessary to obtain full coverage without excessive overthrow. Do not exceed head spacing shown on drawings.
3. If it becomes necessary to relocate or alter sprinkler heads, valves, piping, or other equipment due to changes in site conditions, Contractor shall obtain approval from the Landscape Architect before making such changes.
4. Plans are diagrammatic and approximate. Install all valves and piping in planting areas except where it is not feasible to do so.
5. Sprinkler nozzles specified are available in varying degrees of arcs, and with the addition of pressure compensating screens (PCS). Contractor shall provide for each head the best arc and/or PCS screen to provide adequate coverage and prevent overspray on paving, buildings, etc. at no additional cost.
6. Install all piping, PVC electrical sleeves, etc., under paving prior to paving work. No tees, ells, or other turns in piping are to be located under paving except where shown on drawings. Cap all ends hand tight prior to backfill.
7. Connect each remote control valve to automatic controller with No. 14 pilot wire and No. 14 common wire, type U.F., copper. U.L. approved, solid strand.
8. Set all risers to sprinkler heads and valves with stems perpendicular to finish grade.
9. Contractor to coordinate irrigation work with planting layout to avoid conflicts between piping and plant pits.
10. All materials shall be installed as detailed on the drawings. However, if the plans and/or specifications do not thoroughly describe the methods to be used, the Contractor is to follow the installation methods issued by the manufacturer, with the approval of the Landscape Architect.
11. New pressurized main line piping to be as follows:
    1/2" through 1-1/2" in size - PVC 1120, Schedule 40 solvent weld plastic pipe
    2" and greater - PVC 1120, Class 315 solvent weld plastic pipe
12. Install di-electric unions when dissimilar pipes are connected together. PVC plastic pipe shall be continuously marked with manufacturer's name, pipe size (I.P.S.), class or schedule number, manufacturer's lot number and N.S.F. approval.
13. Design is based on minimum operating pressure and maximum flow demand shown on plan. Contractor shall verify water pressure and report any differences to Landscape Architect prior to construction.
14. Drainage of irrigation water through sprinkler heads will not be allowed. Install an anti-drain valve on riser nipple of any sprinkler head showing drainage after the system has shut off, without additional cost.

IRRIGATION LEGEND

SYMBOL	FUNCTION	PATTERN	MANUFACTURER	MODEL #	RADIUS	MIN PSI	GPM
	POP-UP HEAD	VARIABLE ARC NOZ.	RAINBIRD	1806-18VANH	18'	30 PSI	2.66
	POP-UP HEAD	VARIABLE ARC NOZ.	RAINBIRD	1806-15VANH	15'	30 PSI	1.85
	POP-UP HEAD	HALF	RAINBIRD	1806-15H	15'	30 PSI	1.85
	POP-UP HEAD	VARIABLE ARC NOZ.	RAINBIRD	1806-12VANH, 12VANQ	12'	30 PSI	1.3, .65
	POP-UP HEAD	HALF	RAINBIRD	1806-12H	12'	30 PSI	1.3
	POP-UP HEAD	VARIABLE ARC NOZ.	RAINBIRD	1806-10VANH, 10VANQ	10'	30 PSI	1.45, .75
	POP-UP HEAD	HALF	RAINBIRD	1806-10H	10'	30 PSI	.79
	POP-UP HEAD	VARIABLE ARC NOZ.	RAINBIRD	1806-8VANH, 8VANQ	8'	30 PSI	1.19, .72
	POP-UP HEAD	HALF, QUARTER	RAINBIRD	1806-8H, 8Q	8'	30 PSI	.52, .26
	POP-UP HEAD	VARIABLE ARC NOZ.	RAINBIRD	1806-6VANH	6'	30 PSI	.6
	POP-UP HEAD	HALF	RAINBIRD	1806-5H	5'	30 PSI	.2
	POP-UP HEAD	SIDE STP., END STP.	RAINBIRD	1806-15SST, 15EST	4X30', 4X30'	30 PSI	1.21, .61
	REMOTE CONTROL VALVE		SUPERIOR	950	SEE PLAN FOR SIZE & LOCATION		
	BALL VALVE		WATTS	FBV	LINE SIZE		
	QUICK COUPLER VALVE		RAINBIRD	33DLRC			
	MAIN LINE	18" DEEP	SCHED. 40 P.V.C. (CLASS 315 FOR PIPE GREATER THAN 1-1/2" IN SIZE)				
	LATERAL LINE	12" DEEP	SCHED. 40 P.V.C.				
	IRRIGATION SLEEVING		SEE CONSTRUCTION PLAN FOR LOCATION				
	VALVE SEQUENCE						
	GPM						
	VALVE SIZE						
	NOTE: USE PRESSURE COMPENSATING SCREENS BY RAINBIRD WHERE RADIUS OF SRAY NOZZLES ARE SIGNIFICANTLY REDUCED						

SUBMITTED	APPROVED
	DANIEL A. RIX — DATE CITY ENGINEER REGISTERED CIVIL ENGINEER NO. 38689 REGISTRATION EXPIRES MARCH 31, 2009



LANDSCAPE CONTRACTOR TO CONNECT IRRIGATION CONTROL WIRE FROM EXISTING IRRIGATION CONTROLLER TO REMOTE CONTROL VALVES. ALL CONTROL WIRE TO BE INSTALLED INSIDE 1 1/2" SCHED 80 PVC CONDUIT WITH SWEEP ELLS AT ANY TURNS.

STATIC WATER PRESSURE AT P.O.C. IS 85 P.S.I.. IRRIGATION SYSTEM DESIGNED TO OPERATE AT A MAXIMUM WATER DEMAND OF 30 G.P.M., WITH A MINIMUM WORKING PRESSURE REQUIREMENT OF 30 P.S.I..

NOTE: ALL VALVE AND QUICK COUPLER BOXES TO BE TRAFFIC RATED CONCRETE W/ A CONCRETE FOOTING SUPPORTING THE BOX

REGISTERED LANDSCAPE ARCHITECT — ANNA M. ARMSTRONG — No. 2283 Exp. 03/31/10 — STATE OF CALIFORNIA — 2/10/09

PLANS PREPARED BY:	PLANS PREPARED BY:		REVISIONS						
ARMSTRONG AND WALKER *Landscape Architecture* 1835 Royal Oaks Dr. North Bradbury, Ca. 91008 Phone: (626) 357-4599 Fax: (626) 357-6536	CIVILTEC engineering inc. *General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying* 118 West Lime Avenue Monrovia, Ca. 91016 Phone: (626) 357-0588 Fax: (626) 303-7957 CHRISTOPHER SHEM HAWES — DATE 2/09/08 — 06/30/10	DRAWN BY (PRIVATE) DESIGNED BY (PRIVATE) CHECKED BY JO	MARK	DATE	DESCRIPTION	BY	CHKD.	APPROVED
					AS BUILT			

CITY OF PASADENA—DEPARTMENT OF PUBLIC WORKS

PROJECT **WINDSOR AVENUE IMPROVEMENT** — SHEET 6 OF 8

LIMITS FROM LEHIGH STREET TO 550' NORTH — DWG. NO. 5859

SCALE AS SHOWN — ACCOUNT NUMBER 881000

IRRIGATION PLAN PHASE 2

C:\DOCUMENTS AND SETTINGS\ANNA\MY DOCUMENTS\PROJECTS 1\LPL WATER TREATMENT\NEWAUTOCAD\IRRIGATION PLAN PHASE 2.DWG (02-10-09 10:12:

PLANTING NOTES

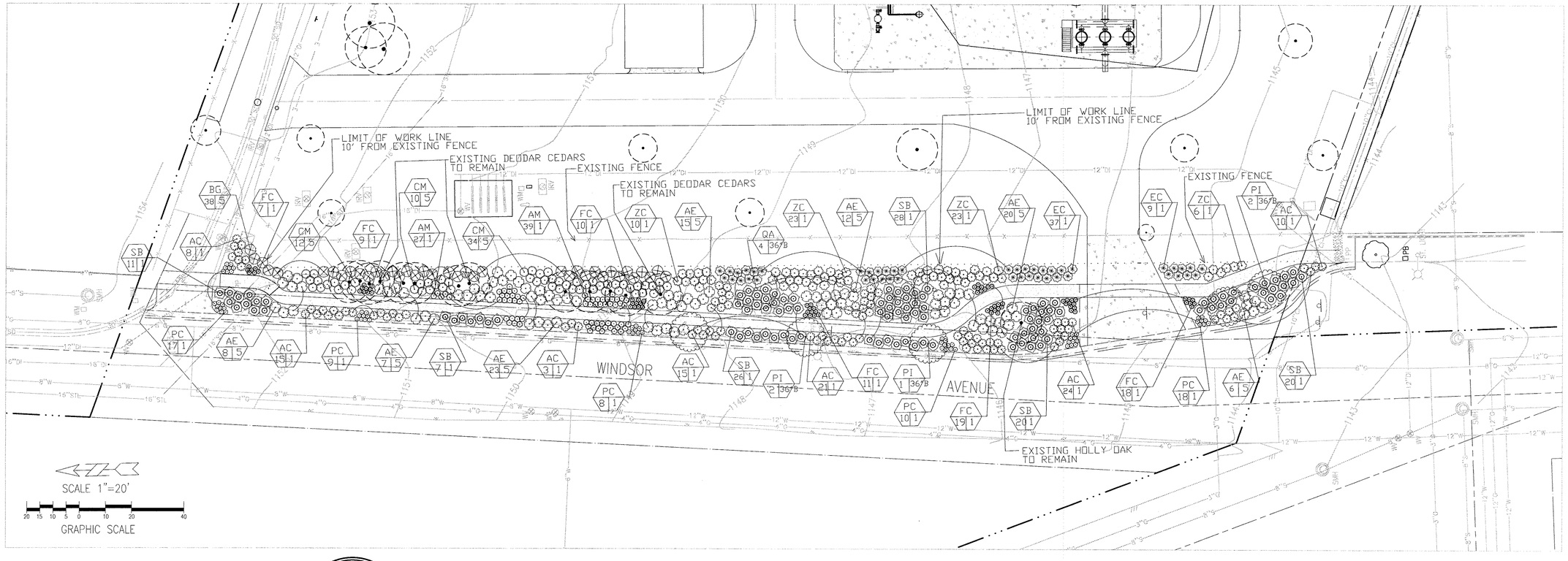
1. Contractor shall maintain a qualified supervisor on the site at all times during installation through completion of work.
2. Contractor shall verify all plant material species and quantities prior to installation. Plant quantities are listed for the convenience of the Contractor; actual number of plant symbols shown on plan shall have priority over quantity listed.
3. All container grown plants and ground covers and installation per the plans are to be provided and paid for by the Contractor. Contractor shall be responsible for the continuous protection of all plants upon delivery to the site and throughout construction.
4. All plant materials shall be inspected and are subject to approval prior to installation by the City and/or Landscape Architect.
5. Remove all debris, weeds, excess material, and rocks larger than 2" in diameter from landscape areas prior to soil preparation and again prior to planting.
6. Excavate plant pits for trees and shrubs twice the diameter and 1-1/2 times the depth of the root ball. Use native soil without amending for backfill to the bottom of the root ball, and the following backfill mix, thoroughly mixed, around the root ball to the surface:
   3 parts by volume on-site soil
   1 part by volume nitrogen stabilized organic amendment (fir or cedar shavings)
   Gro-Power Controlled Release fertilizer, quantity per manufacturer's specifications
   Mycor PlantSaver mycorrhizal fungi inoculant, quantity per manufacturer's specifications (available from J. Harold Mitchell Co., San Gabriel, CA 626-287-1101)
7. Fine grade all planting areas to achieve surface drainage toward street or storm drains.
8. Stake trees according to detail shown on plans.
9. Following completion of planting, spread a continuous 3" thick layer of shredded bark mulch in newly planted areas.
10. Upon completion, remove all extraneous material and debris from the site, and rake the area clean.
11. Contractor shall include in his bid maintenance of the landscape for 60 days, including weeding, pruning, cleanup, adjustment of irrigation system, and replacement of dead or damaged plants.
12. Contractor shall guarantee all shrubs for a period of 90 days and all trees for a period of one year following completion of the 60 day maintenance period, and shall replace any dead plants at no cost to the City unless neglect or damage by City can be shown.

PLANT LEGEND

SYMBOL	BOTANICAL NAME	COMMON NAME	SIZE	QUANT.
Trees				
P I	Pistacia chinense	Chinese Pistache	36" box	5
Q A	Quercus agrifolia	Coast Live Oak	36" box	4
Shrubs				
A E	Arctostaphylos edmundsii 'Carmel Sur'	Carmel Sur Manzanita	5 gallon	91
B G	Berberis 'Golden Abundance'	Golden Abundance Barberry	5 gallon	38
C M	Coprosma repens 'Marble Queen'	Variegated Mirror Plant	5 gallon	56
Perennials and Grasses				
A C	Artemisia californica 'Montara'	Montara Calif. Sagebrush	1 gallon	96
A M	Achillea millefolium hybrids	Yarrow Hybrids	1 gallon	66
E C	Encelia californica	California Sunflower	1 gallon	46
F C	Festuca californica	California Fescue	1 gallon	74
P C	Penstemon centranthifolius	Scarlet Bugler	1 gallon	62
S B	Salvia 'Bee's Bliss'	Bee's Bliss Groundcover Sage	1 gallon	112
Z C	Zauchneria californica 'Catalina'	California Fuchsia	1 gallon	62

Note: Install 3" thick layer of shredded bark mulch in all shrub areas following completion of planting.

SUBMITTED	APPROVED
	DANIEL A. RIX — DATE CITY ENGINEER REGISTERED CIVIL ENGINEER NO. 38689 REGISTRATION EXPIRES MARCH 31, 2009



REGISTERED LANDSCAPE ARCHITECT
ANNA M. ARMSTRONG
No. 2293
Exp. 03/31/10
STATE OF CALIFORNIA

PLANS PREPARED BY:
ARMSTRONG AND WALKER
Landscape Architecture
1835 Royal Oaks Dr. North
Bradbury, Ca. 91008
Phone: (626) 357-4599
Fax: (626) 357-6536

PLANS PREPARED BY:
CIVILTEC *engineering inc.*
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
116 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7927
CHRISTOPHER SHEM HAWES DATE 2/09/08 — 06/30/10

DRAWN BY (PRIVATE)
DESIGNED BY (PRIVATE)
CHECKED BY JO

REVISIONS					
MARK	DATE	DESCRIPTION	BY	CHKD.	APPROVED
		AS BUILT			

CITY OF PASADENA—DEPARTMENT OF PUBLIC WORKS

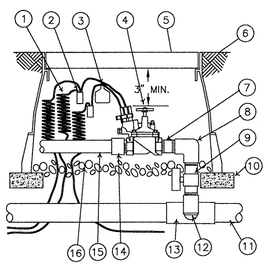
PROJECT **WINDSOR AVENUE IMPROVEMENT**
LIMITS FROM LEHIGH STREET TO 550' NORTH
SCALE AS SHOWN — ACCOUNT NUMBER 881000

SHEET 7 OF 8
DWG. NO. 5859

PLANTING PLAN PHASE 2

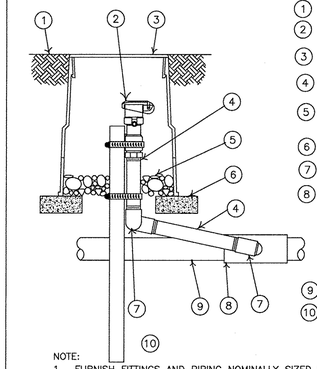
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SUBMITTED	APPROVED
	DANIEL A. RIX DATE CITY ENGINEER REGISTERED CIVIL ENGINEER NO. 38689 REGISTRATION EXPIRES MARCH 31, 2009



1. 30–INCH LINEAR LENGTH OF WIRE COILED
2. WATER PROOF CONNECTION (1 OF 2)
3. ID TAG
4. REMOTE CONTROL VALVE SUPERIOR 950
5. BROOKES BROTHERS CONCRETE VALVE BOX
6. FINISH GRADE/ TOP OF MULCH
7. PVC SCH 40 NIPPLE (CLOSE)
8. PVC SCH 40 ELL
9. INSTALL LINE SIZE BALL VALVE
10. CONCRETE FOOTING
11. PVC MAINLINE PIPE
12. SCH 80 NIPPLE (2– INCH LENGTH HIDDEN) AND SCH 40 ELL
13. PVC SCH 40 TEE OR ELL
14. LINE SIZE UNION
15. PVC LATERAL PIPE
16. 3.0– INCH MINIMUM DEPTH OF 3/4"– WASHED GRAVEL

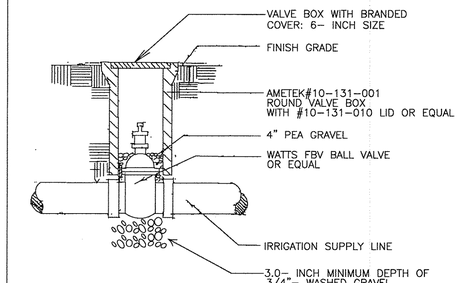
A. REMOTE CONTROL VALVE



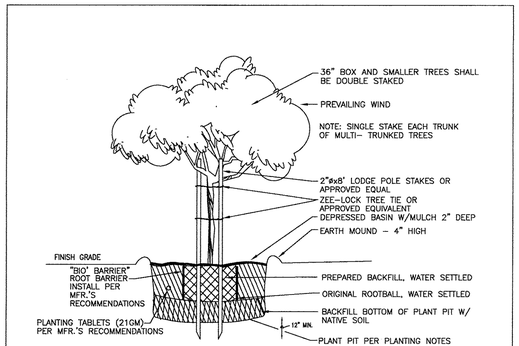
1. FINISH GRADE/ TOP OF MULCH
2. QUICK– COUPLING VALVE: RAIN BIRD MODEL 33DNP
3. BROOKES BROTHERS CONCRETE VALVE BOX
4. PVC SCH 80 NIPPLE (LENGTH AS REQUIRED)
5. 3– INCH MINIMUM DEPTH OF 3/4" – INCH WASHED GRAVEL
6. CONCRETE FOOTING
7. PVC SCH 80 STREET ELL
8. PVC SCH 80 TEE OR ELL
9. PVC SCH 40 ELL
10. 2"X18" GALVANIZED PIPE W/ STAINLESS STEEL GEAR CLAMPS OR EQUIVALENT SUPPORT SYSTEM

NOTE:
1. FURNISH FITTINGS AND PIPING NOMINALLY SIZED IDENTICAL TO NOMINAL QUICK COUPLING VALVE INLET SIZE.

B. QUICK–COUPLING VALVE

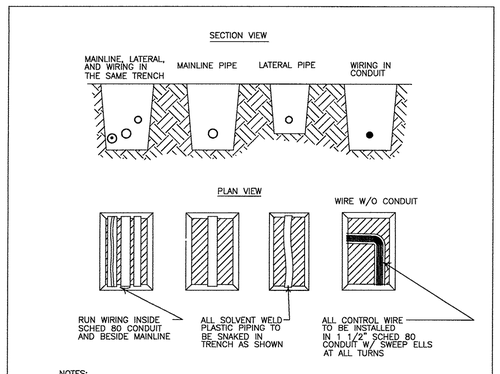


C. BALL VALVE



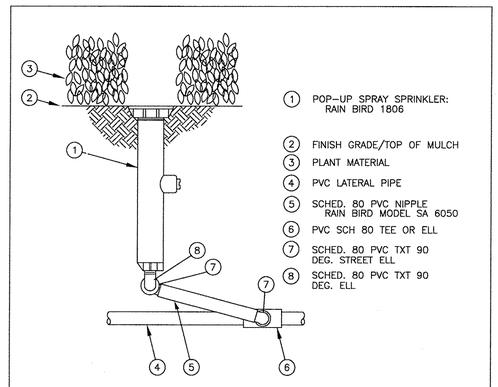
TREE STAKING NO SCALE

G. TREE PLANTING



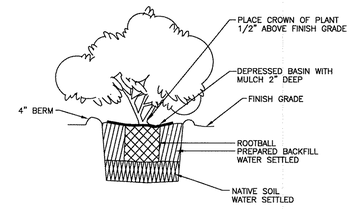
NOTES:
1. SLEEVE BELOW ALL HARDSCAPE ELEMENTS WITH SCH 40 PVC TWICE THE DIAMETER OF THE PIPE OR WIRE BUNDLE WITHIN.
2. FOR PIPE AND WIRE BURIAL DEPTHS SEE SPECFICATIONS.

D. PIPE & WIRE TRENCHING



1. POP–UP SPRAY SPRINKLER: RAIN BIRD 1806
2. FINISH GRADE/TOP OF MULCH
3. PLANT MATERIAL
4. PVC LATERAL PIPE
5. SCHED. 80 PVC NIPPLE RAIN BIRD MODEL SA 6050
6. PVC SCH 80 TEE OR ELL
7. SCHED. 80 PVC TXT 90 DEG. STREET ELL
8. SCHED. 80 PVC TXT 90 DEG. ELL

E. POP–UP SPRAY SPRINKLER



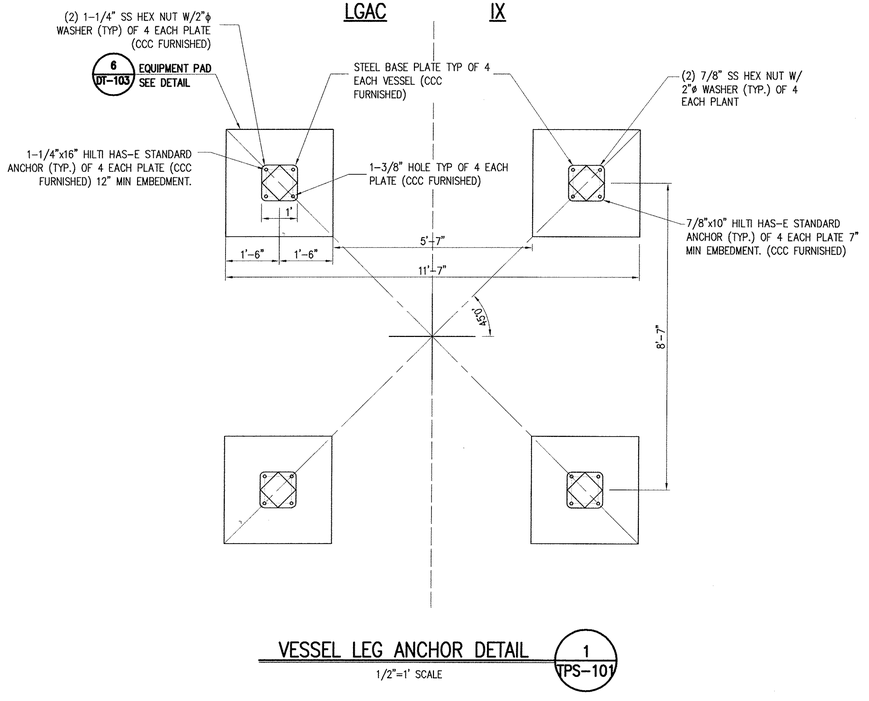
SHRUB PLANTING NO SCALE

F. SHRUB PLANTING

C:\DOCUMENTS AND SETTINGS\ANNA\MY DOCUMENTS\PROJECTS 1\JPL WATER TREATMENT\NEWAUTOCAD\IRRIGATION DETAILS PHASE 2.DWG (02–10–09 10:

REGISTERED LANDSCAPE ARCHITECT
ANNA M. ARMSTRONG
2/9/09
No. 2293
Exp. 03/31/10
STATE OF CALIFORNIA

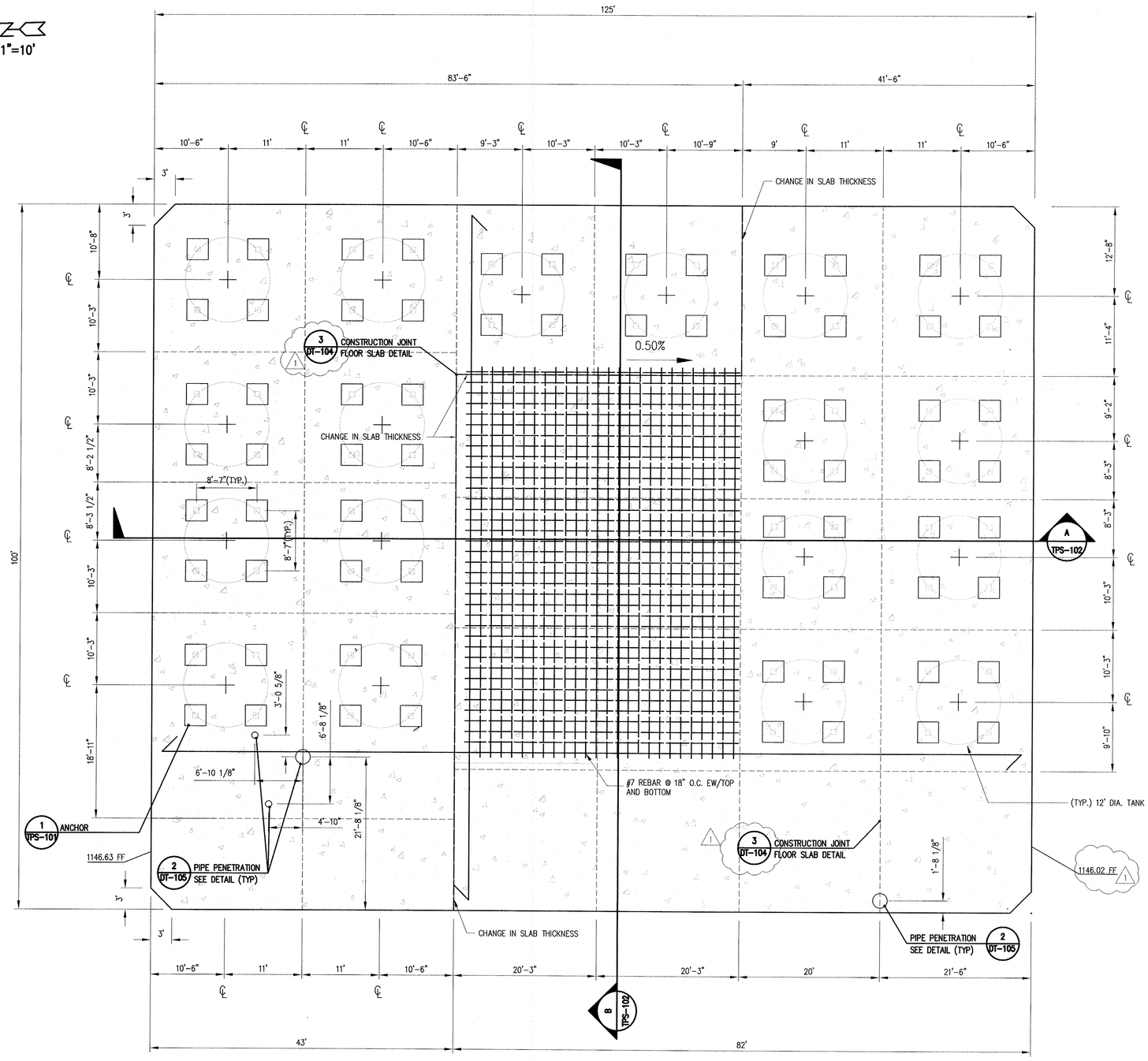
PLANS PREPARED BY: **ARMSTRONG AND WALKER** *Landscape Architecture* 1835 Royal Oaks Dr. North Bradbury, Ca. 91008 Phone: (626) 357-4599 Fax: (626) 357-6536	PLANS PREPARED BY: CIVILTEC engineering inc. *General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying* 118 West Lime Avenue Monrovia, Ca. 91016 Phone: (626) 357-0588 Fax: (626) 303-7957 DATE 2/09/08 CHRISTOPHER SHEM HAWES 06/30/10	DRAWN BY (PRIVATE) DESIGNED BY (PRIVATE) CHECKED BY JO	REVISIONS MARK | DATE | DESCRIPTION | BY | CHKD. | APPROVED AS BUILT	CITY OF PASADENA–DEPARTMENT OF PUBLIC WORKS PROJECT **WINDSOR AVENUE IMPROVEMENT** LIMITS FROM LEHIGH STREET TO 550' NORTH SCALE AS SHOWN ACCOUNT NUMBER 881000	SHEET 8 OF 8 DWG. NO. 5859



VESSEL LEG ANCHOR DETAIL 1/TPS-101

1/2"=1' SCALE

SCALE 1"=10'



REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — 6/30/2010 — CIVIL — STATE OF CALIFORNIA

APPROVED BY: C. Shem Hawes 69578 CHRISTOPHER SHEM HAWES RCE — 2/25/08 DATE

APPROVED: _____ DATE

APPROVED: _____ DATE

PLANS PREPARED BY:

CIVILTEC engineering inc.

General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying

118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

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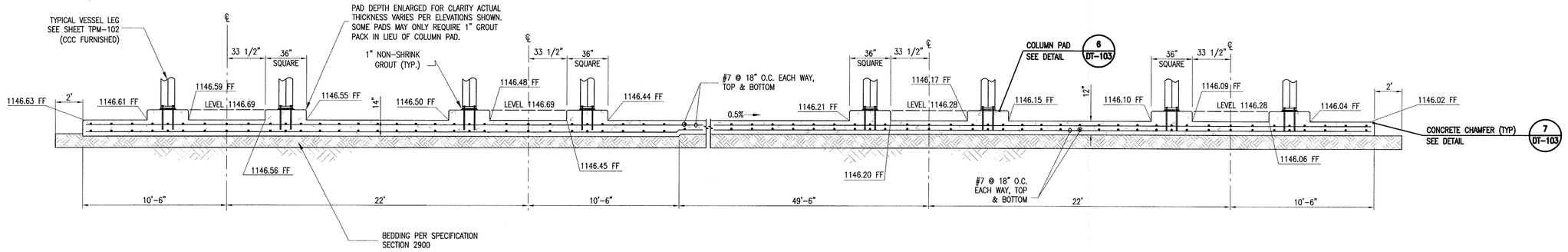
CITY OF PASADENA INCORPORATED JUNE 1886

D.S.-209 & 210A

DATE	SCALE	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 24 OF 79 SHEETS
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DRAWN BY CIVILTEC		MONK HILL TREATMENT SYSTEM TREATMENT PAD PLAN	WORK ORDER 02557 / FILE NUMBER E-1670
DESIGNED BY CIVILTEC			
CHECKED BY CIVILTEC			
SUBMITTED BY CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

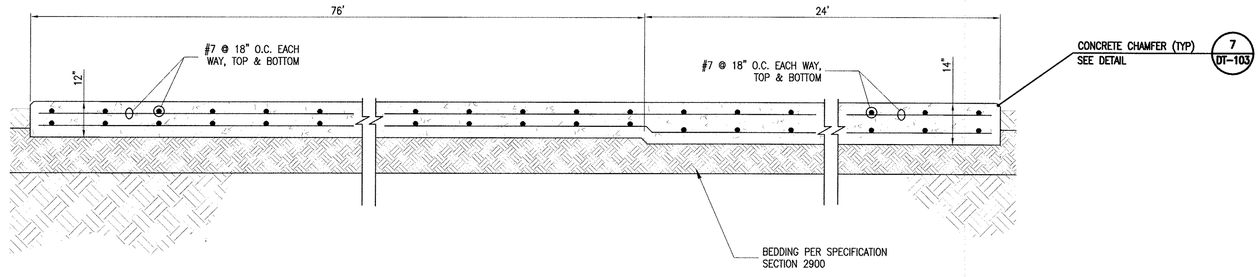
TPS-101

X:\2007\27140-PL MONKHILL TREATMENT PLANT\DWG\SUBMITTAL\FINAL SUBMITTAL\27140-TPS-101.DWG (02-26-09 2:34:39PM)



TYPICAL RAISED PAD SECTION A TPS-101

SCALE: 1/4"=1'-0"



TYPICAL FOUNDATION SECTION B TPS-101

SCALE: 1/2"=1'-0"

K:\2007\2714D-CR_MONKHILL_TREATMENT_PLANT\DWG\SUBMITTALS\FINAL SUBMITTAL\2714D-TPS-102.DWG (02-26-09 2:35:02PM)

TPS-102

REVISION

NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — 6/30/2010 — CIVIL — STATE OF CALIFORNIA

APPROVED BY: C. Shem Hawes 69578 CHRISTOPHER SHEM HAWES RCE 2/25/08 DATE

APPROVED: _____ DATE

APPROVED: _____ DATE

PLANS PREPARED BY:

CIVILTEC engineering inc.

General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying

118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

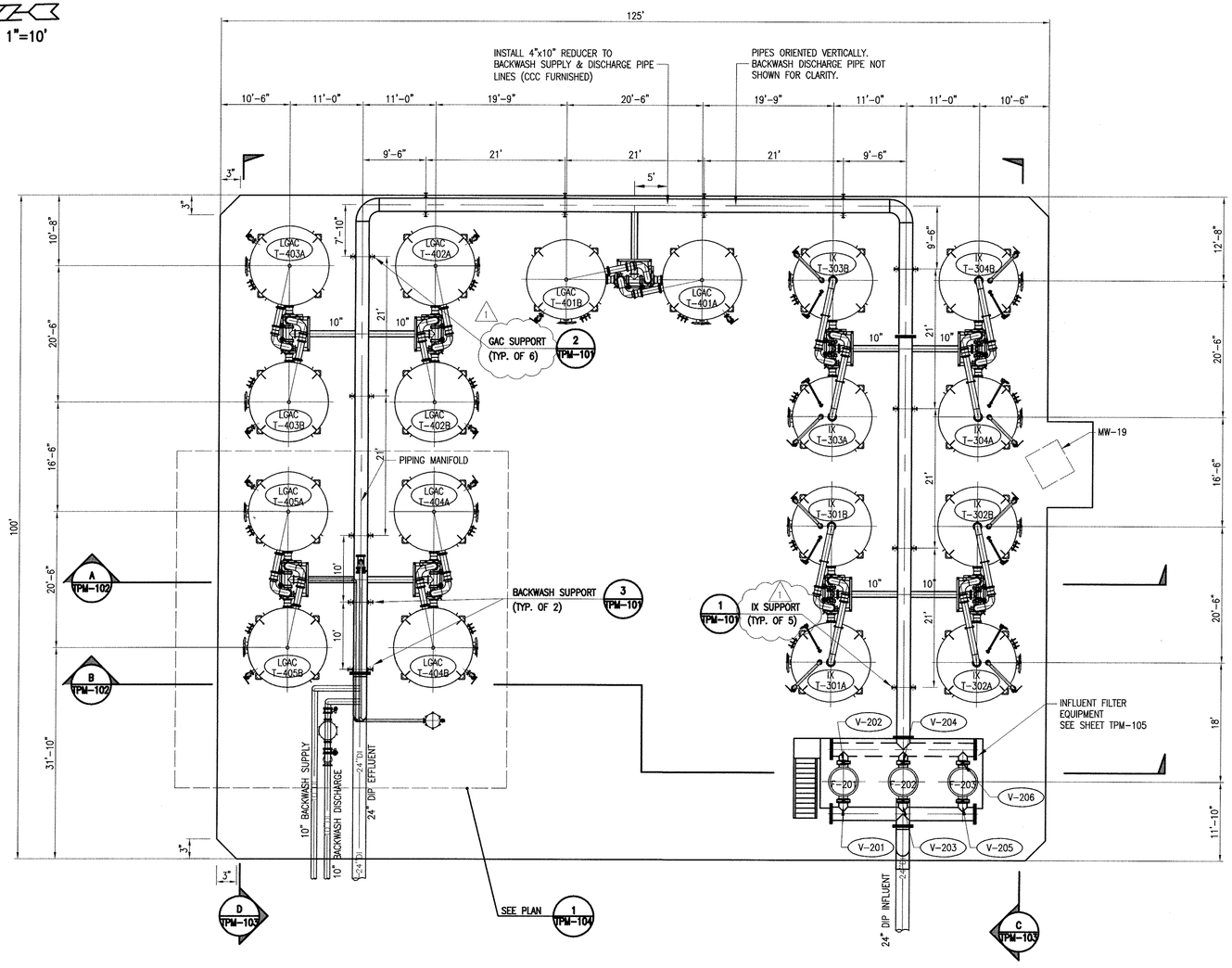
Battelle
The Business of Innovation

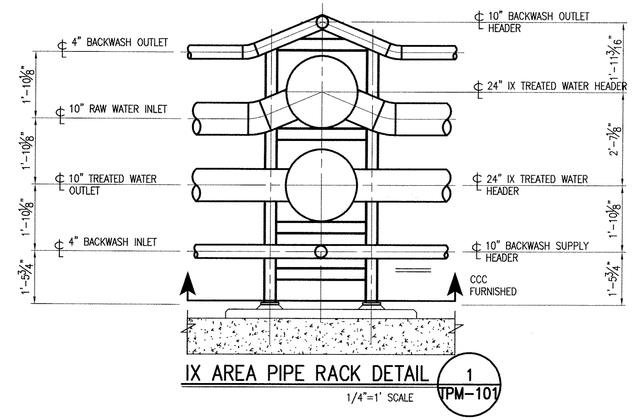
CITY OF PASADENA * INCORPORATED JUNE 1886 *

D.S.-209 & 210A

DATE	SCALE		
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DRAWN BY CIVILTEC DESIGNED BY CIVILTEC CHECKED BY CIVILTEC SUBMITTED BY CIVILTEC		MONK HILL TREATMENT SYSTEM CONCRETE PAD SECTIONS	WORK ORDER 02557 / FILE NUMBER E-1670
FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

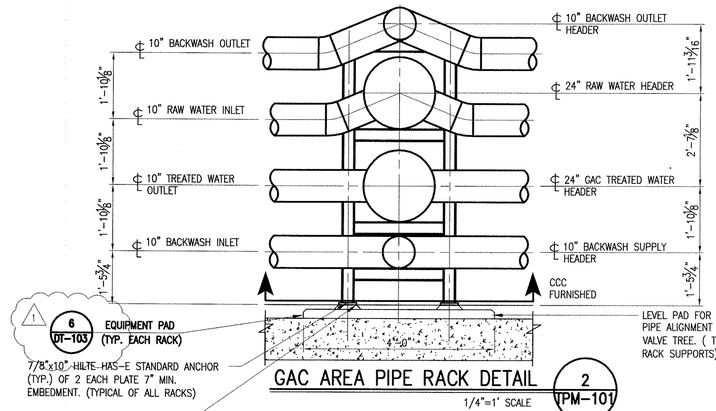
SCALE 1"=10'





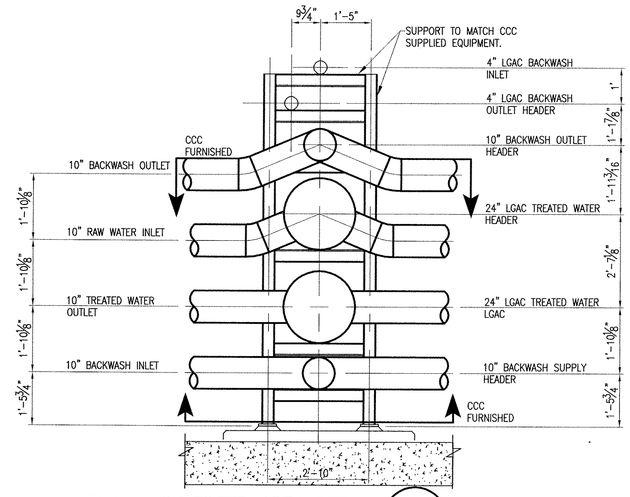
IX AREA PIPE RACK DETAIL 1 TPM-101

1/4"=1' SCALE



GAC AREA PIPE RACK DETAIL 2 TPM-101

1/4"=1' SCALE



BACKWASH FILTER AREA DETAIL 3 TPM-101

1/4"=1' SCALE

TPM-101

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER CHRISTOPHER SHEM HAWES 69578 CIVIL STATE OF CALIFORNIA 6/30/2010

APPROVED BY: C. Shem Hawes 69578 2/25/08
CHRISTOPHER SHEM HAWES RCE DATE
APPROVED: DATE
APPROVED: DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

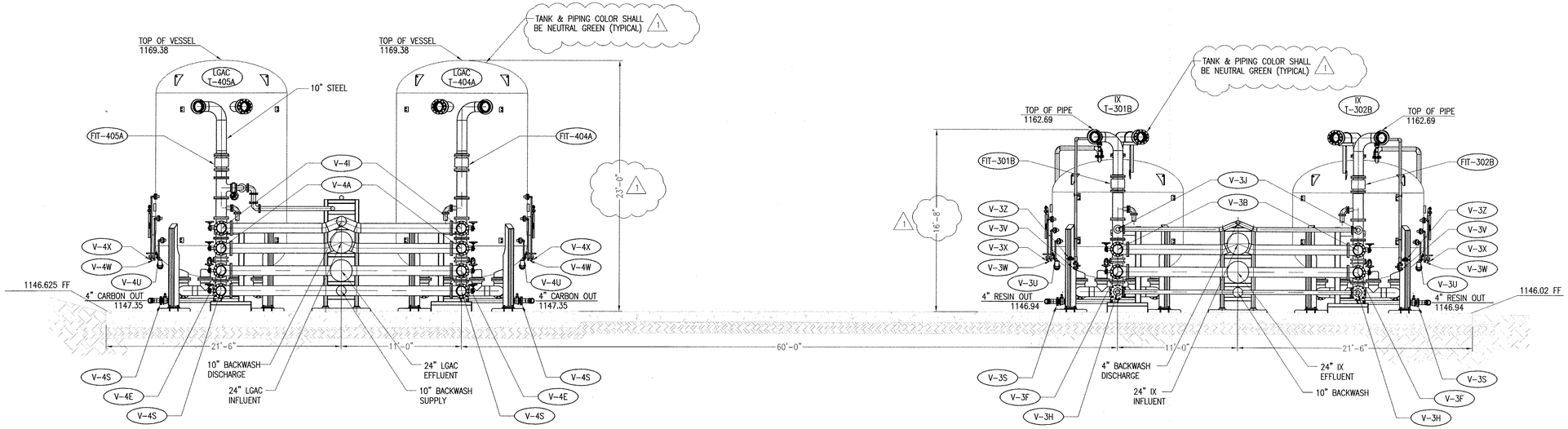
Battelle
The Business of Innovation

CITY OF PASADENA INCORPORATED JUNE 1886

D.S.-209 & 210A

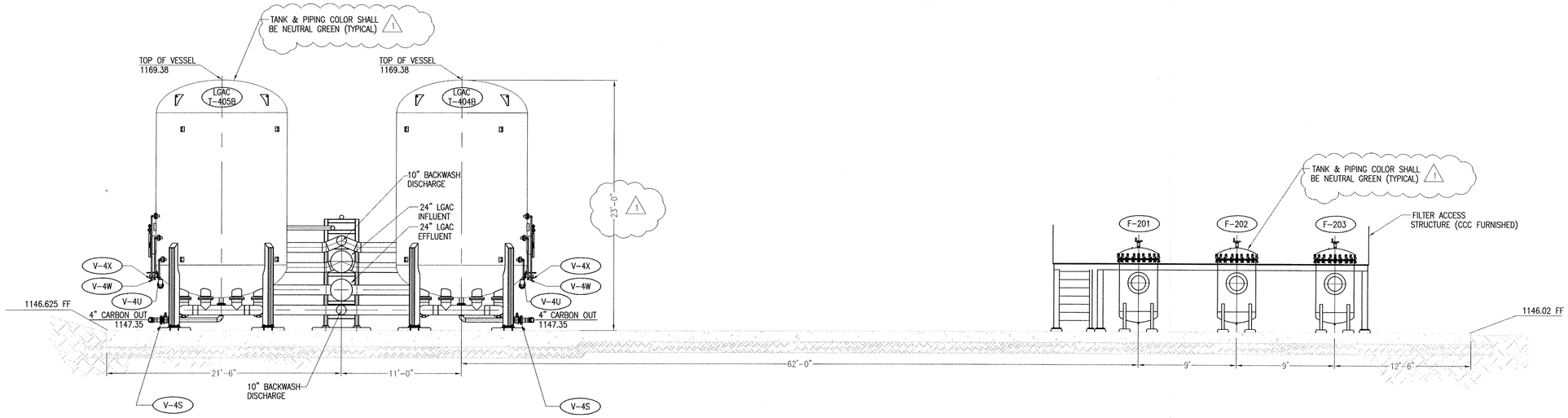
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FEBRUARY 2009	AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 26 OF 79 SHEETS
DRAWN BY CIVILTEC		MONK HILL TREATMENT SYSTEM VESSELS PLAN	WORK ORDER 02557 / FILE NUMBER E-1670
DESIGNED BY CIVILTEC			
CHECKED BY CIVILTEC			
SUBMITTED BY CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED / REVISION

X:\2007\27140-JP_MONKHILL TREATMENT PLANT\DWGS\SUBMITTALS\FINAL SUBMITTAL\27140-TPM-101.DWG (02-25-09 2:36:20PM)



TREATMENT VESSELS ELEVATION A / TPM-101

SCALE: 3/16"=1'-0"



FILTER VESSELS ELEVATION B / TPM-101

SCALE: 3/16"=1'-0"

TPM-102

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — 6/30/2010 — CIVIL — STATE OF CALIFORNIA

APPROVED BY: C. Shem Hawes 69578 CHRISTOPHER SHEM HAWES RCE — 2/25/08 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:

CIVILTEC engineering inc.

General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying

118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
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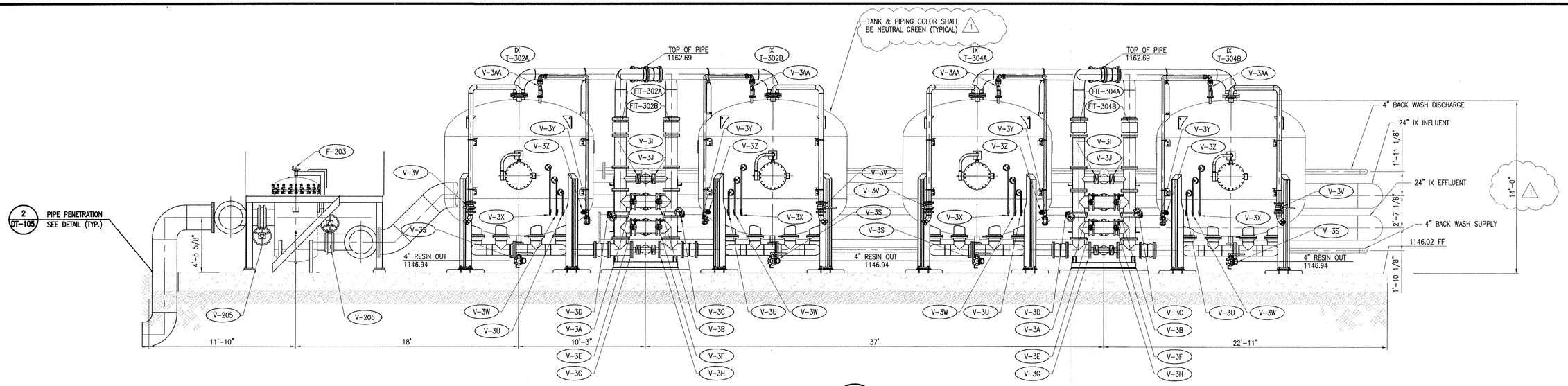
Battelle
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CITY OF PASADENA — INCORPORATED JUNE 1886

D.S.-209 & 210A

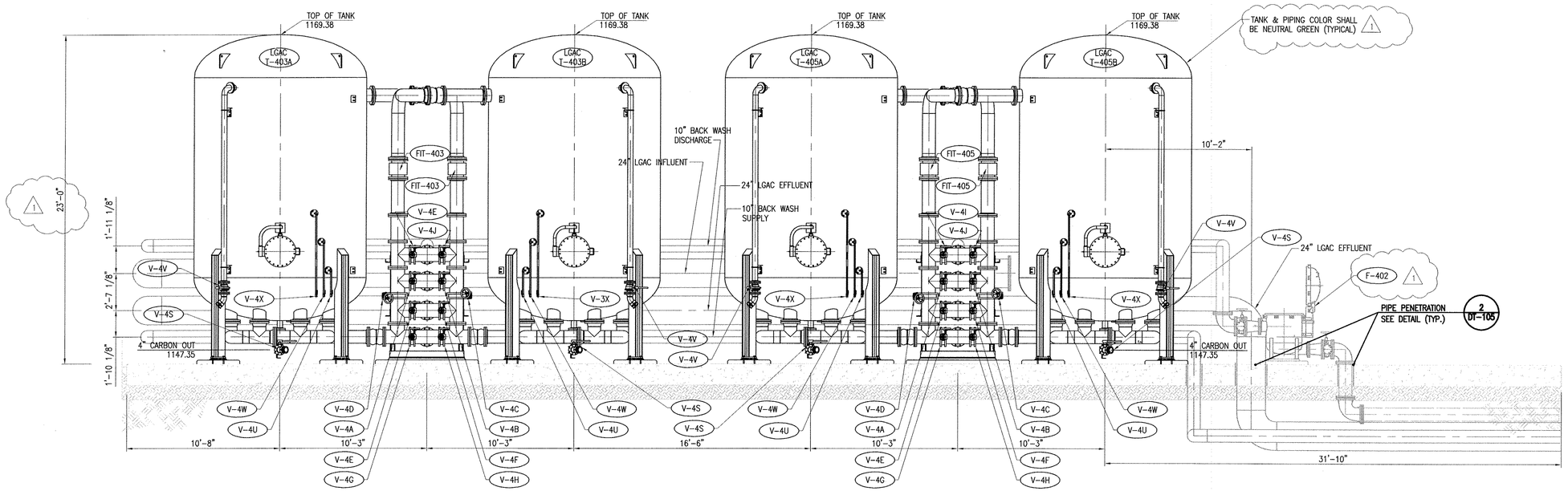
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DESIGNED BY CIVILTEC			
CHECKED BY CIVILTEC			
SUBMITTED BY CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED / REVISION

K:\2007\07145-JP\ MONHILL TREATMENT PLANT\DWG\SUBMITTALS\TPM-102.DWG (02-27-09 8:31:17AM)



IX VESSEL ELEVATION — C / TPM-101

SCALE: 1/4"=1'-0"



LGAC VESSEL ELEVATION — D / TPM-101

SCALE: 1/4"=1'-0"

TPM-103

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — 1/30/2010 — CIVIL — STATE OF CALIFORNIA

APPROVED BY: CHRISTOPHER SHEM HAWES 69578 RCE — 2/25/08 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

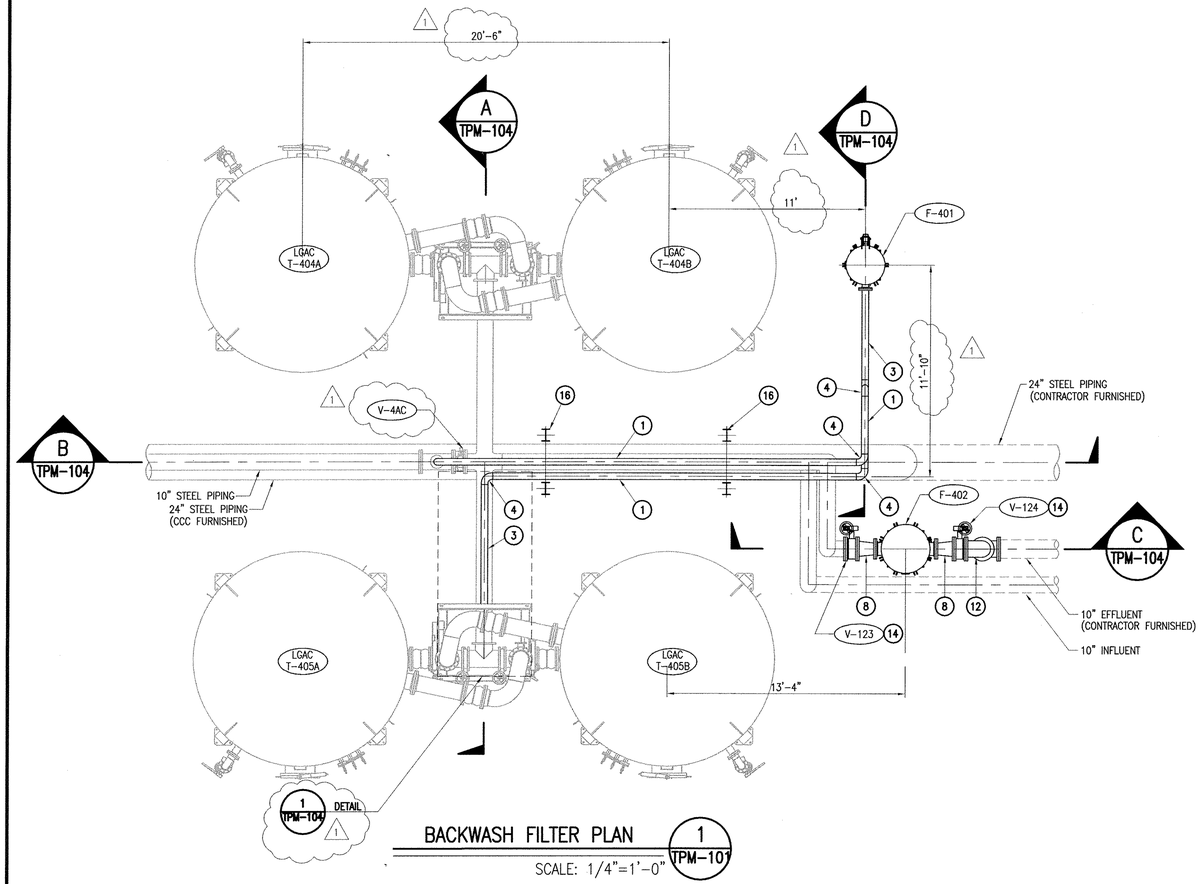
Battelle — The Business of Innovation

CITY OF PASADENA INCORPORATED JUNE 1886

D.S.-209 & 210A

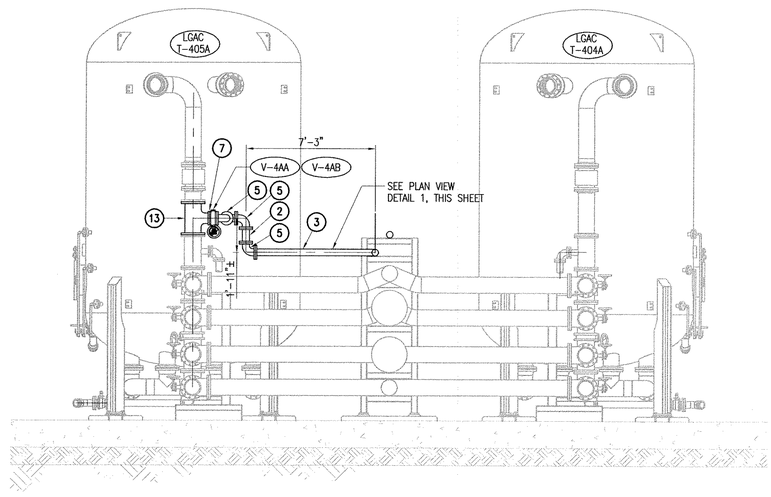
DATE: FEBRUARY 2009	SCALE: AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 28 OF 79 SHEETS
DRAWN BY: CIVILTEC DESIGNED BY: CIVILTEC CHECKED BY: CIVILTEC SUBMITTED BY: CIVILTEC		MONK HILL TREATMENT SYSTEM VESSELS ELEVATIONS	WORK ORDER 02557 / FILE NUMBER E-1670
FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

J:\02007-07140-JPL MONHILL TREATMENT PLANT OMM\SUBMITTALS\FINAL SUBMITTAL\27140-TPM-103.DWG (02-27-09 8:49:16AM)



BACKWASH FILTER PLAN (1 / TPM-107)

SCALE: 1/4"=1'-0"

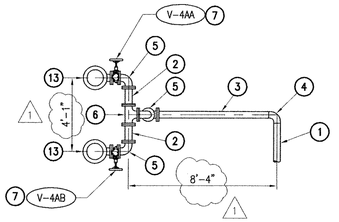


SECTION A (TPM-104)

SCALE: 1/4"=1'-0"

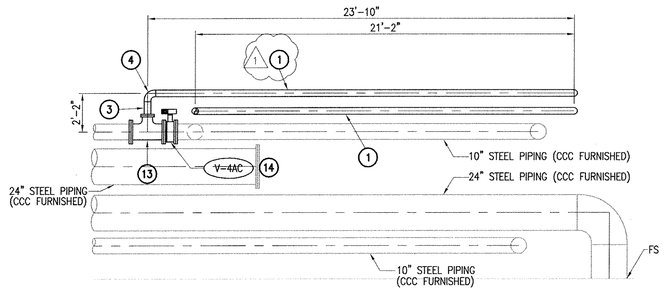
CONSTRUCTION NOTES

1. INSTALL 4" STEEL PIPE, PExPE
2. INSTALL 4" STEEL PIPE, FExFE
3. INSTALL 4" STEEL PIPE, FExPE
4. INSTALL 4"-90° STEEL BEND, PExPE
5. INSTALL 4"-90° STEEL BEND, FExFE
6. INSTALL 4"x4"x4" STEEL TEE, FExFExFE
7. INSTALL 4" BUTTERFLY VALVE, FExFE, WITH HANDWHEEL AND CHAIN
8. INSTALL 10"x8" STEEL REDUCER, FExFE
9. INSTALL 10" DUCTILE IRON PIPE, MJxFE
10. INSTALL 10"-90° DUCTILE IRON BEND, MJxMJ
11. INSTALL 10" ISOLATION KIT
12. INSTALL 10"-90° STEEL BEND, FExFE
13. INSTALL 10"x10"x4" STEEL TEE, FExFExFE
14. INSTALL 10" BUTTERFLY VALVE, FExFE, WITH HANDWHEEL AND CHAIN.
15. INSTALL CONCRETE PEDESTAL
16. INSTALL PIPE SUPPORT PER DETAIL 3, ON SHEET TPM-101.



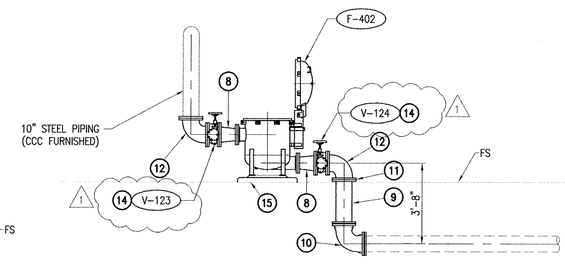
DETAIL (1 / TPM-104)

SCALE: 1/4"=1'-0"



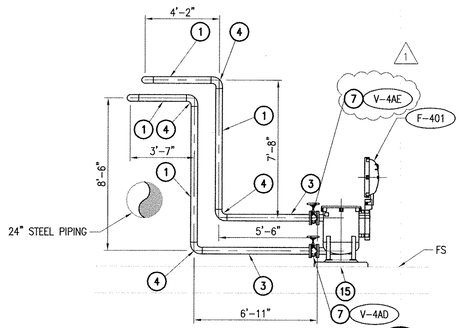
SECTION B (TPM-104)

SCALE: 1/4"=1'-0"



SECTION C (TPM-104)

SCALE: 1/4"=1'-0"



SECTION D (TPM-104)

SCALE: 1/4"=1'-0"

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

CHRISTOPHER SHEM HAWES .69578 6/30/2010 CIVIL — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

APPROVED BY: CHRISTOPHER SHEM HAWES 69578 RCE — 2/25/08 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

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CITY OF PASADENA INCORPORATED JUNE 1886

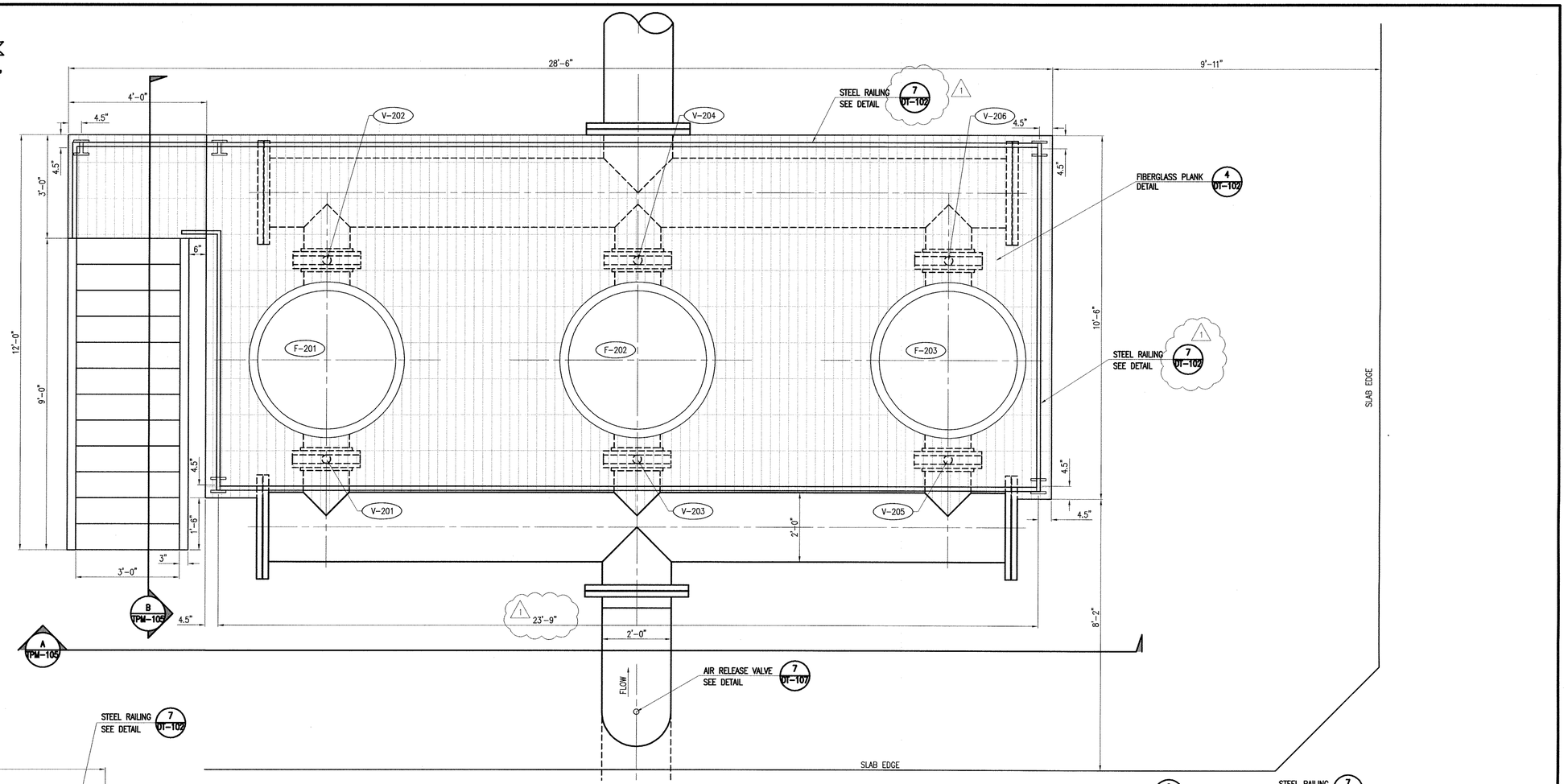
D.S.-209 & 210A

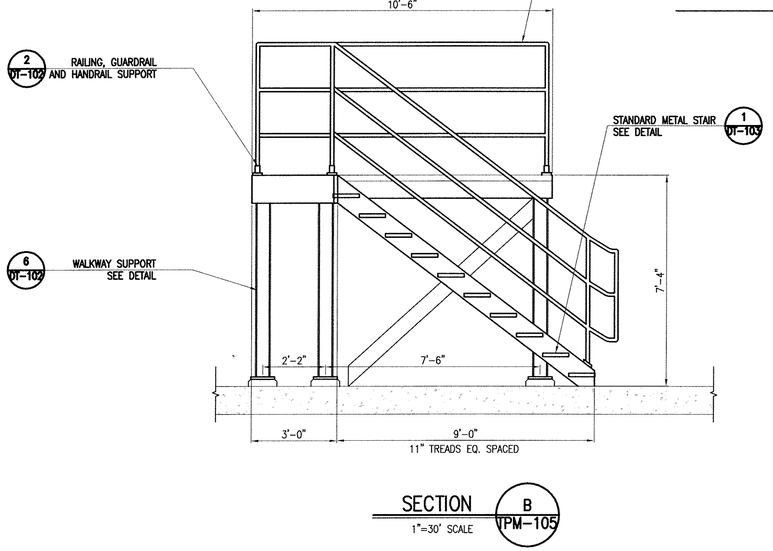
DATE	SCALE		
FEBRUARY 2009	AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 29 OF 79 SHEETS
DRAWN BY CIVILTEC		MONK HILL TREATMENT SYSTEM BACKWASH FILTER	WORK ORDER 02557 / FILE NUMBER E-1670
DESIGNED BY CIVILTEC			
CHECKED BY CIVILTEC			
SUBMITTED BY CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

TPM-104

X:\2007\27140-JR\ MONKHILL TREATMENT PLANT\DWG\SUBMITTALS\27140-TPM-104.DWG (02-26-09 2:36:36PM)

SCALE 1"=20'

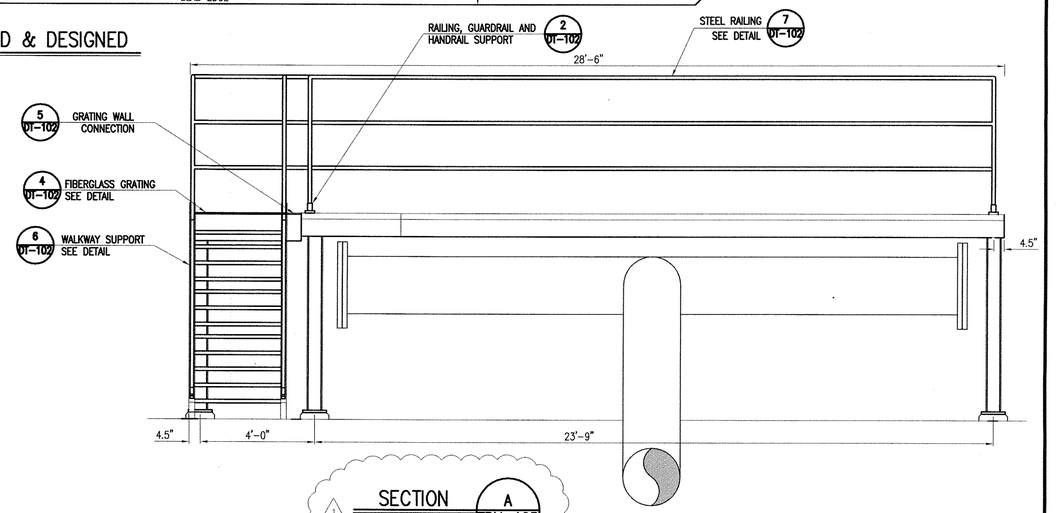




SECTION B TPM-105
1"=30' SCALE

ALL FILTER PLATFORM EQUIPMENT CCC FURNISHED & DESIGNED
1"=20' SCALE

* FILTERS NOT SHOWN FOR CLARITY



1 SECTION A TPM-105
1"=30' SCALE

TPM-105

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — 6/30/2010 — CIVIL — STATE OF CALIFORNIA

APPROVED BY:
CHRISTOPHER SHEM HAWES 69578 RCE — 2/25/08 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

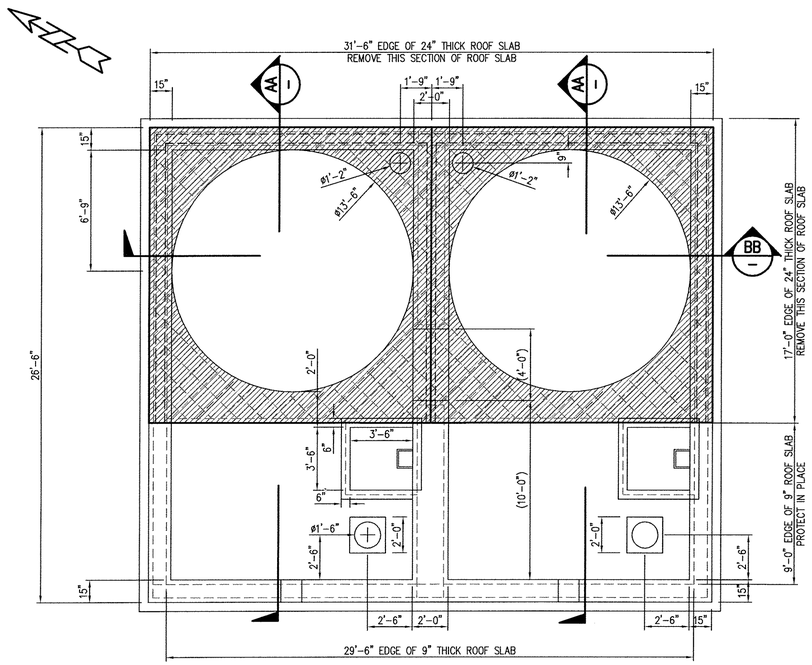
Battelle
The Business of Innovation

CITY OF PASADENA INCORPORATED JUNE 1886

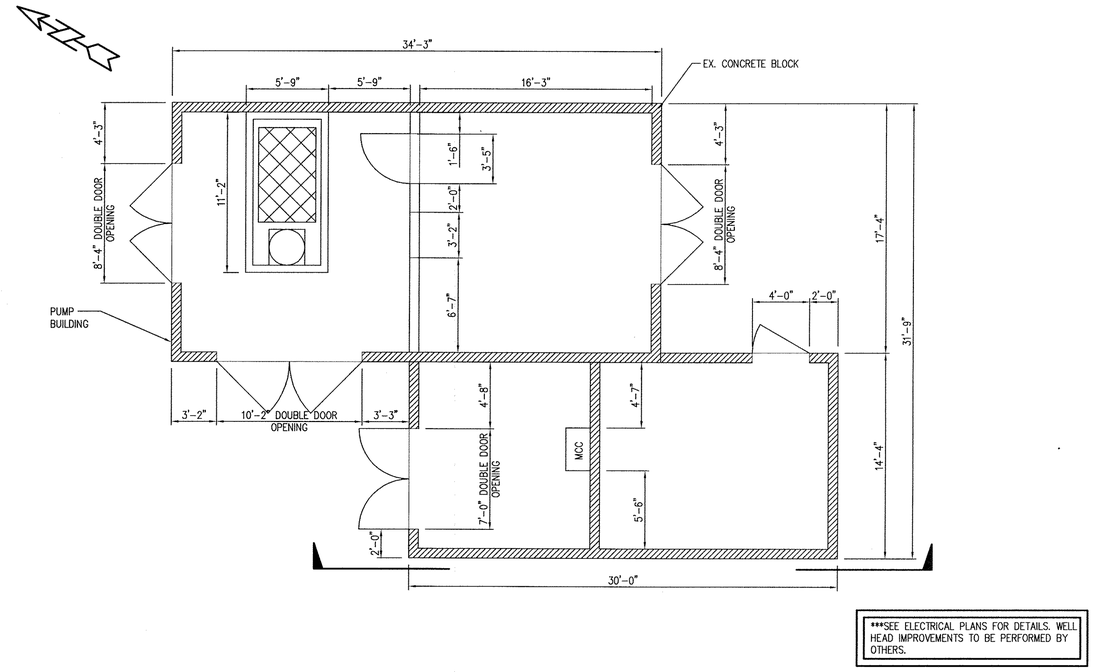
D.S.-209 & 210A

DATE: FEBRUARY 2009	SCALE: AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 30 OF 79 SHEETS
DRAWN BY: CIVILTEC DESIGNED BY: CIVILTEC CHECKED BY: CIVILTEC SUBMITTED BY: CIVILTEC		MONK HILL TREATMENT SYSTEM STAIRS, GUARDRAIL & HANDRAIL PLAN	WORK ORDER: 02557 / FILE NUMBER: E-1670
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED / REVISION

X:\2007\27140-JR, MONKHILL TREATMENT PLANT\DWG\SUBMITTALS\FINAL SUBMITTAL\27140-TPM-105.DWG (02-25-09 2:39:02PM)

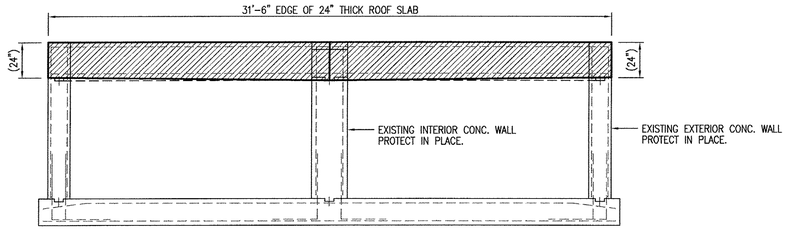


EXISTING SUMP STRUCTURE
SCALE: 1/4"=1'-0"

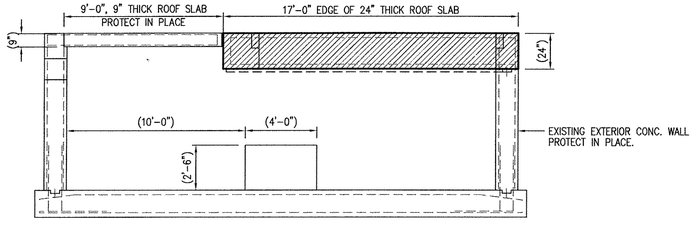


***SEE ELECTRICAL PLANS FOR DETAILS. WELL HEAD IMPROVEMENTS TO BE PERFORMED BY OTHERS.

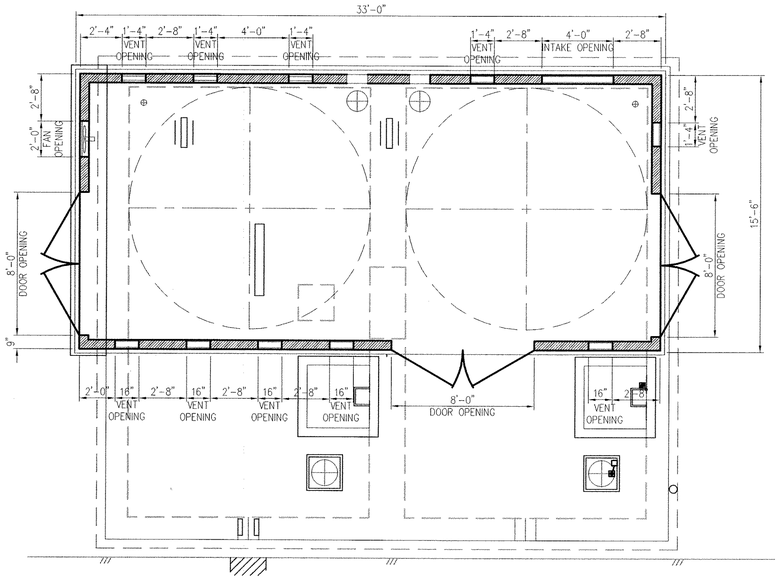
EXISTING WELL BUILDING PLAN
SCALE: 1"=5'-0"



SECTION BB
SCALE: 1/4"=1'-0"



SECTION AA
SCALE: 1/4"=1'-0"



NEW BUILDING WALL OPENINGS
SCALE: 1/4"=1'-0"

VWA-101

REVISION		
NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER
CHRISTOPHER SHEM HAWES
69578
6/30/2010
CIVIL
STATE OF CALIFORNIA

APPROVED BY: C. Shem Hawes 69578 2/25/08
CHRISTOPHER SHEM HAWES RCE DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

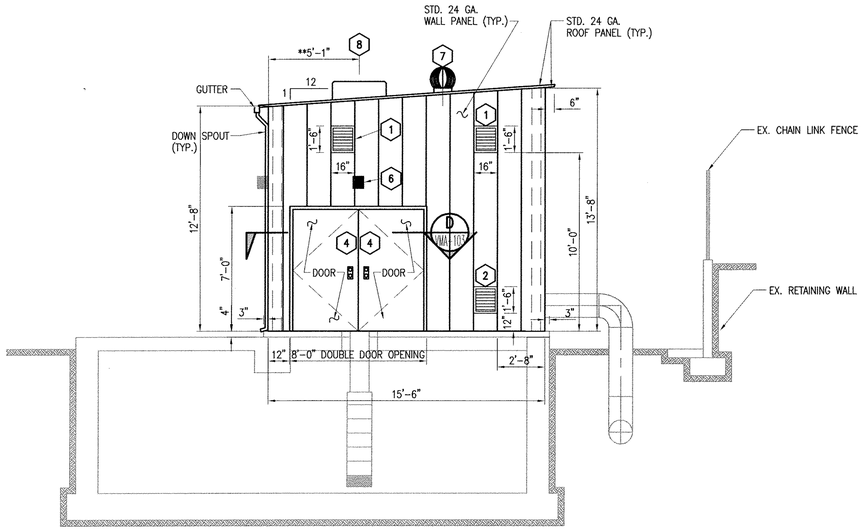
Battelle
The Business of Innovation

CITY OF PASADENA INCORPORATED JUNE 1886

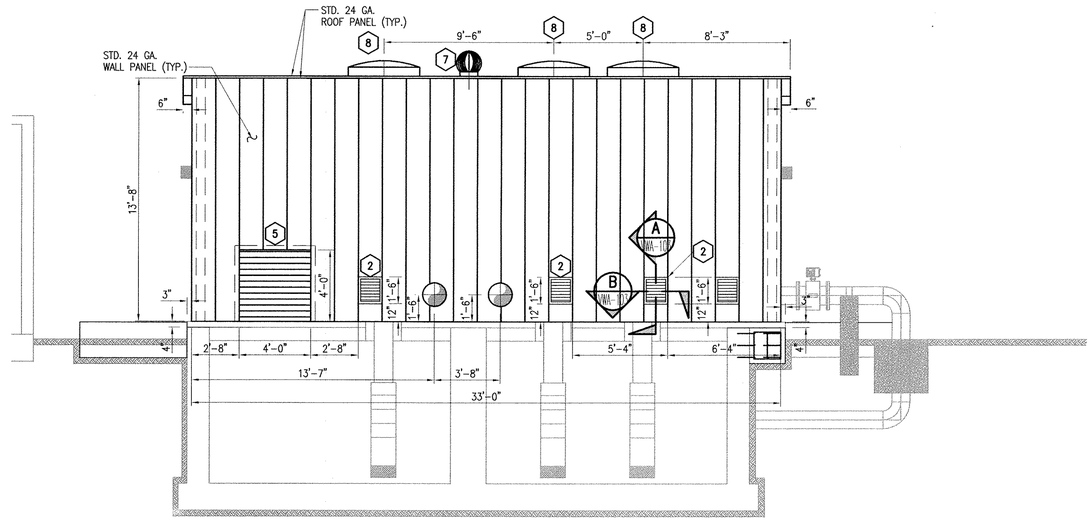
D.S.-209 & 210A

DATE	SCALE		
FEBRUARY 2009	AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 31 OF 79 SHEETS
DRAWN BY CIVILTEC		MONK HILL TREATMENT SYSTEM VENTURA WELL ARCHITECTURAL PLAN	WORK ORDER 02557 / FILE NUMBER E-1670
DESIGNED BY CIVILTEC			
CHECKED BY CIVILTEC			
SUBMITTED BY CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED / REVISION

X:\2007\27140-JR, MONKHILL TREATMENT PLANT\DWG\SUBMITTALS\FINAL SUBMITTAL\27140-VWA-101.DWG (02-25-09 2:39:54PM)



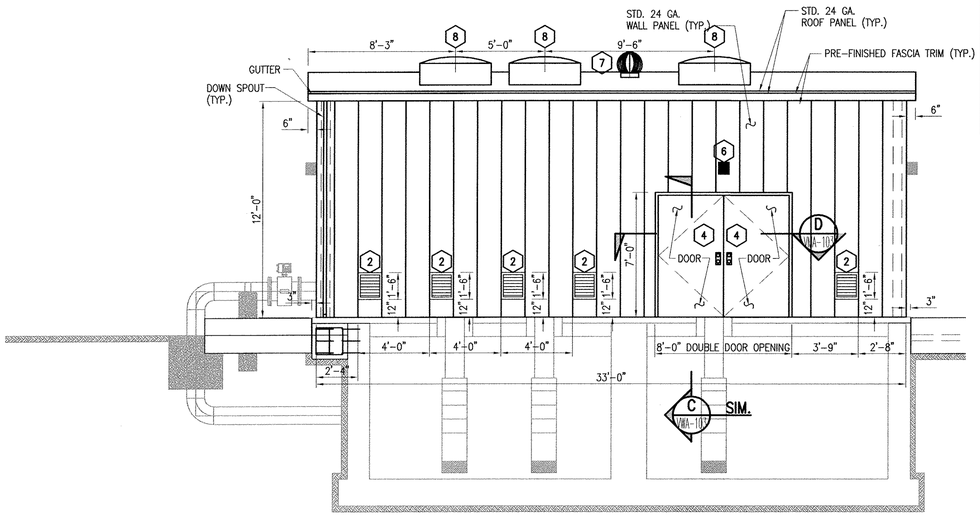
SOUTH ELEVATION
SCALE: 1/4"=1'-0"



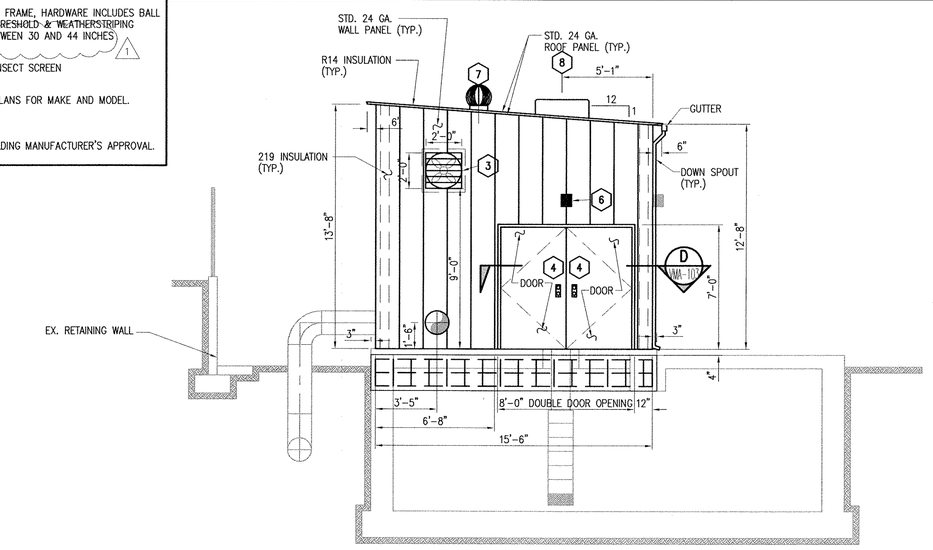
EAST ELEVATION
SCALE: 1/4"=1'-0"

LEGEND

1. 16"x18" HIGH FIXED BLADE LOUVER WITH INSECT SCREEN WITH BOTTOM AT FINISHED FLOOR +10'-0" (TYPICAL OF 2).
2. 16" WIDEx18" HIGH FIXED BLADE LOUVER WITH INSECT SCREEN WITH BOTTOM AT FINISHED FLOOR +1'-0" (TYPICAL).
3. WALL EXHAUST FAN UNIT WITH 24" SQ. DAMPER AND INSECT SCREEN WITH TOP AT FINISHED FLOOR +9'-0" (TYPICAL OF 1).
4. 4'-0"x7'-0" FULL FLUSH SOLID CORE, METAL DOOR FRAME, HARDWARE INCLUDES BALL BEARING HINGES, MORTISED LOCKSET, ALUMINUM THRESHOLD & WEATHERSTRIPING (TYPICAL OF 6). LOCKSET SHALL BE CENTERED BETWEEN 30 AND 44 INCHES ABOVE FLOOR AND LEVEL TYPE. (1)
5. INTAKE 48" SQUARE LOUVERS WITH DAMPER AND INSECT SCREEN AT FINISHED FLOOR +0'-0" (TYPICAL OF 1).
6. WALL MOUNTED EXTERIOR LIGHT, SEE ELECTRICAL PLANS FOR MAKE AND MODEL.
7. ROOF MOUNTED GRAVITY TURBINE VENTILATOR.
8. 4' SQUARE ROOF MOUNTED HATCH COVER PER BUILDING MANUFACTURER'S APPROVAL.



WEST ELEVATION
SCALE: 1/4"=1'-0"



NORTH ELEVATION
SCALE: 1/4"=1'-0"

VWA-102

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — CIVIL — STATE OF CALIFORNIA — 11/30/2010

APPROVED BY: C. Shem Hawes 69578 CHRISTOPHER SHEM HAWES RCE — 2/25/08 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

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CITY OF PASADENA INCORPORATED JUNE 1886

D.S.-209 & 210A

DATE	SCALE
FEBRUARY 2009	AS SHOWN

DRAWN BY CIVILTEC
DESIGNED BY CIVILTEC
CHECKED BY CIVILTEC
SUBMITTED BY CIVILTEC

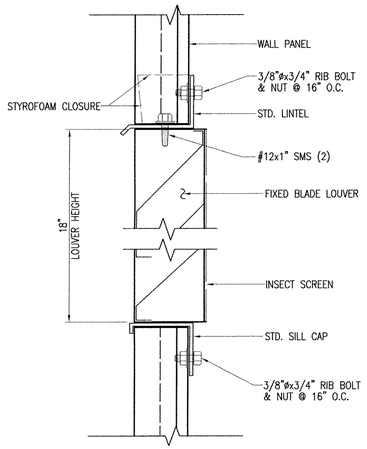
FIELD BOOKS | CALC BOOKS | APPROVED | APPROVED

PASADENA WATER & POWER
CITY OF PASADENA

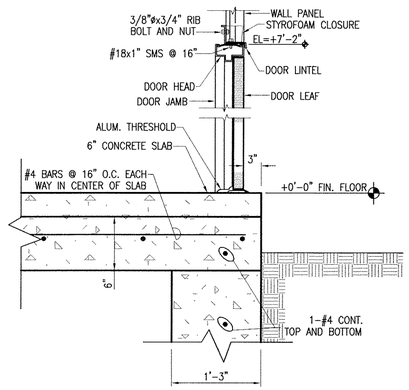
MONK HILL TREATMENT SYSTEM
VENTURA WELL ARCHITECTURAL ELEVATIONS

SHEET NO 32 OF 79 SHEETS
WORK ORDER 02557
FILE NUMBER E-1670
REVISION

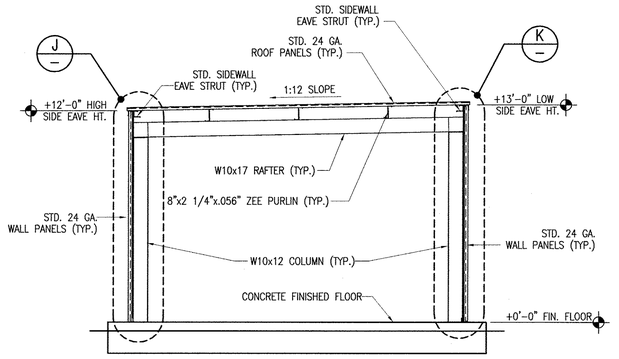
J:\JOBS\27145-PK MONKHILL TREATMENT PLANT\TWO\SUBMITTALS\FINAL SUBMITTAL\27145-VWA-102.DWG (02-27-09 8:58:22AM)



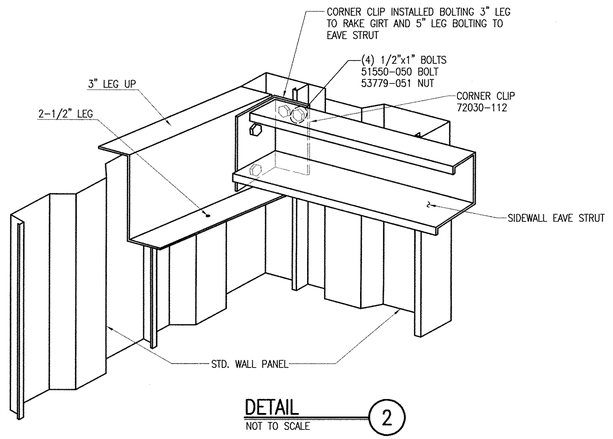
SECTION A
SCALE: 3"=1'-0" VWA-102



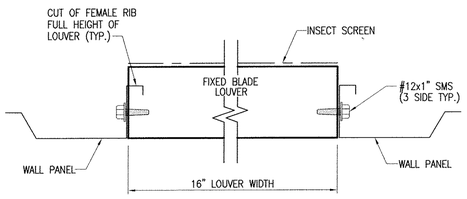
SECTION C
SCALE: 1"=1'-0" VWA-102



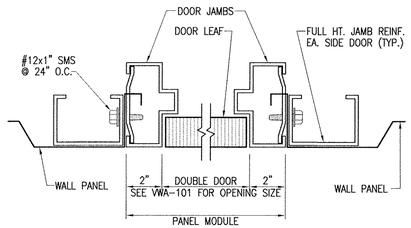
PUMP STATION FIXED BUILDING SECTION 1
SCALE: 1/4" = 1'-0" VWA-104



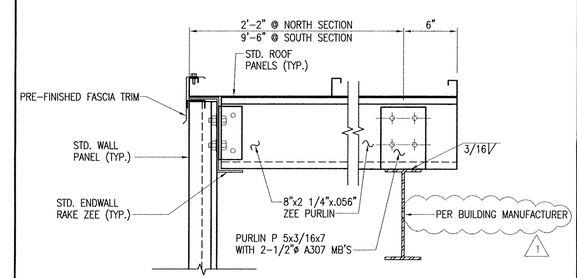
DETAIL 2
NOT TO SCALE



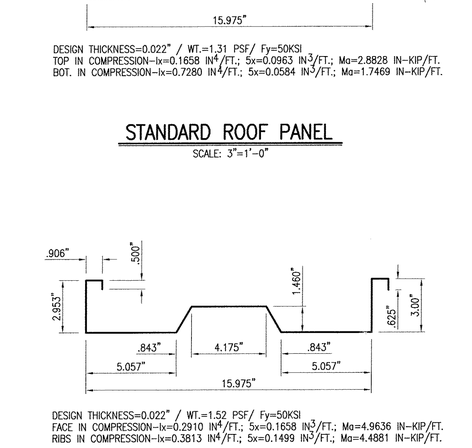
SECTION B
SCALE: 3"=1'-0" VWA-102



SECTION D
SCALE: 3"=1'-0" VWA-102



SECTION H
SCALE: 1 1/2" = 1'-0"

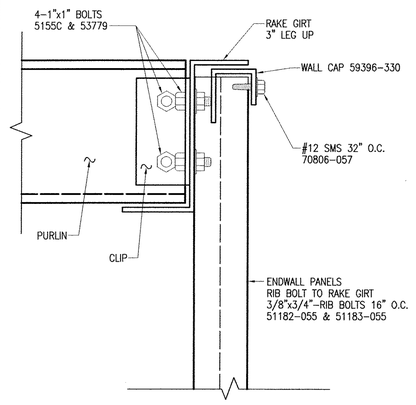


DESIGN THICKNESS=0.022" / WT.=1.31 PSF/ Fy=50KSI
TOP IN COMPRESSION-Ix=0.1658 IN^4/FT.; Sx=0.0963 IN^3/FT.; Ma=2.8828 IN-KIP/FT.
BOT. IN COMPRESSION-Ix=0.7280 IN^4/FT.; Sx=0.0584 IN^3/FT.; Ma=1.7469 IN-KIP/FT.

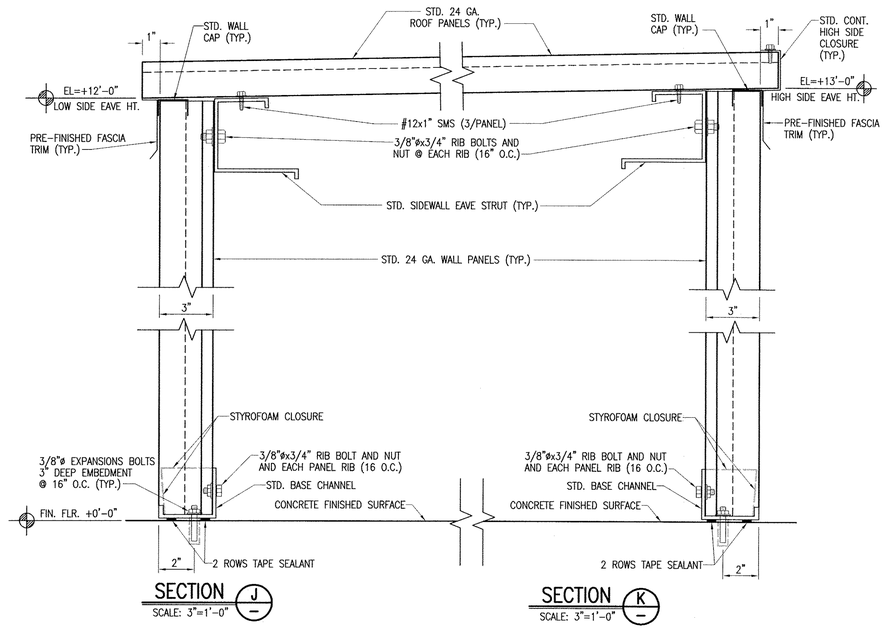
STANDARD ROOF PANEL
SCALE: 3"=1'-0"

DESIGN THICKNESS=0.022" / WT.=1.52 PSF/ Fy=50KSI
FACE IN COMPRESSION-Ix=0.2910 IN^4/FT.; Sx=0.1658 IN^3/FT.; Ma=4.9636 IN-KIP/FT.
RIBS IN COMPRESSION-Ix=0.3813 IN^4/FT.; Sx=0.1499 IN^3/FT.; Ma=4.4881 IN-KIP/FT.

STANDARD WALL PANEL
SCALE: 3"=1'-0"

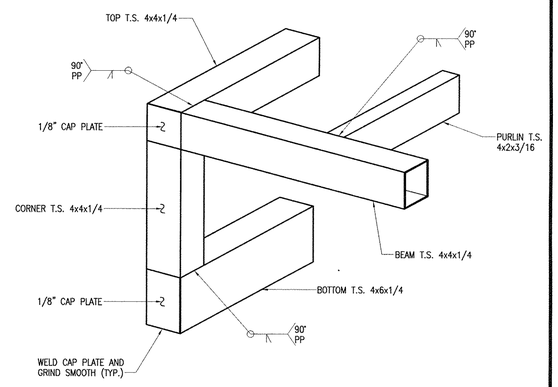


SECTION E
NOT TO SCALE



SECTION J
SCALE: 3"=1'-0"

SECTION K
SCALE: 3"=1'-0"



DETAIL 1
NOT TO SCALE

VWA-103

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

CHRISTOPHER SHEM HAWES 69578 CIVIL STATE OF CALIFORNIA REGISTERED PROFESSIONAL ENGINEER 6/30/2010

APPROVED BY: CHRISTOPHER SHEM HAWES RCE 69578 — 2/25/08 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

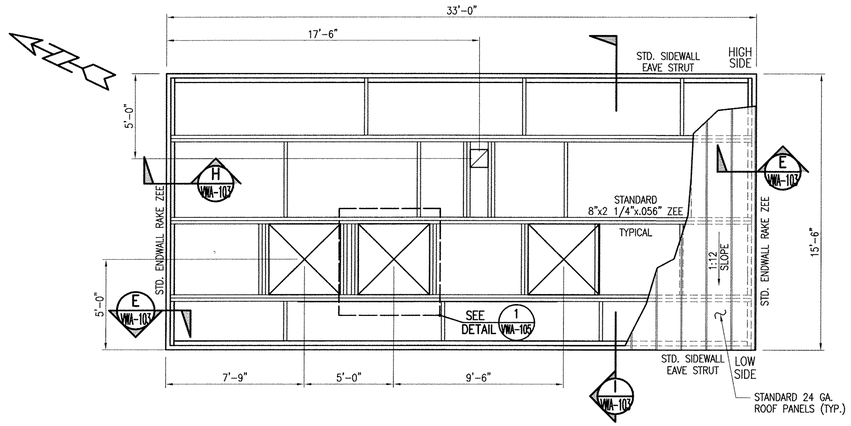
Battelle
The Business of Innovation

CITY OF PASADENA INCORPORATED JUNE 1886

D.S.-209 & 210A

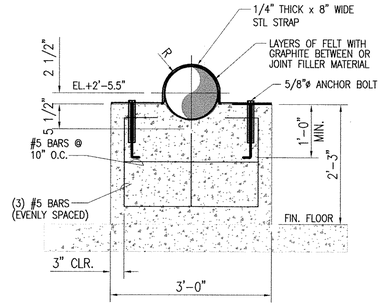
DATE: FEBRUARY 2009	SCALE: AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 33 OF 79 SHEETS
DRAWN BY CIVILTEC; DESIGNED BY CIVILTEC; CHECKED BY CIVILTEC; SUBMITTED BY CIVILTEC		MONK HILL TREATMENT SYSTEM VENTURA WELL ARCHITECTURAL BUILDING SECTIONS	WORK ORDER 02557 / FILE NUMBER E-1670
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED / REVISION

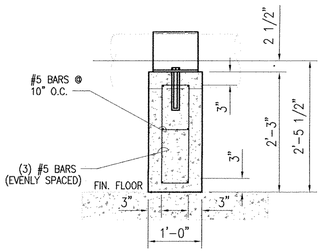
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ROOF FRAMING PLAN

SCALE: 1/4" = 1'-0"





CONC. PIPE SUPPORT DETAIL 5

SCALE: 3/4" = 1'-0"

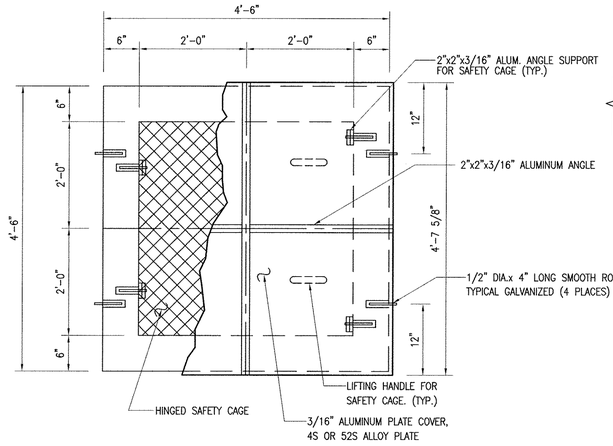
VMS-102

NOT USED 1

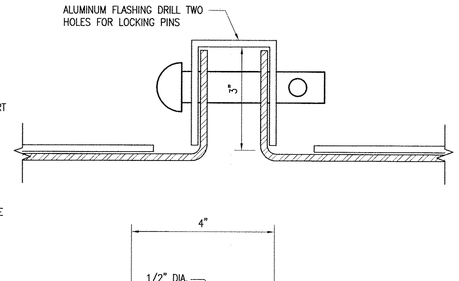
NOT TO SCALE

NOT USED 2

NOT TO SCALE

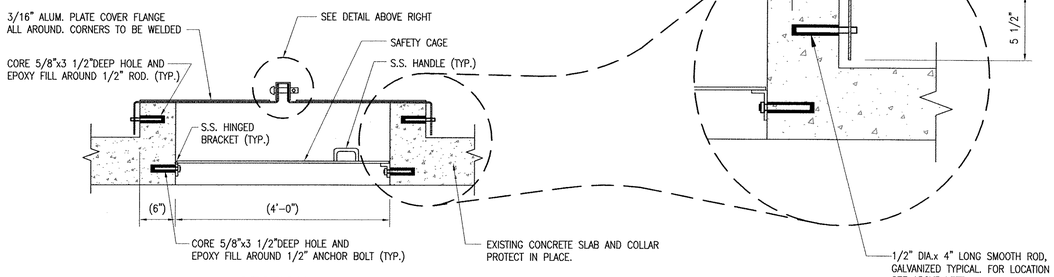


PLAN VIEW



LOCKING PIN DETAIL

NOT TO SCALE

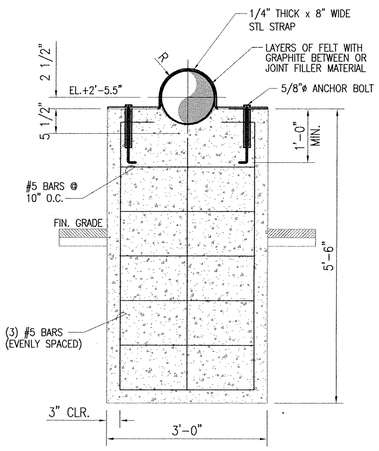


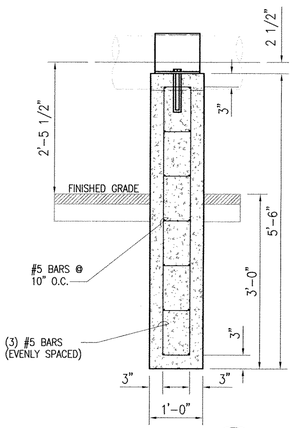
SECTION

SUMP ACCESS COVER DETAIL 3

SCALE: 1/2"=1'-0"

VMS-101





CONC. PIPE SUPPORT DETAIL 4

SCALE: 3/4" = 1'-0"

VMS-102

VWA-104

REVISION		
NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — 6/30/2010 — CIVIL — STATE OF CALIFORNIA

APPROVED BY:
C. Shem Hawes 69578 2/25/08
CHRISTOPHER SHEM HAWES RCE DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

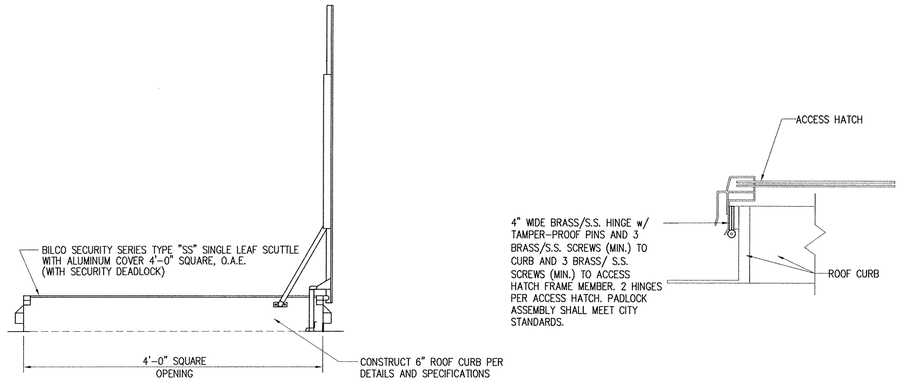
Battelle
The Business of Innovation

CITY OF PASADENA * INCORPORATED JUNE 1886 *

D.S.-209 & 210A

DATE	SCALE	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 34 OF 79 SHEETS
FEBRUARY 2009	AS SHOWN		
DRAWN BY CIVILTEC		MONK HILL TREATMENT SYSTEM VENTURA WELL STRUCTURAL BUILDING DETAILS	WORK ORDER 02557 / FILE NUMBER E-1670
DESIGNED BY CIVILTEC			
CHECKED BY CIVILTEC			
SUBMITTED BY CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

X:\2007\27140-JR_MONKHILL TREATMENT PLANT\DWG\SUBMITTALS\FINAL SUBMITTAL\27140-JR04-104.DWG (02-27-09 9:00:19AM)



ROOF HATCH DETAIL (1 / VWA-104)

SCALE: NTS

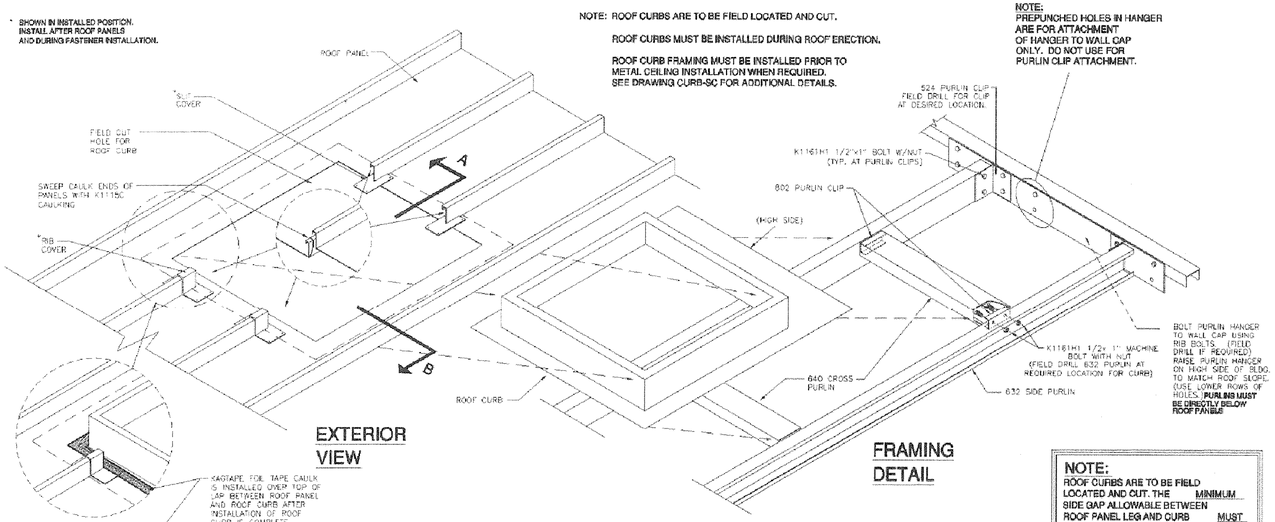
* SHOWN IN INSTALLED POSITION. INSTALL AFTER ROOF PANELS AND DURING FASTENER INSTALLATION.

NOTE: ROOF CURBS ARE TO BE FIELD LOCATED AND CUT.

ROOF CURBS MUST BE INSTALLED DURING ROOF ERECTION.

ROOF CURB FRAMING MUST BE INSTALLED PRIOR TO METAL CEILING INSTALLATION WHEN REQUIRED. SEE DRAWING CURB-SC FOR ADDITIONAL DETAILS.

NOTE: PREPUNCHED HOLES IN HANGER ARE FOR ATTACHMENT OF HANGER TO WALL CAP ONLY. DO NOT USE FOR PURLIN CLIP ATTACHMENT.



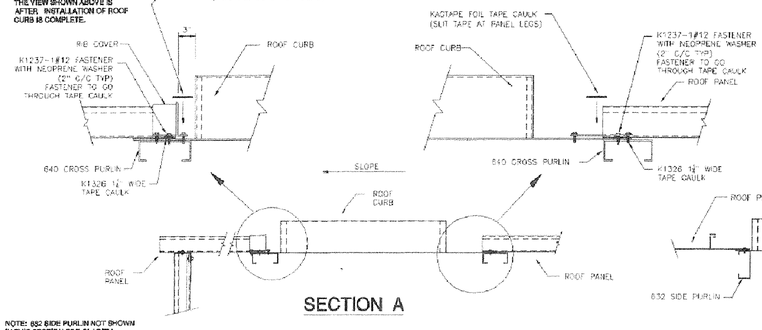
EXTERIOR VIEW

FRAMING DETAIL

NOTE:
ROOF CURBS ARE TO BE FIELD LOCATED AND CUT. THE MINIMUM SIDE GAP ALLOWABLE BETWEEN ROOF PANEL LEG AND CURB MUST BE 6" FOR PROPER CAULKING.

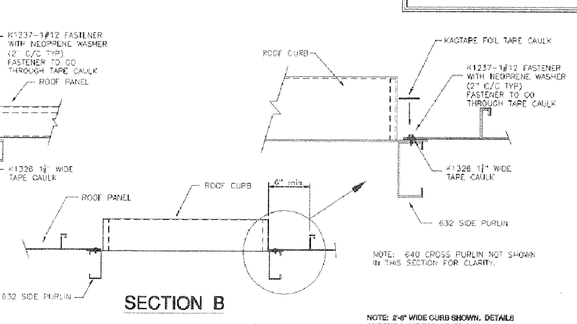
KAGTAPE FOIL TAPE CAULK IS INSTALLED OVER TOP OF LAP BETWEEN ROOF PANEL AND ROOF CURB AFTER INSTALLATION OF ROOF CURB IS COMPLETE. (FULL PERIMETER OF CURB)

NOTE: THE VIEW SHOWN ABOVE IS AFTER INSTALLATION OF ROOF CURB IS COMPLETE.



SECTION A

NOTE: 632 SIDE PURLIN NOT SHOWN IN THIS SECTION FOR CLARITY.



SECTION B

NOTE: 640 CROSS PURLIN NOT SHOWN IN THIS SECTION FOR CLARITY.

NOTE: 2'-6" WIDE CURB SHOWN. DETAILS ARE THE SAME FOR OTHER SIZES.

VWA-105

REVISION		
NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — CIVIL — STATE OF CALIFORNIA — 6/30/2010

APPROVED BY:
CHRISTOPHER SHEM HAWES RCE 69578 — 2/25/08 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

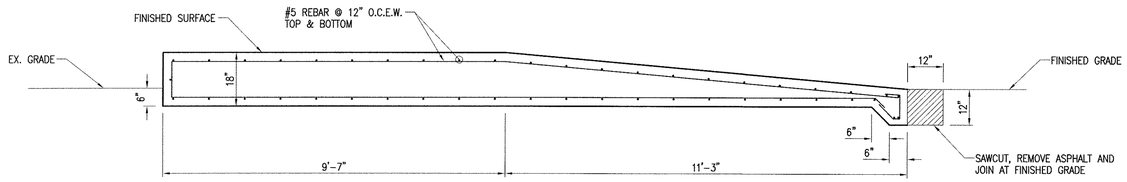
Battelle
The Business of Innovation

CITY OF PASADENA INCORPORATED JUNE 1886

D.S.-209 & 210A

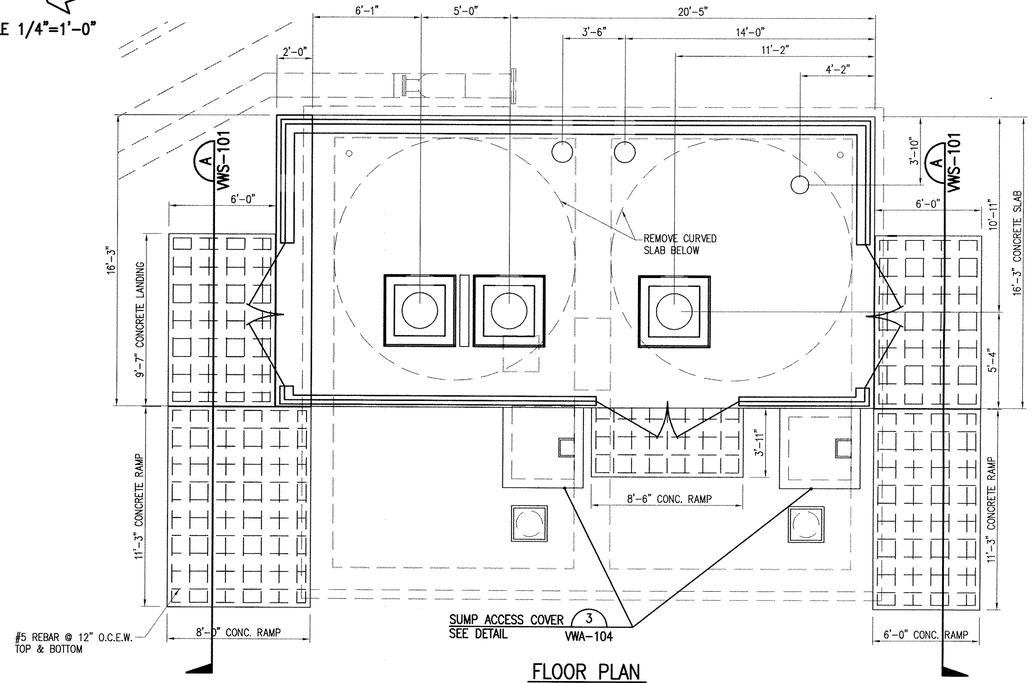
DATE	SCALE	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 35 OF 79 SHEETS
FEBRUARY 2009	AS SHOWN		
DRAWN BY CIVILTEC		MONK HILL TREATMENT SYSTEM VENTURA WELL ARCHITECTURAL DETAILS	WORK ORDER 02557 / FILE NUMBER E-1670
DESIGNED BY CIVILTEC			
CHECKED BY CIVILTEC			
SUBMITTED BY CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

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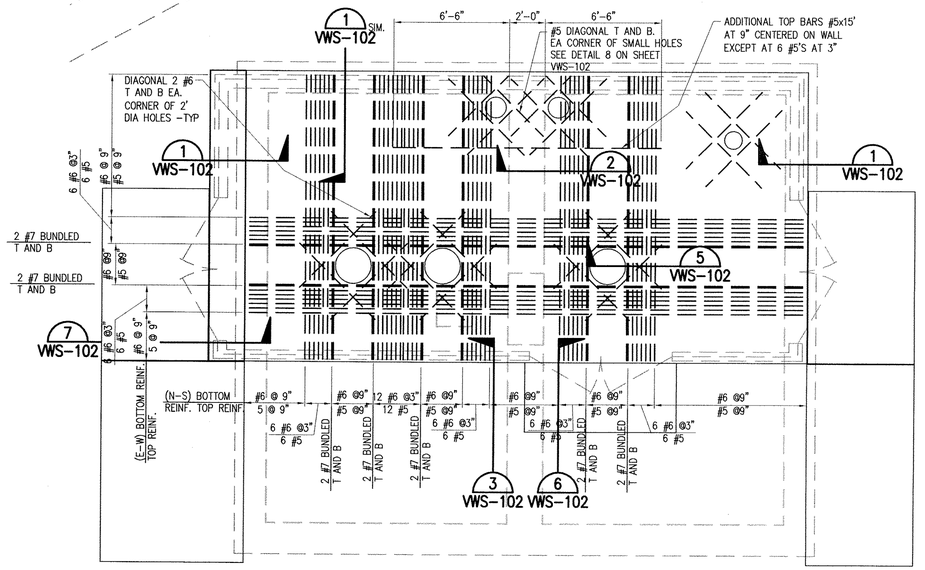
SECTION A
SCALE: 1/2"=1'-0"

SCALE 1/4"=1'-0"



FLOOR PLAN
SCALE: 1/4"=1'-0"

SCALE 1/4"=1'-0"



CONCRETE SLAB NOTES

1. REINFORCEMENT PLACEMENT
   a. BOTTOM BARS:
   –PLACE N–S BARS AT BOTTOM LAYER
   –PLACE E–W BARS AT TOP LAYER
   b. TOP BARS:
   –PLACE E–W BARS AT BOTTOM LAYER
   –PLACE N–S BARS AT TOP LAYER
2. SPLICES IN SLAB REINF. ARE PERMITTED ONLY AS FOLLOWS:
   a. BOTTOM BARS; OVER THE CENTER WALL
   b. TOP BARS; AT MID-SPAN

SLAB REINFORCEMENT
SCALE: 1/4"=1'-0"

VWS-101

REVISION		
NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER
CHRISTOPHER SHEM HAWES
69578
6/30/2010
CIVIL
STATE OF CALIFORNIA

APPROVED BY:
CHRISTOPHER SHEM HAWES RCE 69578 — 2/25/08 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

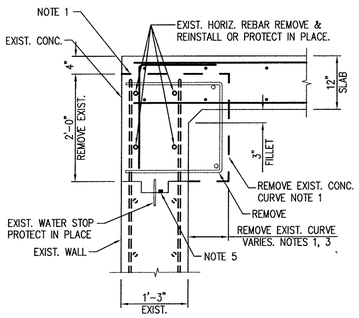
Battelle
The Business of Innovation

CITY OF PASADENA INCORPORATED JUNE 1886

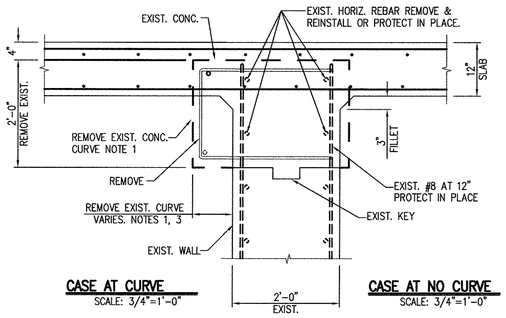
D.S.–209 & 210A

DATE	SCALE	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 36 OF 79 SHEETS
FEBRUARY 2009	AS SHOWN		
DRAWN BY CIVILTEC		MONK HILL TREATMENT SYSTEM	WORK ORDER 02557 / FILE NUMBER E–1670
DESIGNED BY CIVILTEC		VENTURA WELL STRUCTURAL PLAN	
CHECKED BY CIVILTEC			
SUBMITTED BY CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

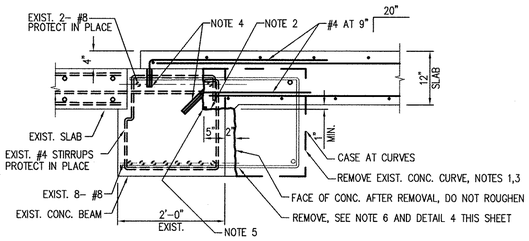
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SECTION AT EXTERIOR WALL 1
SCALE: 3/4"=1'-0" VWS-101

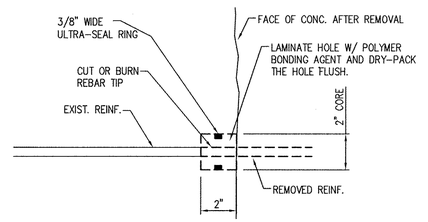


SECTION AT INTERIOR WALL 2
SCALE: 3/4"=1'-0" VWS-101

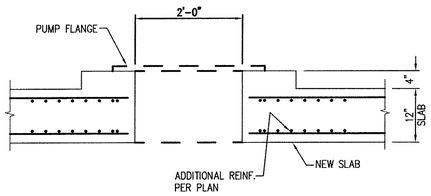


SECTION AT BEAM 3
SCALE: 3/4"=1'-0" VWS-101

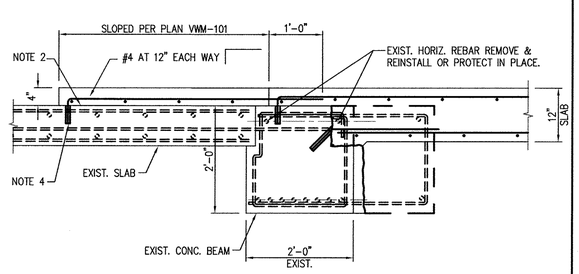
NOTES:
1. REMOVE EXISTING CONCRETE UP TO CONSTRUCTION JOINT AND KEY AND EXPOSE EXISTING REBAR. DO NOT CUT EX. VERTICAL REINF.
2. ROUGHEN SURFACE TO 1/4 IN. AMPLITUDE. TYP. FOR ALL SURFACES TO RECEIVE NEW CONCRETE.
3. SHORE EDGES OF CONCRETE CURVE PRIOR TO CONCRETE REMOVAL.
4. DRILL 6" DEEP AND INSERT DOWEL WITH EPOXY. PRIOR TO DRILLING, DETECT AND MARK EXISTING REINFORCING AND DRILL MIN. 1" CLEAR OF REINF. ALL DRILLING AND ANCHOR INSTALLATION SHALL BE ACCORDING TO EPOXY ESR- APPROVAL REPORT AND REQUIRES DEPUTY INSPECTION.
5. 3/4" ADEKA ULTRA-SEAL MC-2010 MN
6. CORE 2" DIA. AND CHIP OUT CONC. REMOVE EXISTING REINF. TO 2" BELOW SURFACE. LAMINATE HOLE W/ POLYMER BONDING AGENT AND DRY-PACK THE HOLE FLUSH. "SEE REINF." CAP DETAIL.



REINF. CAP 4
SCALE: 3"=1'-0" VWS-101

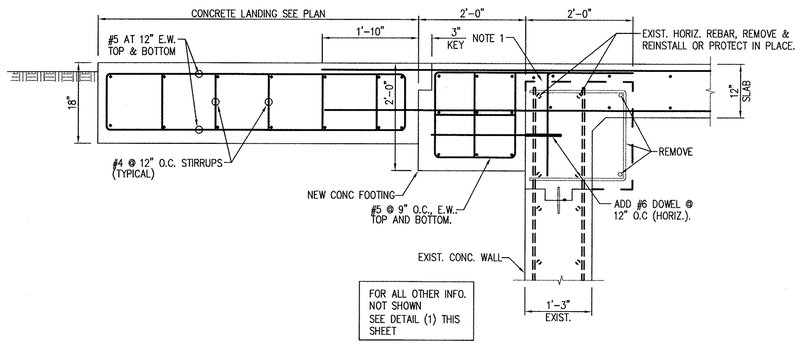


SECTION AT PUMP OPENING 5
SCALE: 3/4"=1'-0" VWS-101



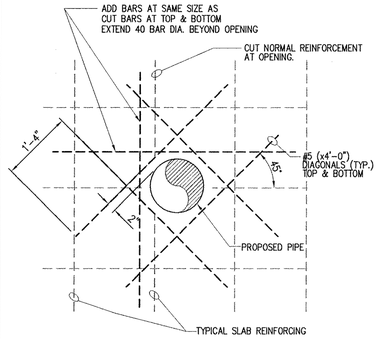
FOR ALL OTHER INFO. NOT SHOWN SEE DETAIL (3) THIS SHEET

LANDING OVER SLAB 6
SCALE: 3/4"=1'-0" VWS-101



FOR ALL OTHER INFO. NOT SHOWN SEE DETAIL (1) THIS SHEET

EXTERIOR LANDING 7
SCALE: 3/4"=1'-0" VWS-101



REINFORCEMENT AROUND FLOOR, ROOF & WALL PENETRATIONS DETAIL 8
SCALE: 3/4"=1'-0" VWS-101

VWS-102

REVISION		
NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — CIVIL — STATE OF CALIFORNIA — 6/30/2010

APPROVED BY:
C. Shem Hawes 69578 2/25/08
CHRISTOPHER SHEM HAWES RCE DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

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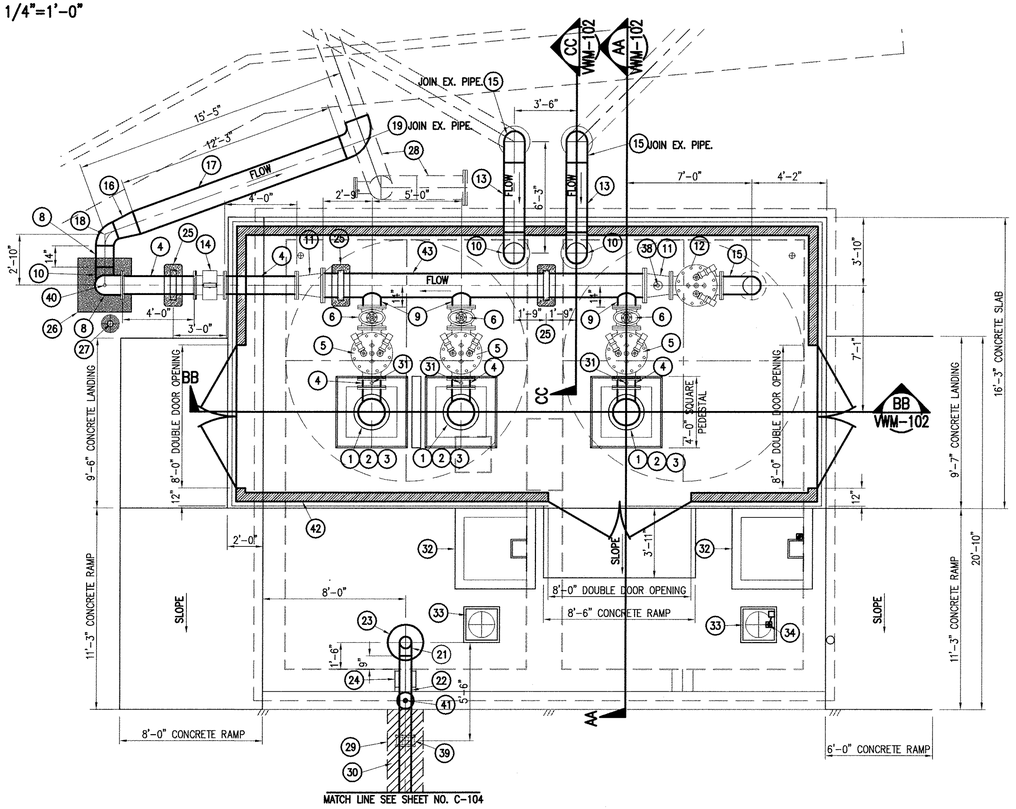
CITY OF PASADENA — INCORPORATED JUNE 1886

D.S.-209 & 210A

DATE	SCALE		
FEBRUARY 2009	AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 37 OF 79 SHEETS
DRAWN BY CIVILTEC		MONK HILL TREATMENT SYSTEM VENTURA WELL STRUCTURAL DETAILS	WORK ORDER 02557 / FILE NUMBER E-1670
DESIGNED BY CIVILTEC			
CHECKED BY CIVILTEC			
SUBMITTED BY CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED / REVISION

X:\2007\27140-JP_MONHILL TREATMENT PLANT\DWG\SUBMITTALS\27140-VWS-102.DWG (02-27-09 6:03:02AM)

SCALE 1/4"=1'-0"



PIPING PLAN
SCALE: 1/4"=1'-0"

CONSTRUCTION NOTES: (THIS SHEET ONLY)

1. INSTALL 250hp MOTOR. (SEE SPECIFICATIONS FOR MAKE AND MODEL)
2. INSTALL VERTICAL TURBINE PUMP. (2850gpm)
(SEE SPECIFICATIONS FOR MAKE AND MODEL. P-101, P-102, P-103 FROM LEFT TO RIGHT)
3. INSTALL 12" STEEL DISCHARGE HEADER, FExFE.
4. INSTALL 12" STEEL SPOOL, FExFE. (HORIZ.)
5. INSTALL 12" CHECK VALVE, FExFE, (SEE SPECIFICATIONS FOR MAKE AND MODEL. V-101, V-103, V-105 FROM LEFT TO RIGHT)
6. INSTALL 12" RESILIENT WEDGE GATE VALVE, FExFE, W/ HANDWHEEL OPERATOR.
(SEE SPECIFICATIONS FOR MAKE AND MODEL. V-102, V-104, V-106 FROM LEFT TO RIGHT)
7. INSTALL 8" DUCTILE IRON PIPE, PRESSURE CLASS 52.
8. INSTALL 12" STEEL SPOOL, WELDxWELD. (VERT.)
9. INSTALL 12" STEEL SPOOL, FExWELD. (HORIZ.)
10. INSTALL 12"-90° STEEL BEND, WELDxWELD. (VERT.)
11. INSTALL 16"x12" STEEL REDUCER, FExFE.
12. INSTALL 12" SURGE CONTROL VALVE, FExFE, (SEE SPECIFICATIONS FOR MAKE AND MODEL. V-111)
13. INSTALL 12" STEEL SPOOL, WELDxWELD. (HORIZ.)
14. INSTALL 12" MAG FLOW METER, FExFE, (SEE SPECIFICATIONS FOR MAKE AND MODEL. FIT-100)
15. INSTALL 12"-90° STEEL BEND, FExPE. (VERT.)
16. INSTALL 16"x12" STEEL REDUCER, WELDxWELD.
17. INSTALL 16" STEEL SPOOL, WELDxWELD. (HORIZ.)
18. INSTALL 12"-70° STEEL BEND, WELDxWELD (HORIZ.)(CUT TO FIT IN THE FIELD).
19. INSTALL 16"-90° STEEL BEND, WELDxWELD. (HORIZ.)
20. INSTALL 12" STEEL SLIP-ON WELDING FLANGE (PLACE IN NEW CONC. SLAB).
21. INSTALL 8" STEEL 90° BEND, WELDxWELD. (VERT.)
22. INSTALL 8" STEEL PIPE, WELDxWELD. (HORIZ.)
23. INSTALL 2'ø x 8" STEEL FUNNEL.
24. INSTALL 8" LEAK SEAL PER DETAIL NO. 1 ON SHEET NO. DT-105.
25. CONSTRUCT CONCRETE PIPE SUPPORT PER DETAIL NO. 4 AND NO. 5 ON SHEET VWA-104.
26. CONSTRUCT 3' SQUARE X 3' DEEP CONCRETE THRUST BLOCK.
27. INSTALL FIXED POST BARRIER PER DETAIL NO. 4 ON SHEET NO. DT-101.
28. CUT AND REMOVE INTERFERING PORTIONS OF EX. WATER LINE.
29. REMOVE EXISTING A.C. PAVEMENT.
30. 4" A.C. PAVEMENT, 1 1/2" FINISHED COARSE OVER 2 1/2" LEVELING COARSE OVER COMPACTED 6" NATIVE MATERIAL COMPACTED TO 90% RELATIVE DENSITY.
31. INSTALL 2" THREAD-O-LET, 2"x1" NYLON BUSHING, 1" NIPPLE, 1" FULL PORT BALL VALVE, THREADED BOTH ENDS WITH LOCKING HANDLE, 1"x1/4" NYLON BUSHING, PRESSURE SWITCH, MERCOID TYPE DA, MODEL NO. DAW 7033-153-7 WITH 1/4" NPT CONNECTOR. (SEE ELECTRICAL PLANS)
32. INSTALL ALUM. DOUBLE DOOR ACCESS HATCH COVER PER DETAIL NO. 3 ON SHEET NO. VWA-104.
33. INSTALL 24" SQ. STEEL HATCH COVER WITH SPRING HINGED AND LOCKING HASP.
34. INSTALL SONIC LEVEL TRANSDUCER AND FITTINGS MOUNTED ON INSIDE OF OPENING. (SEE ELECTRICAL PLAN LIT-101)
35. SAW CUT, REMOVE 6-INCH DEEP EXISTING WET WELL FLOOR STRUCTURE, PROTECT EXIST. REBAR IN PLACE, TIE-IN NEW REINFORCING TO EXIST. REBARS AS REQUIRED, CONSTRUCT NEW CONC. FOOTING AND 6" THICK BY 3' HIGH BY 4' LG. CONC. WALL W/ #4 REINFORCING @ 12" O.C. (VERT. & HORIZ.).
36. INSTALL 12" GRAVITY TURBINE ROOF VENTILATOR.
37. INSTALL 4' SQUARE BUILDING ROOF HATCH PER DETAIL NO. 1 ON SHEET NO. VWA-105.
38. INSTALL 1 1/2" THREAD-O-LET, 1 1/2"x1" NYLON BUSHING, 1" NIPPLE, 1" CORPORATION STOP, MIP THREADED ON BOTH ENDS 1" AIR RELEASE VACUUM VALVE, APCO MODEL NO. 142 PER DETAIL NO. 4 ON SHEET DT-106. (SEE SPECS FOR MAKE AND MODEL V-139)
39. INSTALL 8" TRANSITION COUPLING (STEEL X DUCTILE IRON).
40. INSTALL 1" THREAD-O-LET, 1"x1/4" NYLON BUSHING, ROSEMOUNT PRESSURE TRANSDUCER/ TRANSMITTER WITH 1/4" NPT MALE CONNECTOR WITH MANUAL GAUGE FITTING AS REQUIRED. (SEE SPECS FOR MAKE AND MODEL PIT-100 AND PI-100)
41. INSTALL 1" THREAD-O-LET, 1"x 3/4" NYLON BUSHING, 3/4" FLOW SWITCH, " SWITCH PRO FLOW SWITCH" OR APPROVED EQUAL, RELAY: SPDT, 110VAC, POWER: 120VAC, MAX. PRESSURE: 150psi, MOUNTING: 3/4" NPT FS-100.
42. CONSTRUCT 15'-6" X 33'-0" SINGLE SLOPED ROOF METAL FRAME BUILDING WITH R19 ACOUSTICAL INSULATED EXTERIOR WALLS AND ROOF, "PARKLINE" MANUFACTURER OR APPROVED EQUAL.
43. INSTALL 16" STEEL SPOOL, FExFE. (HORIZ.)

X - INDICATES LOCATION FOR THE ADJUSTABLE PIPE SUPPORT PER DETAIL NO. 5 ON SHEET NO. DT-110.

NOTE:

ALL STEEL PIPING ABOVE GROUND SHALL BE CEMENT MORTAR LINED AND PAINTED.
ALL STEEL PIPING BELOW GROUND SHALL BE CEMENT MORTAR LINED AND COATED.
STOP CEMENT MORTAR COATING 3" ABOVE GROUND.

VWM-101

REVISION		
NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER
CHRISTOPHER SHEM HAWES
69578
6/30/2010
CIVIL
STATE OF CALIFORNIA

APPROVED BY:
C. Shem Hawes 69578 2/25/08
CHRISTOPHER SHEM HAWES RCE DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

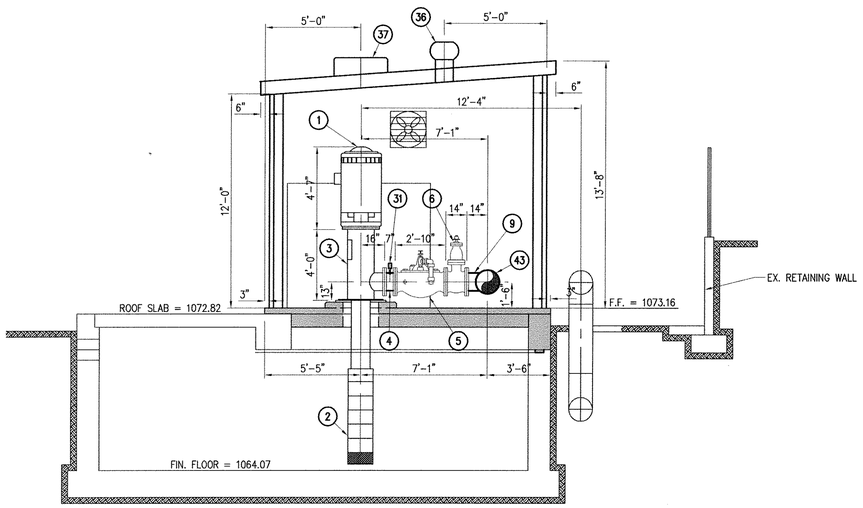
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The Business of Innovation

CITY OF PASADENA INCORPORATED JUNE 1886

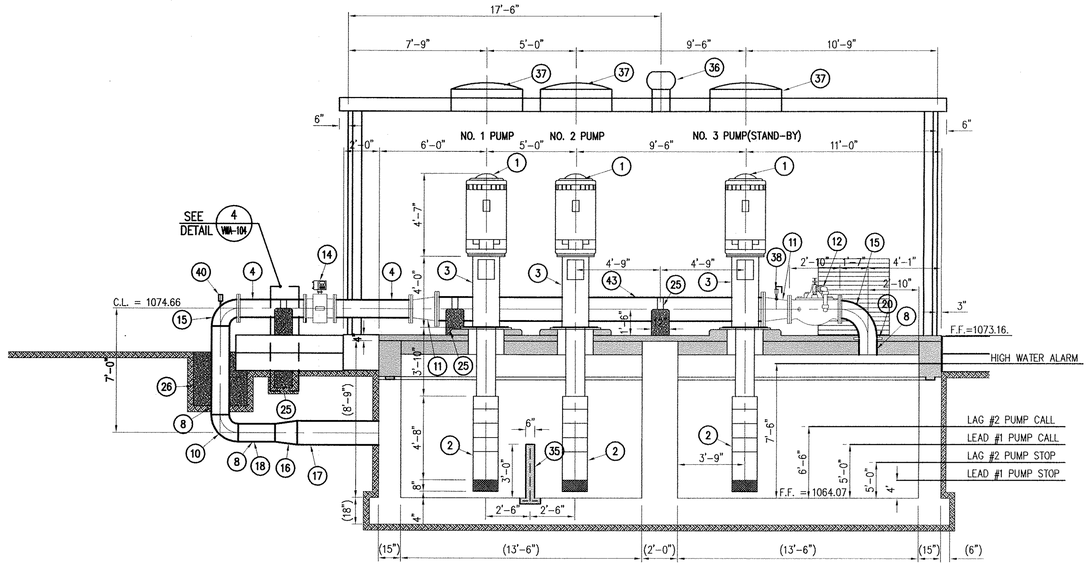
D.S.-209 & 210A

DATE: FEBRUARY 2009	SCALE: AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 38 OF 79 SHEETS
DRAWN BY: CIVILTEC		MONK HILL TREATMENT SYSTEM VENTURA WELL MECHANICAL PIPING PLAN	WORK ORDER: 02557 / FILE NUMBER: E-1670
DESIGNED BY: CIVILTEC			
CHECKED BY: CIVILTEC			
SUBMITTED BY: CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED / REVISION

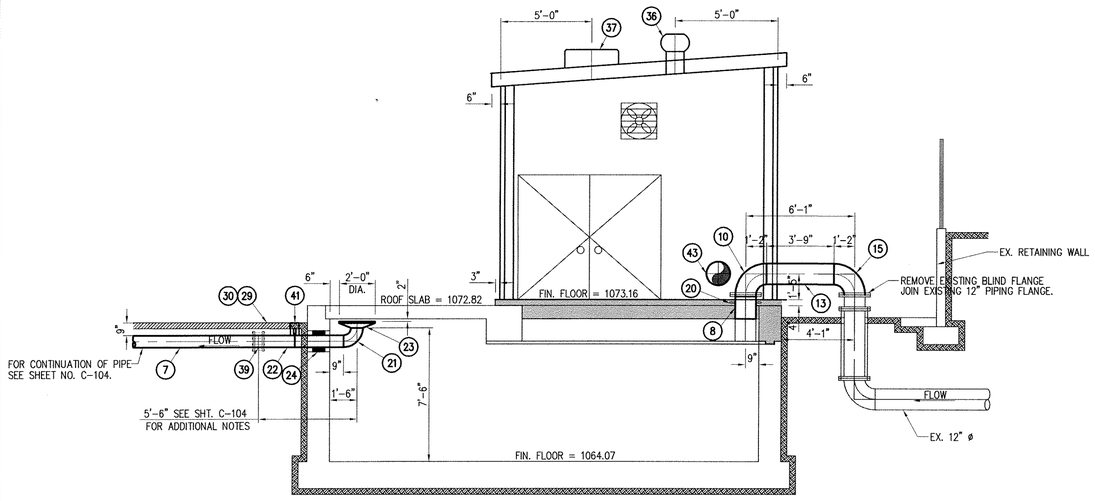
X:\2007\27140-PL MONKHILL TREATMENT PLANT\DWGS\SUBMITTALS\27140-VWM-101.DWG (02-27-09 9:05:20AM)



SECTION AA
SCALE: 1/4"=1'-0" VWS-101



SECTION BB
SCALE: 1/4"=1'-0" VWS-101



SECTION CC
SCALE: 1/4"=1'-0" VWS-101

CONSTRUCTION NOTES: (THIS SHEET ONLY)

1. INSTALL 250hp MOTOR. (SEE SPECIFICATIONS FOR MAKE AND MODEL)
2. INSTALL VERTICAL TURBINE PUMP. (2850gpm) (SEE SPECIFICATIONS FOR MAKE AND MODEL)
3. INSTALL 12" STEEL DISCHARGE HEADER, FExFE.
4. INSTALL 12" STEEL SPOOL, FExFE. (HORIZ.)
5. INSTALL 12" CHECK VALVE, FExFE, (SEE SPECIFICATIONS FOR MAKE AND MODEL)
6. INSTALL 12" RESILIENT WEDGE GATE VALVE, FExFE, W/ HANDWHEEL OPERATOR. (SEE SPECIFICATIONS FOR MAKE AND MODEL)
7. INSTALL 8" DUCTILE IRON PIPE, PRESSURE CLASS 52.
8. INSTALL 12" STEEL SPOOL, WELDxWELD. (VERT.)
9. INSTALL 12" STEEL SPOOL, FExWELD. (HORIZ.).
10. INSTALL 12"-90° STEEL BEND, WELDxWELD. (VERT.).
11. INSTALL 16"x12" STEEL REDUCER, FExFE.
12. INSTALL 12" SURGE CONTROL VALVE, FExFE, (SEE SPECIFICATIONS FOR MAKE AND MODEL)
13. INSTALL 12" STEEL SPOOL, WELDxWELD. (HORIZ.)
14. INSTALL 12" MAG FLOW METER, FExFE, (SEE SPECIFICATIONS FOR MAKE AND MODEL)
15. INSTALL 12"-90° STEEL BEND, FExWELD. (VERT.)
16. INSTALL 16"x12" STEEL REDUCER, WELDxWELD.
17. INSTALL 16" STEEL SPOOL, WELDxWELD. (HORIZ.)
18. INSTALL 12"-70° STEEL BEND, WELDxWELD. (HORIZ.)(CUT TO FIT IN THE FIELD)
20. INSTALL 12" STEEL SLIP-ON WELDING FLANGE, TO BE PLACE IN CONC. SLAB.
21. INSTALL 8" STEEL 90° BEND, WELDxWELD. (VERT.)
22. INSTALL 8" STEEL PIPE, WELDxWELD. (HORIZ.)
23. INSTALL 2'ø x 8" STEEL FUNNEL.
24. INSTALL 8" LEAK SEAL PER DETAIL NO. 1 ON SHEET NO. DT-105.
25. CONSTRUCT CONCRETE PIPE SUPPORT PER DETAIL NO. 4 AND NO. 5 ON SHEET NO. VWA-104.
26. CONSTRUCT 3' SQUARE X 3' DEEP CONCRETE THRUST BLOCK.
27. INSTALL FIXED POST BARRIER PER DETAIL NO. 4 ON SHEET NO. DT-101.
28. CUT AND REMOVE INTERFERING PORTIONS OF EX. 16" WATER LINE.
29. REMOVE EXISTING A.C. PAVEMENT.
30. CONSTRUCT 4" A.C. PAVEMENT, 1 1/2" FINISHED COARSE OVER 2 1/2" LEVELING COARSE OVER 6" NATIVE MATERIAL COMPACTED TO 90% RELATIVE DENSITY.
31. INSTALL 1" THREAD-O-LET, 1"x1/2" NYLON BUSHING, 1/2" NIPPLE, 1/2" FULL PORT BALL VALVE, SCREWED END WITH LOCKING HANDLE, 1/2"x1/4" NYLON BUSHING, PRESSURE GAUGE WITH 1/4" NPT CONNECTOR.
34. INSTALL SONIC LEVEL TRANSDUCER, MOUNT ON INSIDE OF OPENING. (SEE ELECTRICAL PLANS)
35. SAW CUT, REMOVE 6-INCH DEEP EXISTING WET WELL STRUCTURE, PROTECT EXIST. REINFORCEMENT IN PLACE, TIE-IN NEW REINFORCING TO EXISTING REBARS AS REQUIRED, CONSTRUCT NEW CONC. FOOTING AND 6" THICK X 3' HIGH X 4' LG. CONC. WALL WITH #4 REINFORCING @ 12" O.C.(VERT. & HORIZ.)
36. INSTALL 12" SQUARE ROOF GRAVITY TURBINE VENTILATOR, SEE SPECS. FOR MAKE AND MODEL.
37. INSTALL 4' SQUARE BUILDING ROOF HATCH COVER PER DETAIL NO. 1 ON SHEET NO. VWA-105, SEE SPECS FOR MAKE AND MODEL.
38. INSTALL 1" AIR/VACUUM VALVE ASSEMBLY, 1 1/2" THREAD-O-LET, 1 1/2"X1" NYLON BUSHING, 1" CORP. STOP, APCO MODEL NO. 142 OR APPROVED EQUAL.
39. INSTALL 8" TRANSITION COUPLING (STEEL X DUCTILE IRON).
40. INSTALL 1" THREAD-O-LET, 1"x1/4" NYLON BUSHING, ASHCROFT MODEL V2 PRESSURE TRANSDUCER/ TRANSMITTER WITH 1/4" NPT CONNECTOR. (SEE ELECTRICAL PLANS)
41. INSTALL 1" THREAD-O-LET, 1"x3/4" NYLON BUSHING, 3/4" FLOW SWITCH, "SWITCH PRO FLOW SWITCH" OR APPROVED EQUAL, RELAY: SPDT, 10VAC, POWER: 120VAC, MAX. PRESSURE: 150psi, MOUNTING: 3/4" NPT.
43. INSTALL 16" STEEL SPOOL, FExFE. (HORIZ.)

X - INDICATES LOCATION FOR THE ADJUSTABLE PIPE SUPPORT PER DETAIL NO. 5 ON SHEET NO. DT-110..

NOTE:
ALL STEEL PIPING ABOVE GROUND SHALL BE CEMENT MORTAR LINED AND PAINTED.
ALL STEEL PIPING BELOW GROUND SHALL BE CEMENT MORTAR LINED AND COATED.
STOP CEMENT MORTAR COATING 3" ABOVE GROUND.

VWM-102

REVISION		
NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — 6/20/2010 — CIVIL — STATE OF CALIFORNIA

APPROVED BY: CHRISTOPHER SHEM HAWES 69578 RCE — 2/25/08 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

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CITY OF PASADENA — INCORPORATED JUNE 1886

D.S.-209 & 210A

DATE	SCALE		
FEBRUARY 2009	AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 39 OF 79 SHEETS
DRAWN BY CIVILTEC		MONK HILL TREATMENT SYSTEM VENTURA WELL STRUCTURAL SECTIONS	WORK ORDER 02557 / FILE NUMBER E-1670
DESIGNED BY CIVILTEC			
CHECKED BY CIVILTEC			
SUBMITTED BY CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

X:\0607\27140-JPI WONKHILL TREATMENT PLANT\DWG\SUBMITTALS\FINAL SUBMITTAL\27140-VWM-102.DWG 03-02-09 8:44:06AM

VALVE EQUIPMENT SCHEDULE

V #	PROCESS NO	LOCATION	SERVICE	TYPE	SIZE	QUANTITY	MATERIAL	CONNECTION	MAKE & MODEL	REMARKS
V-101		BOOSTER STATION	BACKFLOW PREVENTION	SWING CHECK VALVE	12"	1	IRON BODY, BRONZE MOUNTED	FLXFL	M&H	CONTRACTOR FURNISHED
V-102		BOOSTER STATION	PUMP ISOLATION	GATE	12"	1	DUCTILE IRON BODY	FLXFL	M&H	CONTRACTOR FURNISHED
V-103		BOOSTER STATION	BACKFLOW PREVENTION	SWING CHECK VALVE	12"	1	IRON BODY, BRONZE MOUNTED	FLXFL	M&H	CONTRACTOR FURNISHED
V-104		BOOSTER STATION	PUMP ISOLATION	GATE	12"	1	DUCTILE IRON BODY	FLXFL	M&H	CONTRACTOR FURNISHED
V-105		BOOSTER STATION	BACKFLOW PREVENTION	SWING CHECK VALVE	12"	1	IRON BODY, BRONZE MOUNTED	FLXFL	M&H	CONTRACTOR FURNISHED
V-106		BOOSTER STATION	PUMP ISOLATION	GATE	12"	1	DUCTILE IRON BODY	FLXFL	M&H	CONTRACTOR FURNISHED
V-107		BOOSTER STATION	PRESSURE TRANSMITTER ISOLATION	BALL	1/2"	1	BRASS(NIBCO)-BRONZE(APOLLO)	THREADED	NIBCO T-FP-250 OR APOLLO	CONTRACTOR FURNISHED
V-108		BOOSTER STATION	PRESSURE TRANSMITTER ISOLATION	BALL	1/2"	1	BRASS(NIBCO)-BRONZE(APOLLO)	THREADED	NIBCO T-FP-250 OR APOLLO	CONTRACTOR FURNISHED
V-109	NOT USED									
V-110	NOT USED									
V-111		BOOSTER STATION	PRESSURE RELIEF	RELIEF	12"	1	CAST IRON BODY	FLXFL	CLA-VAL	CONTRACTOR FURNISHED
V-112		WINDSOR WELL	WINDSOR WELL ISOLATION	EXISTING GATE	12"	1		EXISTING	EXISTING	
V-113		BOOSTER STATION DISCHARGE	FLOW ISOLATION	EXISTING GATE	16"	1	CAST IRON BODY	EXISTING	EXISTING	
V-114		WINDSOR WELL DISCHARGE	FLOW ISOLATION	GATE 1	12"	1	DUCTILE IRON BODY	FLXFL	M&H	CONTRACTOR FURNISHED
V-115		BACKWASH SUPPLY	BACKFLOW PREVENTION	RPP	8"	1		FLXFL	FEBCO	CONTRACTOR FURNISHED
V-116		FIRE SERVICE	FIRE SERVICE ISOLATION	GATE	12"	1	DUCTILE IRON BODY	FLxMJ		BY OTHERS
V-117		BACKWASH SUPPLY	FLOW ISOLATION	GATE	12"	1	DUCTILE IRON BODY	FEXMJ	M&H	BY OTHERS
V-118		BACKWASH DISCHARGE	FLOW ISOLATION	GATE	10"	1	DUCTILE IRON BODY	MJXMJ	M&H	CONTRACTOR FURNISHED
V-119		BACKWASH DISCHARGE	FLOW ISOLATION	BALL	4"	1	BRASS(NIBCO)-BRONZE(APOLLO)	THREADED	NIBCO T-FP-600N OR APOLLO	CONTRACTOR FURNISHED
V-120		BACKWASH DISCHARGE	FLOW ISOLATION	BALL	4"	1	BRASS(NIBCO)-BRONZE(APOLLO)	THREADED	NIBCO T-FP-600N OR APOLLO	CONTRACTOR FURNISHED
V-121		DISCHARGE WATER TO SAND BOX	FLOW ISOLATION	BUTTERFLY	24"	1	CAST IRON BODY	FLXFL	M&H	CONTRACTOR FURNISHED
V-122		CLEAN WATER TO WINDSOR RESERV.	FLOW ISOLATION	BUTTERFLY	24"	1	CAST IRON BODY	FLXFL	M&H	CONTRACTOR FURNISHED
V-123		BACKWASH DISCHARGE FILTER	FLOW ISOLATION	BUTTERFLY	10"	1	CAST IRON BODY	FLXFL	M&H	CONTRACTOR FURNISHED
V-124		BACKWASH DISCHARGE FILTER	FLOW ISOLATION	BUTTERFLY	10"	1	CAST IRON BODY	FLXFL	M&H	CONTRACTOR FURNISHED
V-131		EXISTING WINDSOR WELL	PRESSURE TRANSMITTER	BALL	1/2"	1		THREADED		BY OTHERS
V-132		EXISTING WINDSOR WELL	PRESSURE TRANSMITTER	BALL	1/2"	1		THREADED		BY OTHERS
V-133		EXISTING VENTURA WELL	PRESSURE TRANSMITTER	BALL	1/2"	1		THREADED		BY OTHERS
V-134		EXISTING VENTURA WELL	PRESSURE TRANSMITTER	BALL	1/2"	1		THREADED		BY OTHERS
V-135		EXISTING ARROYO WELL	PRESSURE TRANSMITTER	BALL	1/2"	1		THREADED		BY OTHERS
V-136		EXISTING ARROYO WELL	PRESSURE TRANSMITTER	BALL	1/2"	1		THREADED		BY OTHERS
V-137		EXISTING WELL # 52	PRESSURE TRANSMITTER	BALL	1/2"	1		THREADED		BY OTHERS
V-138		EXISTING WELL # 52	PRESSURE TRANSMITTER	BALL	1/2"	1		THREADED		BY OTHERS
V-139		BOOSTER STATION	AIR RELEASE VALVE ISOLATION	BALL	1"	1	BRASS (NIBCO)-BRONZE(APOLLO)	THREADED	NIBCO T-FP-250 OR APOLLO	CONTRACTOR FURNISHED
V-201		INFLUENT FILTER	FILTER ISOLATION	BUTTERFLY	16"	1		FLXFL		CALGON CARBON FURNISHED
V-202		INFLUENT FILTER	FILTER ISOLATION	BUTTERFLY	16"	1		FLXFL		CALGON CARBON FURNISHED
V-203		INFLUENT FILTER	FILTER ISOLATION	BUTTERFLY	16"	1		FLXFL		CALGON CARBON FURNISHED
V-204		INFLUENT FILTER	FILTER ISOLATION	BUTTERFLY	16"	1		FLXFL		CALGON CARBON FURNISHED
V-205		INFLUENT FILTER	FILTER ISOLATION	BUTTERFLY	16"	1		FLXFL		CALGON CARBON FURNISHED
V-206		INFLUENT FILTER	FILTER ISOLATION	BUTTERFLY	16"	1		FLXFL		CALGON CARBON FURNISHED
V-207		INFLUENT FILTER	GSP ISOLATION	BALL	1/2"	1		THREADED		CALGON CARBON FURNISHED
V-208		INFLUENT FILTER	AIR RELEASE VALVE ISOLATION	BALL	1"	1		THREADED		CALGON CARBON FURNISHED
V-209		INFLUENT FILTER	GSP ISOLATION	BALL	1/2"	1		THREADED		CALGON CARBON FURNISHED
V-210		INFLUENT FILTER	SAMPLER ISOLATION	BALL	1"	1		THREADED		CALGON CARBON FURNISHED
V-212		INFLUENT FILTER	AIR RELEASE VALVE ISOLATION	BALL	1"	1		THREADED		CALGON CARBON FURNISHED
V-214		INFLUENT FILTER	SAMPLER ISOLATION	BALL	1"	1		THREADED		CALGON CARBON FURNISHED
V-216		INFLUENT FILTER	AIR RELEASE VALVE ISOLATION	BALL	1"	1		THREADED		CALGON CARBON FURNISHED
V-218		INFLUENT FILTER	SAMPLER ISOLATION	BALL	1"	1		THREADED		CALGON CARBON FURNISHED
V-219		INFLUENT FILTER	PRESSURE TRANSMITTER	BALL	1/2"	1		THREADED		CALGON CARBON FURNISHED
V-220		INFLUENT FILTER	PRESSURE TRANSMITTER	BALL	1/2"	1		THREADED		CALGON CARBON FURNISHED
V-221		INFLUENT FILTER	PRESSURE INDICATOR	BALL	1/2"	1		THREADED		CALGON CARBON FURNISHED
V-222		INFLUENT FILTER	PRESSURE INDICATOR	BALL	1/2"	1		THREADED		CALGON CARBON FURNISHED
V-223		INFLUENT FILTER	AIR RELEASE VALVE ISOLATION	BALL	1"	1		THREADED		CONTRACTOR FURNISHED
V-224		INFLUENT FILTERS	AIR RELEASE VALVE ISOLATION	BALL	1"	1	BRASS (NIBCO)-BRONZE(APOLLO)	THREADED	NIBCO T-FP-250 OR APOLLO	CONTRACTOR FURNISHED 1
V-3A		IX VESSELS - UNTREATED WATER	INFLUENT ISOLATION	BUTTERFLY	10"	4		FLXFL		CALGON CARBON FURNISHED
V-3B		IX VESSELS - UNTREATED WATER	INFLUENT ISOLATION	BUTTERFLY	10"	4		FLXFL		CALGON CARBON FURNISHED
V-3C		IX LEAD VESSEL - UNTREATED WATER	INFLUENT ISOLATION	BUTTERFLY	10"	4		FLXFL		CALGON CARBON FURNISHED

SCH-101

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — 12/30/2010 — CIVIL — STATE OF CALIFORNIA

APPROVED BY: C. Shem Hawes 69578 02/25/09
CHRISTOPHER SHEM HAWES RCE — DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

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CITY OF PASADENA — INCORPORATED JUNE 1886

D.S.-209 & 210A

DATE: DECEMBER 2008	SCALE: AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 40 OF 79 SHEETS
DRAWN BY: CIVILTEC DESIGNED BY: CIVILTEC CHECKED BY: CIVILTEC SUBMITTED BY: CIVILTEC		MONK HILL TREATMENT SYSTEM VALVE SCHEDULE	WORK ORDER: 02557 / FILE NUMBER: E-1670
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED / REVISION

X:\2007\27140-JR\ MONKHILL TREATMENT PLANT\DWG\SUBMITTAL\27140-SCH-101.DWG (02-27-09 9:22:14AM)

VALVE EQUIPMENT SCHEDULE

V #	PROCESS NO	LOCATION	SERVICE	TYPE	SIZE	QUANTITY	MATERIAL	CONNECTION	MAKE & MODEL	REMARKS
V-3D		IX LAG VESSEL - UNTREATED WATER	INFLUENT ISOLATION	BUTTERFLY	10"	4		FLXFL		CALGON CARBON FURNISHED
V-3E		IX VESSELS - TREATED WATER	EFFLUENT ISOLATION	BUTTERFLY	10"	4		FLXFL		CALGON CARBON FURNISHED
V-3F		IX VESSELS - TREATED WATER	EFFLUENT ISOLATION	BUTTERFLY	10"	4		FLXFL		CALGON CARBON FURNISHED
V-3G		IX VESSELS - BACKWASH SUPPLY	BACKWASH ISOLATION	BUTTERFLY	4"	4		FLXFL		CALGON CARBON FURNISHED
V-3H		IX VESSELS - BACKWASH SUPPLY	BACKWASH ISOLATION	BUTTERFLY	4"	4		FLXFL		CALGON CARBON FURNISHED
V-3I		IX VESSELS - BACKWASH DISCHARGE	BACKWASH ISOLATION	BUTTERFLY	10"	4		FLXFL		CALGON CARBON FURNISHED
V-3J		IX VESSELS - BACKWASH DISCHARGE	BACKWASH ISOLATION	BUTTERFLY	10"	4		FLXFL		CALGON CARBON FURNISHED
V-3K		IX LAG VESSEL - PDIT	ISOLATION	BALL	1/2"	4		THREADED		CALGON CARBON FURNISHED
V-3L		IX LEAD VESSEL - PDIT	ISOLATION	BALL	1/2"	4		THREADED		CALGON CARBON FURNISHED
V-3M		IX VESSELS - (PI) UNTREATED WATER	ISOLATION	BALL	1/2"	4		THREADED		CALGON CARBON FURNISHED
V-3N		IX VESSELS - (PI) UNTREATED WATER	ISOLATION	BALL	1/2"	4		THREADED		CALGON CARBON FURNISHED
V-3O		IX VESSELS - (PDIT) UNTREATED WATER	ISOLATION	BALL	1/2"	4		THREADED		CALGON CARBON FURNISHED
V-3P		IX VESSELS - (PDIT) UNTREATED WATER	ISOLATION	BALL	1/2"	4		THREADED		CALGON CARBON FURNISHED
V-3Q		IX LEAD VESSEL - (PI) BACKWASH SUPPLY	ISOLATION	BALL	1/2"	4		THREADED		CALGON CARBON FURNISHED
V-3R		IX LAG VESSEL - (PI) BACKWASH SUPPLY	ISOLATION	BALL	1/2"	4		THREADED		CALGON CARBON FURNISHED
V-3S		IX VESSEL - SAMPLER	ISOLATION	GLOBE	4"	8		THREADED		CALGON CARBON FURNISHED
V-3T		IX VESSEL - SAMPLER	ISOLATION	BALL	1/2"	8		THREADED		CALGON CARBON FURNISHED
V-3U		IX VESSEL	ISOLATION	BALL	1/2"	8		THREADED		CALGON CARBON FURNISHED
V-3V		IX VESSEL - SAMPLER	ISOLATION	GLOBE	1"	8		THREADED		CALGON CARBON FURNISHED
V-3W		IX VESSEL	ISOLATION	BALL	1/2"	8		THREADED		CALGON CARBON FURNISHED
V-3X		IX VESSEL	ISOLATION	BALL	1/2"	8		THREADED		CALGON CARBON FURNISHED
V-3Y		IX VESSEL	ISOLATION	BALL	1"	8		THREADED		CALGON CARBON FURNISHED
V-3Z		IX VESSEL	ISOLATION	BALL	1/2"	8		THREADED		CALGON CARBON FURNISHED
V-3AA		IX VESSEL - RELEASE	ISOLATION	BALL	1"	8		THREADED		CALGON CARBON FURNISHED
V-4A		LGAC VESSELS - UNTREATED WATER	INFLUENT ISOLATION	BUTTERFLY	10"	5		FLXFL		CALGON CARBON FURNISHED
V-4B		LGAC VESSELS - UNTREATED WATER	INFLUENT ISOLATION	BUTTERFLY	10"	5		FLXFL		CALGON CARBON FURNISHED
V-4C		LGAC LEAD VESSEL - UNTREATED WATER	INFLUENT ISOLATION TO THE LEAD VESSEL	BUTTERFLY	10"	5		FLXFL		CALGON CARBON FURNISHED
V-4D		LGAC LAG VESSEL - UNTREATED WATER	INFLUENT ISOLATION TO THE LAG VESSEL	BUTTERFLY	10"	5		FLXFL		CALGON CARBON FURNISHED
V-4E		LGAC VESSELS - TREATED WATER	EFFLUENT ISOLATION	BUTTERFLY	10"	5		FLXFL		CALGON CARBON FURNISHED
V-4F		LGAC VESSELS - TREATED WATER	EFFLUENT ISOLATION	BUTTERFLY	10"	5		FLXFL		CALGON CARBON FURNISHED
V-4G		LGAC VESSELS - BACKWASH SUPPLY	BACKWASH ISOLATION	BUTTERFLY	4"	5		FLXFL		CALGON CARBON FURNISHED
V-4H		LGAC VESSELS - BACKWASH SUPPLY	BACKWASH ISOLATION	BUTTERFLY	4"	5		FLXFL		CALGON CARBON FURNISHED
V-4I		LGAC VESSELS - BACKWASH DISCHARGE	BACKWASH ISOLATION	BUTTERFLY	10"	5		FLXFL		CALGON CARBON FURNISHED
V-4J		LGAC VESSELS - BACKWASH DISCHARGE	BACKWASH ISOLATION	BUTTERFLY	10"	5		FLXFL		CALGON CARBON FURNISHED
V-4K		LGAC LAG VESSEL - PDIT	ISOLATION	BALL	1/2"	5		THREADED		CALGON CARBON FURNISHED
V-4L		LGAC LEAD VESSEL - PDIT	ISOLATION	BALL	1/2"	5		THREADED		CALGON CARBON FURNISHED
V-4M		LGAC VESSELS - (PI) UNTREATED WATER	ISOLATION	BALL	1/2"	5		THREADED		CALGON CARBON FURNISHED
V-4N		LGAC VESSELS - (PI) UNTREATED WATER	ISOLATION	BALL	1/2"	5		THREADED		CALGON CARBON FURNISHED
V-4O		LGAC VESSELS - (PDIT) UNTREATED WATER	ISOLATION	BALL	1/2"	5		THREADED		CALGON CARBON FURNISHED
V-4P		LGAC VESSELS - (PDIT) UNTREATED WATER	ISOLATION	BALL	1/2"	5		THREADED		CALGON CARBON FURNISHED
V-4Q		LGAC LEAD VESSEL - (PI) BACKWASH SUPPLY	ISOLATION	BALL	1/2"	5		THREADED		CALGON CARBON FURNISHED
V-4R		LGAC LAG VESSEL - (PI) BACKWASH SUPPLY	ISOLATION	BALL	1/2"	5		THREADED		CALGON CARBON FURNISHED
V-4S		LGAC VESSEL - SAMPLER	ISOLATION	GLOBE	4"	10		THREADED		CALGON CARBON FURNISHED
V-4T		LGAC VESSEL - SAMPLER	ISOLATION	BALL	1/2"	10		THREADED		CALGON CARBON FURNISHED
V-4U		LGAC VESSEL	ISOLATION	BALL	1/2"	10		THREADED		CALGON CARBON FURNISHED
V-4V		LGAC VESSEL - SAMPLER	ISOLATION	GLOBE	1"	10		THREADED		CALGON CARBON FURNISHED
V-4W		LGAC VESSEL	ISOLATION	BALL	1/2"	10		THREADED		CALGON CARBON FURNISHED
V-4X		LGAC VESSEL	ISOLATION	BALL	1/2"	10		THREADED		CALGON CARBON FURNISHED
V-4Y		LGAC VESSEL	ISOLATION	BALL	1"	10		THREADED		CALGON CARBON FURNISHED
V-4Z		LGAC VESSEL	ISOLATION	BALL	1/2"	10		THREADED		CALGON CARBON FURNISHED
V-4AA		LGAC VESSEL - BACKWASH DISCHARGE	BACKWASH ISOLATION	BUTTERFLY	4"	1		FLXFL		CONTRACTOR FURNISHED
V-4AB		LGAC VESSEL - BACKWASH DISCHARGE	BACKWASH ISOLATION	BUTTERFLY	4"	1		FLXFL		CONTRACTOR FURNISHED
V-4AC		LGAC VESSEL - BACKWASH DISCHARGE	BACKWASH ISOLATION	BUTTERFLY	4"	1		FLXFL		CONTRACTOR FURNISHED
V-4AD		IX VESSEL - BACKWASH DISCHARGE	FILTER ISOLATION	BUTTERFLY	4"	1		FLXFL		CONTRACTOR FURNISHED
V-4AE		IX VESSEL - BACKWASH DISCHARGE	FILTER ISOLATION	BUTTERFLY	4"	1		FLXFL		CONTRACTOR FURNISHED

1

SCH-102

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER
CHRISTOPHER SHEM HAWES
69578
6/30/2010
CIVIL
STATE OF CALIFORNIA

APPROVED BY:
CHRISTOPHER SHEM HAWES RCE 69578 — 2/25/08 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

Battelle
The Business of Innovation

CITY OF PASADENA INCORPORATED JUNE 1886

D.S.-209 & 210A

DATE	SCALE		
FEBRUARY 2009	AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 41 OF 79 SHEETS
DRAWN BY CIVILTEC DESIGNED BY CIVILTEC CHECKED BY CIVILTEC SUBMITTED BY CIVILTEC		MONK HILL TREATMENT SYSTEM VALVE SCHEDULE	WORK ORDER 02557 / FILE NUMBER E-1670
FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

X:\2007\27140-JR, MONKHILL TREATMENT PLANT\DWG\SUBMITTAL\FINAL SUBMITTAL\27140-SCH-102.DWG (02-27-09 9:23:09AM)

PUMP EQUIPMENT SCHEDULE

P #	PROCESS NO	LOCATION	SERVICE	TYPE	HP (KW)	CAPACITY/SIZE	TDH	MAKE & MODEL	REMARKS
P-101		BOOSTER STATION	RAW WATER PUMP	VERTICAL TURBINE	250	2,800 GPM	270 FT	PEERLESS VERTICAL- 16HxB	CONTRACTOR FURNISHED
P-102		BOOSTER STATION	RAW WATER PUMP	VERTICAL TURBINE	250	2,800 GPM	270 FT	PEERLESS VERTICAL- 16HxB	CONTRACTOR FURNISHED
P-103		BOOSTER STATION	RAW WATER PUMP	VERTICAL TURBINE	250	2,800 GPM	270 FT	PEERLESS VERTICAL- 16HxB	CONTRACTOR FURNISHED
P-801		AMMONIA STORAGE AREA	CHEMICAL PUMP	PERISTALTIC					BY OTHERS
P-802		AMMONIA STORAGE AREA	CHEMICAL PUMP	PERISTALTIC					BY OTHERS

MECHANICAL EQUIPMENT SCHEDULE

P #	PROCESS NO	LOCATION	SERVICE	CAPACITY/SIZE	MAKE & MODEL	REMARKS
T-301A		TREATMENT PAD	PERCHLORATE REMOVAL	1,750 GPM	CALGON CARBON MODEL 12	CALGON CARBON FURNISHED
T-301B		TREATMENT PAD	PERCHLORATE REMOVAL	1,750 GPM	CALGON CARBON MODEL 12	CALGON CARBON FURNISHED
T-302A		TREATMENT PAD	PERCHLORATE REMOVAL	1,750 GPM	CALGON CARBON MODEL 12	CALGON CARBON FURNISHED
T-302B		TREATMENT PAD	PERCHLORATE REMOVAL	1,750 GPM	CALGON CARBON MODEL 12	CALGON CARBON FURNISHED
T-303A		TREATMENT PAD	PERCHLORATE REMOVAL	1,750 GPM	CALGON CARBON MODEL 12	CALGON CARBON FURNISHED
T-303B		TREATMENT PAD	PERCHLORATE REMOVAL	1,750 GPM	CALGON CARBON MODEL 12	CALGON CARBON FURNISHED
T-304A		TREATMENT PAD	PERCHLORATE REMOVAL	1,750 GPM	CALGON CARBON MODEL 12	CALGON CARBON FURNISHED
T-304B		TREATMENT PAD	PERCHLORATE REMOVAL	1,750 GPM	CALGON CARBON MODEL 12	CALGON CARBON FURNISHED
T-401A		TREATMENT PAD	VOC REMOVAL	1,400 GPM	CALGON CARBON MODEL 12	CALGON CARBON FURNISHED
T-401B		TREATMENT PAD	VOC REMOVAL	1,400 GPM	CALGON CARBON MODEL 12	CALGON CARBON FURNISHED
T-402A		TREATMENT PAD	VOC REMOVAL	1,400 GPM	CALGON CARBON MODEL 12	CALGON CARBON FURNISHED
T-402B		TREATMENT PAD	VOC REMOVAL	1,400 GPM	CALGON CARBON MODEL 12	CALGON CARBON FURNISHED
T-403A		TREATMENT PAD	VOC REMOVAL	1,400 GPM	CALGON CARBON MODEL 12	CALGON CARBON FURNISHED
T-403B		TREATMENT PAD	VOC REMOVAL	1,400 GPM	CALGON CARBON MODEL 12	CALGON CARBON FURNISHED
T-404A		TREATMENT PAD	VOC REMOVAL	1,400 GPM	CALGON CARBON MODEL 12	CALGON CARBON FURNISHED
T-404B		TREATMENT PAD	VOC REMOVAL	1,400 GPM	CALGON CARBON MODEL 12	CALGON CARBON FURNISHED
T-405A		TREATMENT PAD	VOC REMOVAL	1,400 GPM	CALGON CARBON MODEL 12	CALGON CARBON FURNISHED
T-405B		TREATMENT PAD	VOC REMOVAL	1,400 GPM	CALGON CARBON MODEL 12	CALGON CARBON FURNISHED
F-201		TREATMENT PAD	INFLUENT FILTRATION	3,500 GPM	TOWNER FILTRATION	CALGON CARBON FURNISHED
F-202		TREATMENT PAD	INFLUENT FILTRATION	3,500 GPM	TOWNER FILTRATION	CALGON CARBON FURNISHED
F-203		TREATMENT PAD	INFLUENT FILTRATION	3,500 GPM	TOWNER FILTRATION	CALGON CARBON FURNISHED
F-401		TREATMENT PAD	IX BACKFLUSH FILTRATION	450 GPM	EATON MAXILINE 4 BAG O.A.E	CONTRACTOR FURNISHED
F-402		TREATMENT PAD	LGAC BACKWASH FILTRATION	1,750 GPM	EATON MAXILINE 8 BAG O.A.E	CONTRACTOR FURNISHED

SCH-103

REVISION

NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — CIVIL — STATE OF CALIFORNIA — 6/30/2010

APPROVED BY: C. Shem Hawes 69578 — CHRISTOPHER SHEM HAWES RCE — 2/25/08 DATE

APPROVED: _____ DATE

APPROVED: _____ DATE

PLANS PREPARED BY:

CIVILTEC engineering inc.

General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying

118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

Battelle
The Business of Innovation

CITY OF PASADENA — INCORPORATED JUNE 1886

D.S.-209 & 210A

DATE	SCALE		
FEBRUARY 2009	AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO. 42 OF 79 SHEETS
DRAWN BY CIVILTEC DESIGNED BY CIVILTEC CHECKED BY CIVILTEC SUBMITTED BY CIVILTEC		MONK HILL TREATMENT SYSTEM PUMP AND MECHANICAL SCHEDULE	WORK ORDER 02557 / FILE NUMBER E-1670
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED / REVISION

X:\2007\27140-JP\ MONHILL TREATMENT PLANT\DWG\SUBMITTAL\27140-SCH-103.DWG (02-27-09 9:23:50AM)

INSTRUMENTATION EQUIPMENT SCHEDULE

I #	PROCESS NO	LOCATION	SERVICE	MAKE & MODEL	REMARKS
FS-100		BOOSTER STATION	SUMP OVERFLOW INDICATOR TO SPREADING GROUNDS		CONTRACTOR FURNISHED
FIT-100		BOOSTER STATION	PUMP DISCHARGE FLOW TRANSMITTER	ROSEMOUNT O.A.E.	CONTRACTOR FURNISHED
FIT-102		WINDSOR WELL	WELL DISCHARGE FLOWTRANSMITTER		BY OTHERS
FIT-103		VENTURA WELL	WELL DISCHARGE FLOWTRANSMITTER	1	BY OTHERS
FIT-104		ARROYO WELL	WELL DISCHARGE FLOWTRANSMITTER	ROSEMOUNT O.A.E.	CONTRACTOR FURNISHED
FIT-105		WELL No. 52	WELL DISCHARGE FLOWTRANSMITTER		BY OTHERS
LIT-100		BOOSTER STATION	SONIC TRANSMITTER	MILLTRONICS HYDRORANGER	CONTRACTOR FURNISHED
LIT-101		BOOSTER STATION	SUMP LEVEL TRANSMITTER 1	KPSI SERIES 750 O.A.E	CONTRACTOR FURNISHED
LIT-102		WINDSOR WELL	WELL LEVEL TRANSMITTER		BY OTHERS
LIT-103		VENTURA WELL	WELL LEVEL TRANSMITTER		BY OTHERS
LIT-104		ARROYO WELL	WELL LEVEL TRANSMITTER		BY OTHERS
LIT-105		WELL No. 52	WELL LEVEL TRANSMITTER		BY OTHERS
FIT-501		BACKWASH DISCHARGE	FLOW TRANSMITTER	TIGER MAG O.A.E	CONTRACTOR FURNISHED
LS-101		BOOSTER STATION	LOW SUMP LEVEL FLOAT 1	ROTO-FLOAT O.A.E	CONTRACTOR FURNISHED
PIT-100		BOOSTER STATION	PUMP DISCHARGE PRESURE TRANSMITTER	ROSEMOUNT O.A.E. 1	CONTRACTOR FURNISHED
PI-100		BOOSTER STATION	PUMP DISCHARGE INDICATOR	WIKA 0-200 PSI	CONTRACTOR FURNISHED
PI-102		WINDSOR WELL	WELL DISCHARGE PRESSURE INDICATOR		BY OTHERS
PI-103		VENTURA WELL	WELL DISCHARGE PRESSURE INDICATOR		BY OTHERS
PI-104		ARROYO WELL	WELL DISCHARGE PRESSURE INDICATOR		BY OTHERS
PI-105		WELL No. 52	WELL DISCHARGE PRESSURE INDICATOR		BY OTHERS
LS-102		BOOSTER STATION	HIGH SUMP LEVEL FLOAT 1	ROTO-FLOAT O.A.E	CONTRACTOR FURNISHED
PIT-200		INFLUENT FILTERS	PRESSURE TRANSMITTER		CALGON CARBON
PDIT-201		INFLUENT FILTERS	DIFFERENTIAL PRESSURE TRANSMITTER		CALGON CARBON
PI-202		FILTERED EFFLUENT	PRESSURE TRANSMITTER		CALGON CARBON
PDIT-301A		FILTERED INFLUENT TO IX LEAD VESSELS	DIFFERENTIAL PRESSURE INDICATOR		CALGON CARBON
PI-301AA		FILTERED INFLUENT TO IX LEAD VESSELS	PRESSURE INDICATOR		CALGON CARBON
PI-301A		IX TREATED EFFLUENT WATER FROM VESSEL	PRESSURE INDICATOR		CALGON CARBON
FIT-301A		IX TREATED EFFLUENT WATER TO LAG VESSEL	FLOW TRANSMITTER		CALGON CARBON
FIE-301A		PRESSURE RUPTURE DISK			CALGON CARBON
PDIT-301B		IX TREATED EFFLUENT WATER	DIFFERENTIAL PRESSURE TRANSMITTER		CALGON CARBON
PI-301B		IX TREATED EFFLUENT WATER	PRESSURE INDICATOR		CALGON CARBON
FIT-301B		IX TREATED EFFLUENT WATER TO LEAD VESSEL	FLOW TRANSMITTER		CALGON CARBON
FIE-301B		PRESSURE RUPTURE DISK	FLOW ELEMENT		CALGON CARBON
PDIT-302A		FILTERED INFLUENT TO IX LEAD VESSELS	DIFFERENTIAL PRESSURE INDICATOR		CALGON CARBON
PI-302AA		FILTERED INFLUENT TO IX LEAD VESSELS	PRESSURE INDICATOR		CALGON CARBON
PI-302A		IX TREATED EFFLUENT WATER FROM LEAD VESSEL	PRESSURE INDICATOR		CALGON CARBON
FIT-302A		IX TREATED EFFLUENT WATER TO LAG VESSEL	FLOW TRANSMITTER		CALGON CARBON
FIE-302A		PRESSURE RUPTURE DISK	FLOW ELEMENT		CALGON CARBON
PDIT-302B		IX TREATED EFFLUENT WATER	DIFFERENTIAL PRESSURE TRANSMITTER		CALGON CARBON
PI-302B		IX TREATED EFFLUENT WATER	PRESSURE INDICATOR		CALGON CARBON
FIT-302B		IX TREATED EFFLUENT WATER TO LEAD VESSEL	FLOW TRANSMITTER		CALGON CARBON
FIE-302B		PRESSURE RUPTURE DISK	FLOW ELEMENT		CALGON CARBON
PDIT-303A		FILTERED INFLUENT TO IX LEAD VESSELS	DIFFERENTIAL PRESSURE INDICATOR		CALGON CARBON
PI-303AA		FILTERED INFLUENT TO IX LEAD VESSELS	PRESSURE INDICATOR		CALGON CARBON
PI-303A		IX TREATED EFFLUENT WATER FROM LEAD VESSEL	PRESSURE INDICATOR		CALGON CARBON
FIT-303A		IX TREATED EFFLUENT WATER TO LAG VESSEL	FLOW TRANSMITTER		CALGON CARBON
FIE-303A		PRESSURE RUPTURE DISK	FLOW ELEMENT		CALGON CARBON
PDIT-303B		IX TREATED EFFLUENT WATER	DIFFERENTIAL PRESSURE TRANSMITTER		CALGON CARBON
PI-303B		IX TREATED EFFLUENT WATER	PRESSURE INDICATOR		CALGON CARBON
FIT-303B		IX TREATED EFFLUENT WATER TO LEAD VESSEL	FLOW TRANSMITTER		CALGON CARBON
FIE-303B		PRESSURE RUPTURE DISK	FLOW ELEMENT		CALGON CARBON
PDIT-304A		FILTERED INFLUENT TO IX LEAD VESSELS	DIFFERENTIAL PRESSURE INDICATOR		CALGON CARBON
PI-304AA		FILTERED INFLUENT TO IX LEAD VESSELS	PRESSURE INDICATOR		CALGON CARBON
PI-304A		IX TREATED EFFLUENT WATER FROM LEAD VESSEL	PRESSURE INDICATOR		CALGON CARBON
FIT-304A		IX TREATED EFFLUENT WATER TO LAG VESSEL	FLOW TRANSMITTER		CALGON CARBON
FIE-304A		PRESSURE RUPTURE DISK	FLOW ELEMENT		CALGON CARBON

INSTRUMENTATION EQUIPMENT SCHEDULE

I #	PROCESS NO	LOCATION	SERVICE	MAKE & MODEL	REMARKS
PDIT-304B		IX TREATED EFFLUENT WATER	DIFFERENTIAL PRESSURE TRANSMITTER		CALGON CARBON
PI-304B		IX TREATED EFFLUENT WATER	PRESSURE INDICATOR		CALGON CARBON
FIT-304B		IX TREATED EFFLUENT WATER TO LEAD VESSEL	FLOW TRANSMITTER		CALGON CARBON
FIE-304B		PRESSURE RUPTURE DISK	FLOW ELEMENT		CALGON CARBON
PDIT-401A		FILTERED INFLUENT TO LGAC LEAD VESSELS	DIFFERENTIAL PRESSURE INDICATOR		CALGON CARBON
PI-401AA		FILTERED INFLUENT TO LGAC LEAD VESSELS	PRESSURE INDICATOR		CALGON CARBON
PI-401A		LGAC TREATED EFFLUENT WATER FROM LEAD VESSEL	PRESSURE INDICATOR		CALGON CARBON
FIT-401A		LGAC TREATED EFFLUENT WATER TO LAG VESSEL	FLOW TRANSMITTER		CALGON CARBON
FIE-401A		PRESSURE RUPTURE DISK	FLOW ELEMENT		CALGON CARBON
PDIT-401B		LGAC TREATED EFFLUENT WATER	DIFFERENTIAL PRESSURE TRANSMITTER		CALGON CARBON
PI-401B		LGAC TREATED EFFLUENT WATER	PRESSURE INDICATOR		CALGON CARBON
FIT-401B		LGAC TREATED EFFLUENT WATER TO LEAD VESSEL	FLOW TRANSMITTER		CALGON CARBON
FIE-401B		PRESSURE RUPTURE DISK	FLOW ELEMENT		CALGON CARBON
PDIT-402A		FILTERED INFLUENT TO LGAC LEAD VESSELS	DIFFERENTIAL PRESSURE INDICATOR		CALGON CARBON
PI-402AA		FILTERED INFLUENT TO LGAC LEAD VESSELS	PRESSURE INDICATOR		CALGON CARBON
PI-402A		LGAC TREATED EFFLUENT WATER FROM LEAD VESSEL	PRESSURE INDICATOR		CALGON CARBON
FIT-402A		LGAC TREATED EFFLUENT WATER TO LAG VESSEL	FLOW TRANSMITTER		CALGON CARBON
FI-402A		LGAC TREATED EFFLUENT WATER TO LAG VESSEL	FLOW INDICATOR		CALGON CARBON
FIE-402A		PRESSURE RUPTURE DISK	FLOW ELEMENT		CALGON CARBON
PDIT-402B		LGAC TREATED EFFLUENT WATER	DIFFERENTIAL PRESSURE TRANSMITTER		CALGON CARBON
PI-402B		LGAC TREATED EFFLUENT WATER	PRESSURE INDICATOR		CALGON CARBON
FIT-402B		LGAC TREATED EFFLUENT WATER TO LEAD VESSEL	FLOW TRANSMITTER		CALGON CARBON
FIE-402B		PRESSURE RUPTURE DISK	FLOW ELEMENT		CALGON CARBON
PDIT-403A		FILTERED INFLUENT TO IX LEAD VESSELS	DIFFERENTIAL PRESSURE INDICATOR		CALGON CARBON
PI-403AA		FILTERED INFLUENT TO LGAC LEAD VESSELS	PRESSURE INDICATOR		CALGON CARBON
PI-403A		LGAC TREATED EFFLUENT WATER FROM LEAD VESSEL	PRESSURE INDICATOR		CALGON CARBON
FIT-403A		LGAC TREATED EFFLUENT WATER TO LAG VESSEL	FLOW TRANSMITTER		CALGON CARBON
FIE-403A		PRESSURE RUPTURE DISK	FLOW ELEMENT		CALGON CARBON
PDIT-403B		LGAC TREATED EFFLUENT WATER	DIFFERENTIAL PRESSURE TRANSMITTER		CALGON CARBON
PI-403B		LGAC TREATED EFFLUENT WATER	PRESSURE INDICATOR		CALGON CARBON
FIT-403B		LGAC TREATED EFFLUENT WATER TO LEAD VESSEL	FLOW TRANSMITTER		CALGON CARBON
FIE-403B		PRESSURE RUPTURE DISK	FLOW ELEMENT		CALGON CARBON
PDIT-404A		FILTERED INFLUENT TO LGAC LEAD VESSELS	DIFFERENTIAL PRESSURE INDICATOR		CALGON CARBON
PI-404AA		FILTERED INFLUENT TO LGAC LEAD VESSELS	PRESSURE INDICATOR		CALGON CARBON
PI-404A		LGAC TREATED EFFLUENT WATER FROM LEAD VESSEL	PRESSURE INDICATOR		CALGON CARBON
FIT-404A		LGAC TREATED EFFLUENT WATER TO LAG VESSEL	FLOW TRANSMITTER		CALGON CARBON
FIE-404A		PRESSURE RUPTURE DISK	FLOW ELEMENT		CALGON CARBON
PDIT-404B		LGAC TREATED EFFLUENT WATER	DIFFERENTIAL PRESSURE TRANSMITTER		CALGON CARBON
PI-404B		LGAC TREATED EFFLUENT WATER	PRESSURE INDICATOR		CALGON CARBON
FIT-404B		LGAC TREATED EFFLUENT WATER TO LEAD VESSEL	FLOW TRANSMITTER		CALGON CARBON
FIE-404B		PRESSURE RUPTURE DISK	FLOW ELEMENT		CALGON CARBON
PDIT-405A		FILTERED INFLUENT TO LGAC LEAD VESSELS	DIFFERENTIAL PRESSURE INDICATOR		CALGON CARBON
PI-405AA		FILTERED INFLUENT TO LGAC LEAD VESSELS	PRESSURE INDICATOR		CALGON CARBON
PI-405A		LGAC TREATED EFFLUENT WATER FROM LEAD VESSEL	PRESSURE INDICATOR		CALGON CARBON
FIT-405A		LGAC TREATED EFFLUENT WATER TO LAG VESSEL	FLOW TRANSMITTER		CALGON CARBON
FIE-405A		PRESSURE RUPTURE DISK	FLOW ELEMENT		CALGON CARBON
PDIT-405B		LGAC TREATED EFFLUENT WATER	DIFFERENTIAL PRESSURE TRANSMITTER		CALGON CARBON
PI-405B		LGAC TREATED EFFLUENT WATER	PRESSURE INDICATOR		CALGON CARBON
FIT-405B		LGAC TREATED EFFLUENT WATER TO LEAD VESSEL	FLOW TRANSMITTER		CALGON CARBON
FIE-405B		PRESSURE RUPTURE DISK	FLOW ELEMENT		CALGON CARBON
FIT-500		MAGMETER - CLEAN WATER TO WINDSOR RESERVOIR	FLOW TRANSMITTER	TIGER MAG O.A.E	CONTRACTOR FURNISHED
FIT-502		MAGMETER - DISCHARGE WATER TO SAND BOX	FLOW TRANSMITTER	TIGER MAG O.A.E	CONTRACTOR FURNISHED 1
PIT-102		WINDSOR WELL	PRESSURE TRANSMITTER		BY OTHERS
PIR-103		VENTURA WELL	PRESSURE TRANSMITTER	1	BY OTHERS
PIT-104		ARROYO WELL	PRESSURE TRANSMITTER		BY OTHERS
PIT-105		WELL 52	PRESSURE TRANSMITTER		BY OTHERS

INSTRUMENTATION EQUIPMENT SCHEDULE

I #	LOCATION	SERVICE	REMARKS
FIT-503	BACKWASH SUPPLY	FLOW TRANSMITTER 1	BY OTHERS

SCH-104

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — CIVIL — STATE OF CALIFORNIA — 12/31/2010

APPROVED BY: CHRISTOPHER SHEM HAWES RCE 69578 — 2/25/08 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

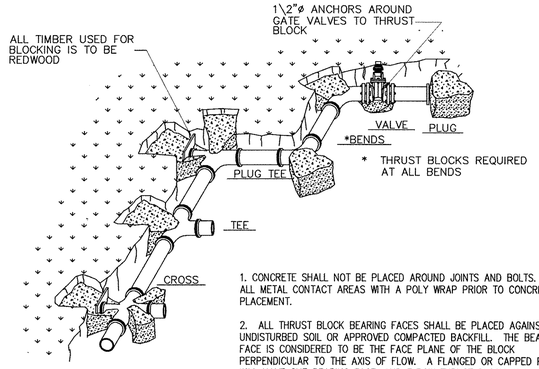
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The Business of Innovation

CITY OF PASADENA * INCORPORATED JUNE 1886 *

D.S.-209 & 210A

DATE: FEBRUARY 2009	SCALE: AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 43 OF 79 SHEETS
DRAWN BY: CIVILTEC; DESIGNED BY: CIVILTEC; CHECKED BY: CIVILTEC; SUBMITTED BY: CIVILTEC		MONK HILL TREATMENT SYSTEM INSTRUMENTATION SCHEDULE	WORK ORDER 02557; FILE NUMBER E-1670
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED; REVISION

X:\2007\07140-JR- MONHILL TREATMENT PLANT\DWG\SUBMITTALS\FINAL SUBMITTAL\07140-SCH-104.DWG (02-27-09 3:25:45AM)



1. CONCRETE SHALL NOT BE PLACED AROUND JOINTS AND BOLTS. COVER ALL METAL CONTACT AREAS WITH A POLY WRAP PRIOR TO CONCRETE PLACEMENT.

2. ALL THRUST BLOCK BEARING FACES SHALL BE PLACED AGAINST UNDISTURBED SOIL OR APPROVED COMPACTED BACKFILL. THE BEARING FACE IS CONSIDERED TO BE THE FACE PLANE OF THE BLOCK PERPENDICULAR TO THE AXIS OF FLOW. A FLANGED OR CAPPED PIPE END WILL HAVE ONE BEARING FACE, AND ELBOW THRUST BLOCK WILL HAVE TOW, A TEE WILL HAVE THREE, AND A CROSS WILL HAVE FOUR, EACH OF WHICH MUST MEET THE TABLE REQUIREMENTS. FLOW IS CONSIDERED TO BE IN BOTH DIRECTIONS FOR STRAIGHT THROUGH IN LINE COMPONENTS SUCH AS VALVES, REDUCERS, AND ETC., WHICH THEREFORE HAVE A MINIMUM OF TWO BEARING FACES.

3. SQUARE ALL EDGES TO RECEIVE CONCRETE. THRUST BLOCKS SHALL BE GENERALLY CUBIC IN CONFIGURATION.

4. CALCULATED WITH AN ALLOWABLE BEARING PRESSURE OF 1500 LBS. PER SQ. FT.

5. ALL FITTINGS AND VALVES SHALL BE ANCHORED WITH TWO #5 REBAR.

6. CENTER ALL FITTINGS OVER THRUST BLOCKS.

7. ALL REBAR SHALL BE FUSION BONDED EPOXY COATED AFTER IT HAS BEEN SHAPED OR BENT TO FIT.

THRUST BLOCK DETAIL 1
NOT TO SCALE

THRUST BLOCK BEARING AREA IN SQ. FT. @150 PSI GAUGE

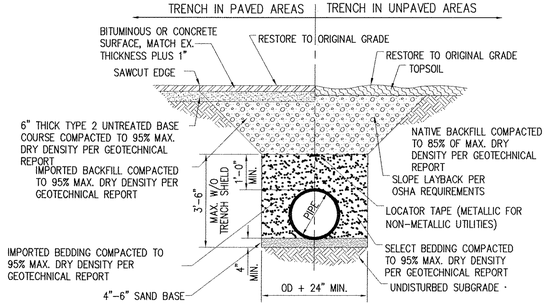
PIPE SIZE	CROSS	TEE	WYE	DEAD END	VALVE	90° BEND	45° BEND	22.5° BEND	11.25° BEND
4	2.7	1.9	1.9	1.9	–	2.7	1.5	1.1	1.1
6	6.1	4.3	4.3	4.3	–	6.1	3.3	1.7	1.1
8	10.8	7.7	7.7	7.7	–	10.8	5.8	3.0	1.6
10	16.9	11.9	11.9	11.9	–	16.9	9.1	4.7	2.4
12	24.2	17.1	17.1	17.1	17.1	24.2	13.2	6.8	3.4
14	33.0	23.3	23.3	23.3	23.3	33.0	17.9	9.1	4.6
16	43.0	30.4	30.4	30.4	30.4	43.0	23.3	11.9	6.0
18	54.5	38.5	38.5	38.5	38.5	54.5	29.5	15.1	7.5
20	67.2	47.5	47.5	47.5	47.5	67.2	36.3	18.6	9.3
24	96.6	68.4	68.4	68.4	68.4	96.6	52.3	26.7	13.4

THRUST BLOCK BEARING AREA IN SQ. FT. @200 PSI GAUGE

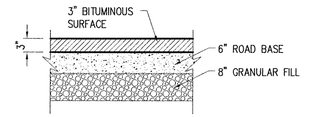
PIPE SIZE	CROSS	TEE	WYE	DEAD END	VALVE	90° BEND	45° BEND	22.5° BEND	11.25° BEND
4	2.4	1.7	1.7	1.7	–	2.4	1.3	1.0	1.0
6	5.4	3.8	3.8	3.8	–	5.4	2.9	1.5	1.0
8	9.6	6.8	6.8	6.8	–	9.6	5.2	2.7	1.4
10	15.0	10.6	10.6	10.6		15.0	8.1	4.2	2.1
	21.5	15.2							
	29.3	20.7							
	38.2	27.0							
	48.4	34.2							
	59.7	42.2							
	85.9	60.8							

THRUST BLOCK BEARING AREA IN SQ. FT. @500 PSI GAUGE

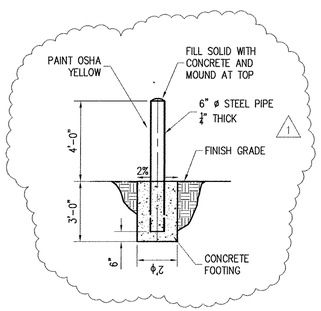
PIPE SIZE	CROSS	TEE	WYE	END	VALVE	BEND	BEND	BEND	BEND
4	6	4.25	4.25	4.25		6	3.25	2.5	2.5
	13.5	9.5							
	24	17							
	37.5	26.5							
	53.75	38							
	73.25	51.75							
	95.5	67.5							
	121	85.5							
	149.25	105.5							
	214.75	152							



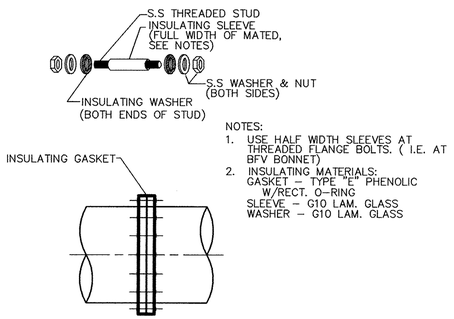
TYPICAL TRENCH DETAIL 2
NOT TO SCALE



TYPICAL ROADWAY SECTION 3
NOT TO SCALE

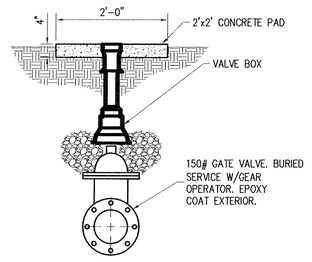


PIPE BOLLARD DETAIL 4
NOT TO SCALE



NOTES:
1. USE HALF WIDTH SLEEVES AT THREADED FLANGE BOLTS. (I.E. AT BFV BONNET)
2. INSULATING MATERIALS:
   GASKET – TYPE "E" PHENOLIC W/RECT. O-RING
   SLEEVE – G10 LAM. GLASS
   WASHER – G10 LAM. GLASS

INSULATING FLANGE KIT 5
NOT TO SCALE



NOTE:
PROVIDE PROTECTIVE COATING TO EXTERIOR SURFACE OF VALVE BODY AND PROVIDE STAINLESS STEEL NUTS AND BOLTS

BURIED GATE VALVE DETAIL 6
NOT TO SCALE

DT-101

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER – CHRISTOPHER SHEM HAWES – 69578 – 1/30/2010 – CIVIL – STATE OF CALIFORNIA

APPROVED BY: CHRISTOPHER SHEM HAWES RCE 69578 — 2/25/08 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

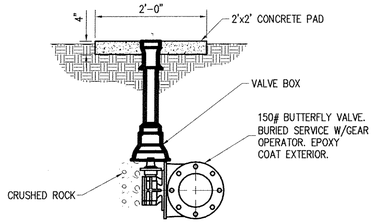
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The Business of Innovation

CITY OF PASADENA INCORPORATED JUNE 1886

D.S.–209 & 210A

DATE: FEBRUARY 2009	SCALE: AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 44 OF 79 SHEETS
DRAWN BY CIVILTEC DESIGNED BY CIVILTEC CHECKED BY CIVILTEC SUBMITTED BY CIVILTEC		MONK HILL TREATMENT SYSTEM GENERAL DETAILS	WORK ORDER 02557 / FILE NUMBER E–1670
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED / REVISION

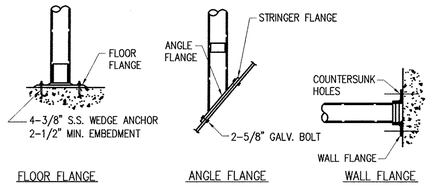
X:\2007\27140–JP\ MONKHILL TREATMENT PLANT\DWG\SUBMITTALS\FINAL SUBMITTAL\27140–GENERAL DETAIL–07–101.DWG (02–27–09 @ 7:21 AM)



NOTE:
PROVIDE PROTECTIVE COATING TO EXTERIOR SURFACE OF VALVE BODY AND PROVIDE STAINLESS STEEL NUTS AND BOLTS

BURIED BUTTERFLY VALVE DETAIL 1

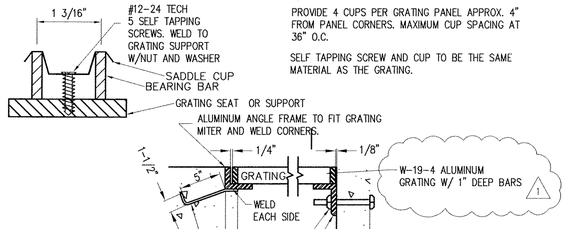
NOT TO SCALE



NOTE
USE THIS DETAIL WHERE WALL THICKNESS IS LESS THAN 8".

RAILING GUARDRAIL & HANDRAIL SUPPORT 2

NOT TO SCALE



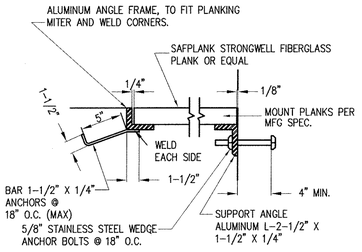
PROVIDE 4 CUPS PER GRATING PANEL APPROX. 4" FROM PANEL CORNERS. MAXIMUM CUP SPACING AT 36" O.C.

SELF TAPPING SCREW AND CUP TO BE THE SAME MATERIAL AS THE GRATING.

COAT ALUMINUM IN CONTACT WITH GROUT OR CONCRETE PER SPECS.

ALUMINUM GRATING DETAIL 3

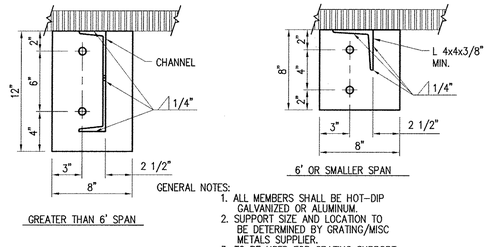
NOT TO SCALE



COAT ALUMINUM IN CONTACT WITH GROUT OR CONCRETE PER SPECS.

FIBERGLASS PLANK DETAIL 4

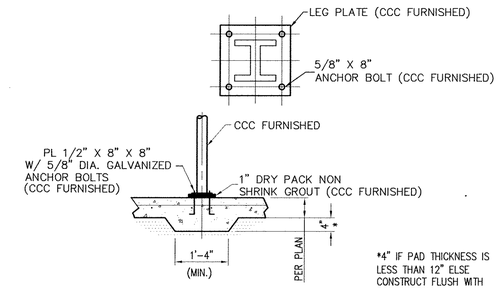
NOT TO SCALE



GENERAL NOTES:
1. ALL MEMBERS SHALL BE HOT-DIP GALVANIZED OR ALUMINUM.
2. SUPPORT SIZE AND LOCATION TO BE DETERMINED BY GRATING/MISC METALS SUPPLIER.
3. TO BE USED FOR GRATING SUPPORT WHERE IMBEDS ARE NOT APPLICABLE. OR AVAILABLE.
4. ANCHOR BOLTS SHALL BE MIN. 5/8"ø S.S. AND 6" MIN. IMBED.

GRATING/DIAMOND PLATE SUPPORT WALL CONNECTION 5

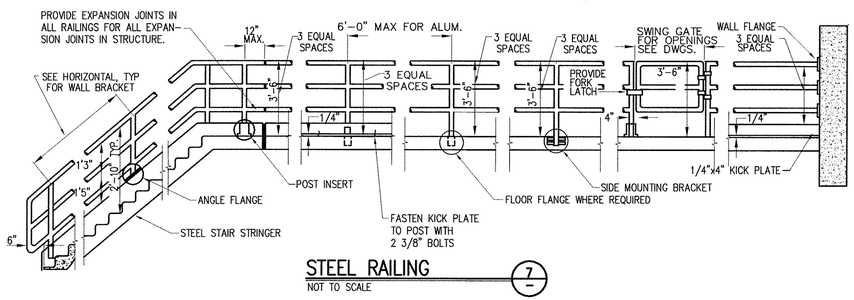
NOT TO SCALE



*4" IF PAD THICKNESS IS LESS THAN 12" ELSE CONSTRUCT FLUSH WITH PAD BOTTOM.

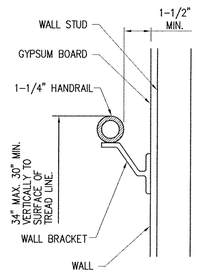
WALKWAY SUPPORT 6

NOT TO SCALE



STEEL RAILING 7

NOT TO SCALE



HANDRAIL WALL BRACKET 8

NOT TO SCALE

DT-102

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — CIVIL — STATE OF CALIFORNIA — 6/30/2010

APPROVED BY:
CHRISTOPHER SHEM HAWES 69578 RCE — 2/25/08 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

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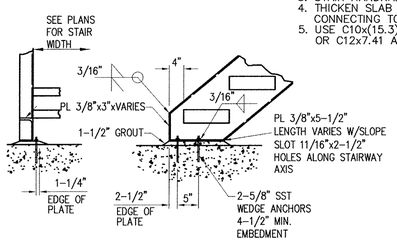
CITY OF PASADENA — INCORPORATED JUNE 1886

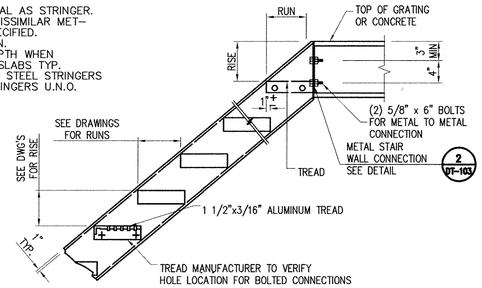
D.S.-209 & 210A

DATE	SCALE		
FEBRUARY 2009	AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 45 OF 79 SHEETS
DRAWN BY CIVILTEC		MONK HILL TREATMENT SYSTEM GENERAL DETAILS	WORK ORDER 02557 / FILE NUMBER E-1670
DESIGNED BY CIVILTEC			
CHECKED BY CIVILTEC			
SUBMITTED BY CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED / REVISION

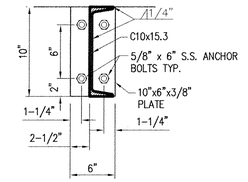
X:\2007\27140-JPL MONHILL TREATMENT PLANT\DWGS\SUBMITTALS\FINAL SUBMITTAL\27140-GENERAL DETAIL-DT-102.DWG (02-27-09 9:28:03AM)

NOTES
1. USE BASE PL OF SAME METAL AS STRINGER.
2. PROVIDE PROTECTION FOR DISSIMILAR METALS AND CONCRETE AS SPECIFIED.
3. STAIR HANDRAIL NOT SHOWN.
4. THICKEN SLAB TO 1'-0" DEPTH WHEN CONNECTING TO CONCRETE SLABS TYP.
5. USE C10x(15.3) GALVANIZED STEEL STRINGERS OR C12x7.41 ALUMINUM STRINGERS U.N.O.

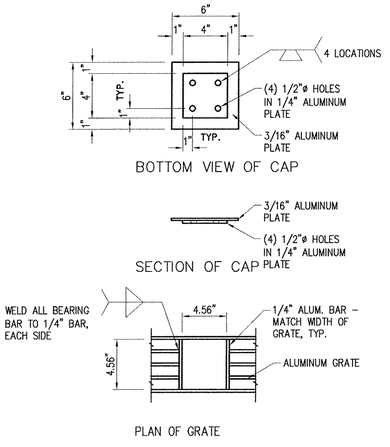




STANDARD METAL STAIR DETAIL
NOT TO SCALE — 1 / –

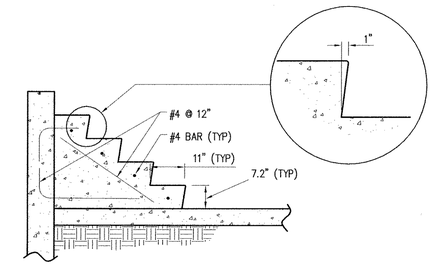


METAL STAIR WALL CONNECTION
NOT TO SCALE — 2 / –

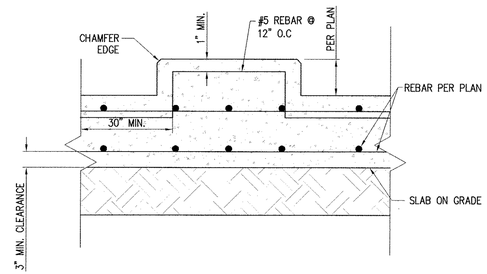


GRATE PENETRATION W/ CAP DETAIL
NOT TO SCALE — 3 / –

NOT USED
NOT TO SCALE — 4 / –

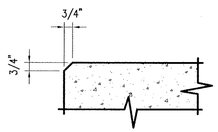


CONCRETE STAIR DETAIL
NOT TO SCALE — 5 / –



EQUIPMENT PAD
NOT TO SCALE — 6 / TPS-102

ALL EXPOSED CONCRETE CORNERS TO BE CHAMFERED



TYPICAL CONCRETE CHAMFER DETAIL
NOT TO SCALE — 7 / –

DT-103

REVISION		
NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — 1/30/2010 — CIVIL — STATE OF CALIFORNIA

APPROVED BY: CHRISTOPHER SHEM HAWES RCE 69578 — 2/25/08 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

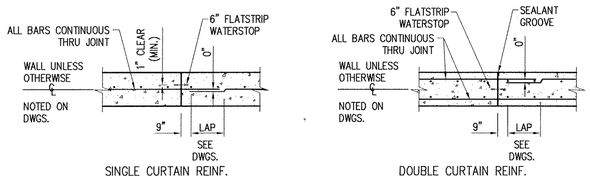
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The Business of Innovation

CITY OF PASADENA INCORPORATED JUNE 1886

D.S.-209 & 210A

DATE: FEBRUARY 2009	SCALE: AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 46 OF 79 SHEETS
DRAWN BY CIVILTEC; DESIGNED BY CIVILTEC; CHECKED BY CIVILTEC; SUBMITTED BY CIVILTEC		MONK HILL TREATMENT SYSTEM GENERAL DETAILS	WORK ORDER 02557 / FILE NUMBER E-1670
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED / REVISION

X:\2007\27140-(P) MONHILL TREATMENT PLANT\DWG\SUBMITTAL\27140-GENERAL DETAIL-DT-103.DWG (02-22-09 @ 08:35AM)



NOTE:

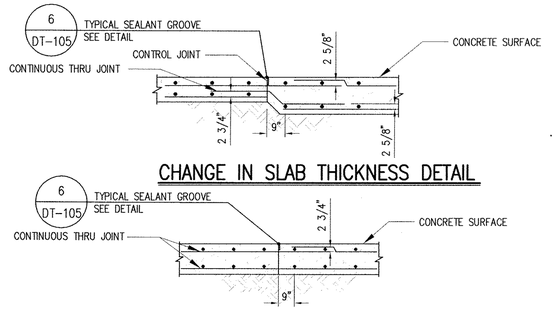
1. WATERSTOP AND SEALANT GROOVES TO BE PROVIDED IN ALL WATER RETAINING FLOORS.

2. WHERE WATERSTOP IS REQUIRED IN SINGLE CURTAIN WALL REINF. PLACE WATERSTOP ON WATER SIDE OF WALL.

3. WHEN WATERSTOP IS REQUIRED IN DOUBLE CURTAIN WALL REINFORCEMENT, PLACE SEALANT GROOVE AND SEALANT ON WATER SIDE OF WALL.

WALL CONSTRUCTION JOINT DETAILS (1)
NOT TO SCALE

NOT USED (2)
NOT TO SCALE



CHANGE IN SLAB THICKNESS DETAIL

FLOOR SLAB DETAIL

SLAB CONTROL JOINT (3)
NOT TO SCALE

NORMAL WEIGHT CONCRETE -fc' = 3000 PSI									
REINFORCEMENT BAR SPLICE LENGTHS									
TENSION SPLICE	BAR SIZE	#11	#10	#9	#8	#7	#6	#5	#4
CLASS "A" (TENSION SPLICE)	TOP	8'-0"	6'-6"	5'-1"	4'-0"	3'-1"	2'-3"	1'-9"	1'-5"
	BOTTOM	5'-8"	4'-8"	3'-8"	2'-11"	2'-2"	1'-7"	1'-3"	1'-0"
CLASS "B"	TOP	10'-4"	8'-5"	6'-8"	5'-3"	4'-0"	2'-11"	2'-3"	1'-10"
	BOTTOM	7'-6"	6'-0"	4'-9"	3'-9"	2'-10"	2'-1"	1'-8"	1'-4"
CLASS "C"	TOP	13'-7"	11'-0"	8'-8"	6'-10"	5'-3"	3'-10"	3'-0"	2'-5"
	BOTTOM	9'-8"	7'-11"	6'-2"	4'-11"	3'-9"	2'-9"	2'-2"	1'-8"

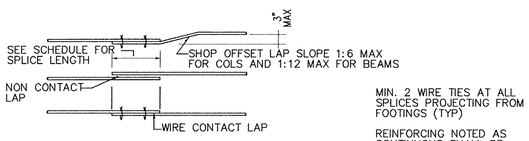
NOTES:

1. TOP BAR REFERS TO HORIZONTAL REINFORCING WITH MORE THAN 12" OF CONCRETE BELOW BAR AND ALL HORIZONTAL WALL REINFORCING.

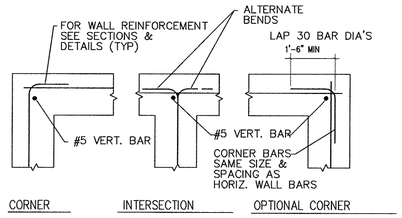
2. BOTTOM BAR REFERS TO HORIZONTAL REINFORCING WITH LESS THAN 12" OF CONCRETE BELOW BAR AND ALL VERTICAL REINFORCING.

3. FOR ALL TENSION DEVELOPMENT USE BOTTOM BAR LENGTHS FOR CLASS "A" SPLICE.

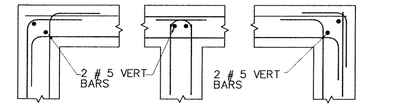
4. NO MORE THAN 1/2 THE TOTAL NUMBER OF BARS SHALL BE SPLICED IN ONE LOCATION, ADJACENT BAR SPLICES SHALL BE STAGGERED, LENGTH OF SPLICE 2'-0" MIN. TO CENTER LINE OF SPLICES. BAR SPLICES SHALL BE CLASS "B" UNLESS NOTED OTHERWISE.



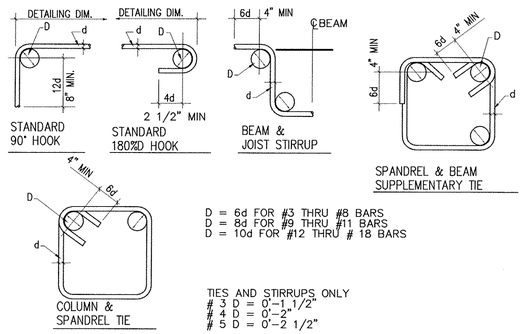
REINFORCING LAP SCHEDULE (4)
NOT TO SCALE



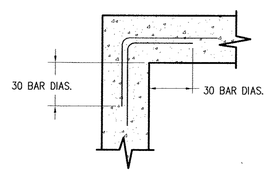
SINGLE CURTAIN OF REBAR (5)
NOT TO SCALE



DOUBLE CURTAIN OF REBAR (6)
NOT TO SCALE



BAR BENDING DETAILS (7)
NOT TO SCALE



HORIZONTAL WALL REINFORCING CORNER (8)
NOT TO SCALE

DT-104

REVISION		
NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — 6/30/2010 — CIVIL — STATE OF CALIFORNIA

APPROVED BY: C. Shem Hawes 69578 — CHRISTOPHER SHEM HAWES RCE — 2/25/08 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

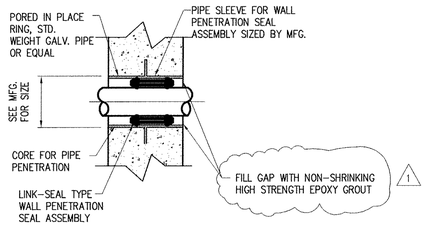
Battelle
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CITY OF PASADENA — INCORPORATED JUNE 1886

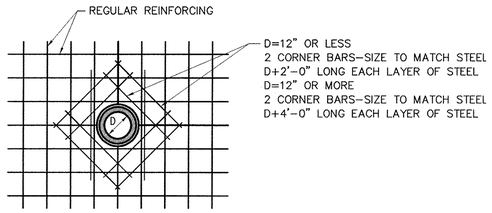
D.S.-209 & 210A

DATE	SCALE		
FEBRUARY 2009	AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 47 OF 79 SHEETS
DRAWN BY CIVILTEC		MONK HILL TREATMENT SYSTEM GENERAL DETAILS	WORK ORDER 02557 / FILE NUMBER E-1670
DESIGNED BY CIVILTEC			
CHECKED BY CIVILTEC			
SUBMITTED BY CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED / REVISION

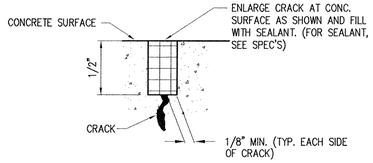
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LINK SEAL DETAIL 1
NOT TO SCALE

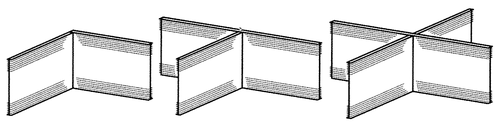


PIPE WALL AND FLOOR PENETRATION EXTRA REINFORCING DETAIL 2
NOT TO SCALE

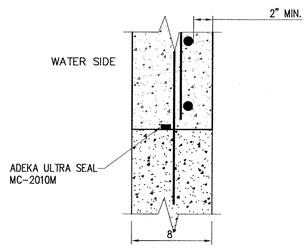


NOTE
PRIOR TO FILLING, STRUCTURES TO CONTAIN WATER SHALL HAVE ALL CRACKS REPAIRED AS SHOWN IN THIS DETAIL.

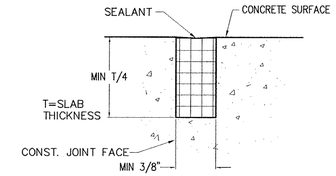
CONCRETE CRACK REPAIR 3
NOT TO SCALE



FLATSTRIP WATERSTOPS 4
NOT TO SCALE

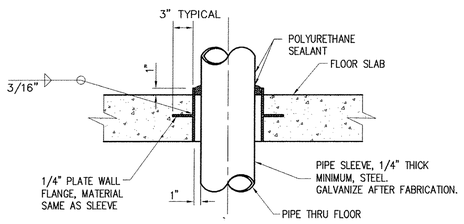


HYDROPHILIC WATER STOP DETAIL 5
NOT TO SCALE



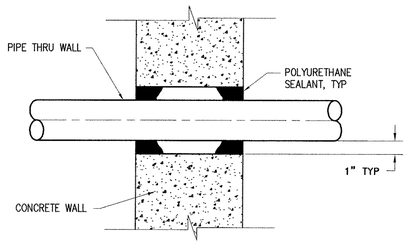
CONTROL JOINTS, EXPANSION JOINTS

SEALANT GROOVE 6
NOT TO SCALE

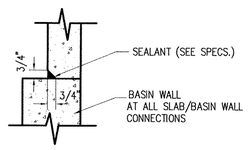


ALL FLOOR PENETRATIONS FOR HARD PIPING OF EQUIPMENT SHALL HAVE A FLOOR SLEEVE.

FLOOR PIPE SLEEVE 7
NOT TO SCALE



WALL CORE DETAIL 8
NOT TO SCALE



CONCRETE CHAMFER AT SLAB/BASIN WALL DETAIL 9
NOT TO SCALE

DT-105

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — CIVIL — STATE OF CALIFORNIA — 1/30/2010

APPROVED BY:
CHRISTOPHER SHEM HAWES 69578 RCE — 2/25/08 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

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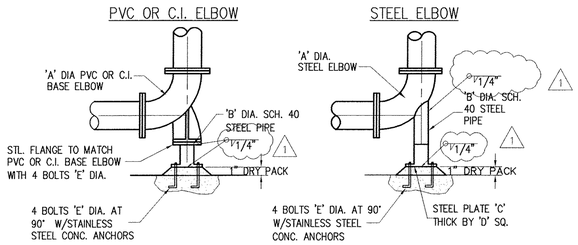
CITY OF PASADENA — INCORPORATED JUNE 1886

D.S.-209 & 210A

DATE	SCALE	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 48 OF 79 SHEETS
FEBRUARY 2009	AS SHOWN		
DRAWN BY CIVILTEC		MONK HILL TREATMENT SYSTEM GENERAL DETAILS	WORK ORDER 02557 / FILE NUMBER E-1670
DESIGNED BY CIVILTEC			
CHECKED BY CIVILTEC			
SUBMITTED BY CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

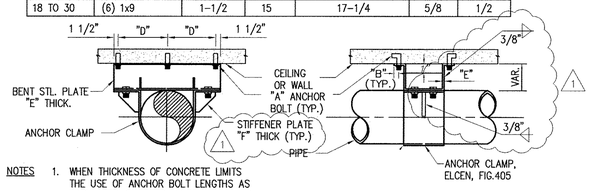
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ELBOW	DIMENSION IN INCHES			
'A' DIA	'B' DIA	'C' THICK	'D' SQ	'E' DIA
4	2	3/8	6	5/8
6	2 1/2	3/8	7	5/8
8	4	1/2	9	5/8
10	4	1/2	9	5/8
12	6	1/2	11	3/4
14	6	1/2	11	3/4
16	6	1/2	11	5/8
18	8	1/2	11	3/4
20	8	1/2	13-1/2	3/4
24	8	1/2	13-1/2	3/4
30	10	3/4	16	7/8
36	12	3/4	19	7/8
42	16	3/4	23-1/2	1
48	18	3/4	25	1-1/8



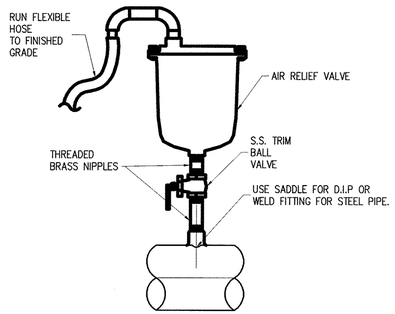
PIPE ELBOW SUPPORT 1/–
NOT TO SCALE

DIMENSIONS IN INCHES						
PIPE DIA.	"A"	"B"	"C"	"D" (APPROX)	"E"	"F"
2 TO 4	(4) 5/8x6	1-1/4	5-3/4	8-1/2 (OMIT ONE)	3/8	1/4
6 TO 10	(6) 3/4x7	1-1/2	11	7-5/8	1/2	3/8
12 TO 16	(6) 7/8x8-1/2	1-1/2	13	10-1/4	1/2	3/8
18 TO 30	(6) 1x9	1-1/2	15	17-1/4	5/8	1/2

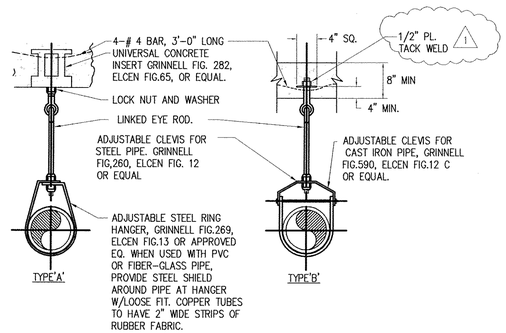


NOTES
1. WHEN THICKNESS OF CONCRETE LIMITS THE USE OF ANCHOR BOLT LENGTHS AS TABULATED, SHORTER BOLTS WELDED TO REINFORCING BARS MAY BE USED.
2. GALVANIZE AFTER FABRICATION.

PIPE ANCHOR 2/–
NOT TO SCALE

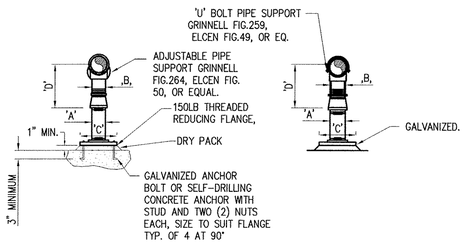


AIR RELIEF VALVE 4/–
NOT TO SCALE



PIPE HANGER RODS AND SUPPORT SPACING					
PIPE DIA. (INCHES)	ROD DIA. (INCHES)	MAX. SUPPORT SPACING (FEET)		WEIGHT LIMIT (LBS)	
		STL.PIPE	C.I. PIPE	TYPE 'A'	TYPE 'B'
1 & SMALLER	3/8	6	5	610	1700
1-1/4 TO 2	3/8	9	5	610	1700
2-1/2 TO 3-1/2	1/2	12	5	1130	3200
4 TO 5	5/8	14	5	1430	3800
6, 8	3/4	16	5	1430	3800
10, 12	7/8	18	–	1430	3800
14, 16	1	20	–	1430	3800

PIPE HANGER 3/–
NOT TO SCALE



ADJUSTABLE PIPE SUPPORT DETAIL 5/–
NOT TO SCALE

ADJUSTABLE PIPE SUPPORT APPROXIMATE DIMENSIONS IN INCHES					
PIPE SIZE	'A'	'B'	'C'	'D' MINIMUM	'D' MAXIMUM
2-1/2	2-1/2	1-1/2	9	8	11-1/2
3	2-1/2	1-1/2	9	8-1/2	11-3/4
3-1/2	2-1/2	1-1/2	9	8-1/2	12
4	3	*2-1/2	9	10-1/4	14
6	3	*2-1/2	9	11-5/8	15-1/4
8	3	*2-1/2	9	13-5/8	16-1/2
10	3	*2-1/2	9	14-5/8	18-1/4
12	3	*2-1/2	9	15-5/8	19-3/4
14	4	3	11	18-7/8	20-3/4
16	4	3	11	19-7/8	22-1/4
18	6	3-1/2	13-1/2	21-1/4	24
20	6	3-1/2	13-1/2	23-1/4	25-1/2
24	6	4	13-1/2	26-1/2	28-1/4
30	6	4	13-1/2	29-5/8	31-1/2
32	6	4	13-1/2	30-5/8	32-3/4
36	6	4	13-1/2	32-5/8	34-3/4

* DENOTES REFERENCE TO MANUFACTURER

DT-106

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — 01/30/2010 — CIVIL — STATE OF CALIFORNIA

APPROVED BY:
CHRISTOPHER SHEM HAWES 69578 RCE — 2/25/08 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

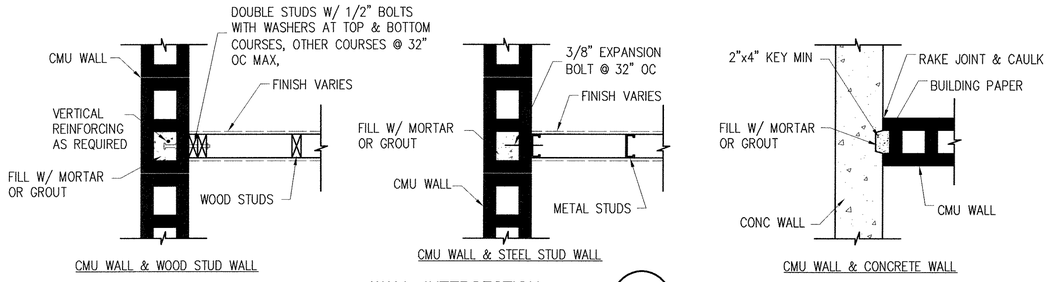
Battelle
The Business of Innovation

CITY OF PASADENA INCORPORATED JUNE 1886

D.S.-209 & 210A

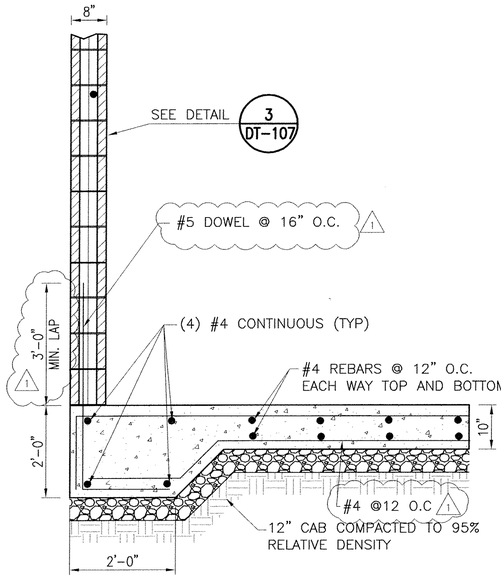
DATE	SCALE	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 49 OF 79 SHEETS
FEBRUARY 2009	AS SHOWN		
DRAWN BY CIVILTEC		MONK HILL TREATMENT SYSTEM GENERAL DETAILS	WORK ORDER 02557 / FILE NUMBER E-1670
DESIGNED BY CIVILTEC			
CHECKED BY CIVILTEC			
SUBMITTED BY CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

X:\2007\27140-JPL MONKHILL TREATMENT PLANT\DWGS\SUBMITTALS\FINAL SUBMITTAL\27140-GENERAL DETAIL-DT-106.DWG (02-27-09 9:30:19AM)



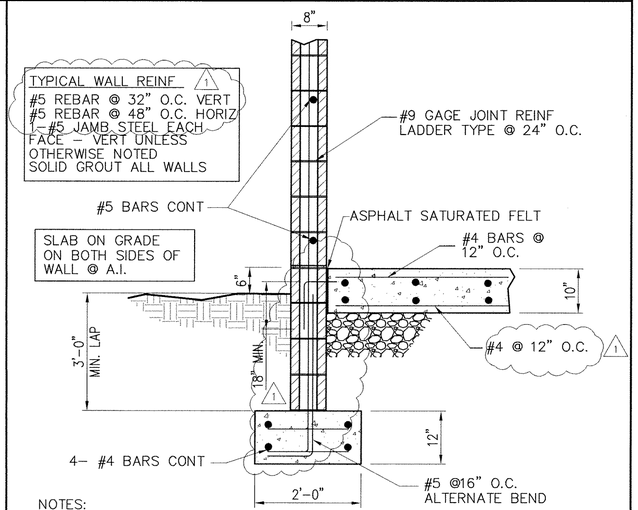
WALL INTERSECTION 1 DT-107

NOT TO SCALE



CONCRETE PAD SECTION 2 DT-107

NOT TO SCALE

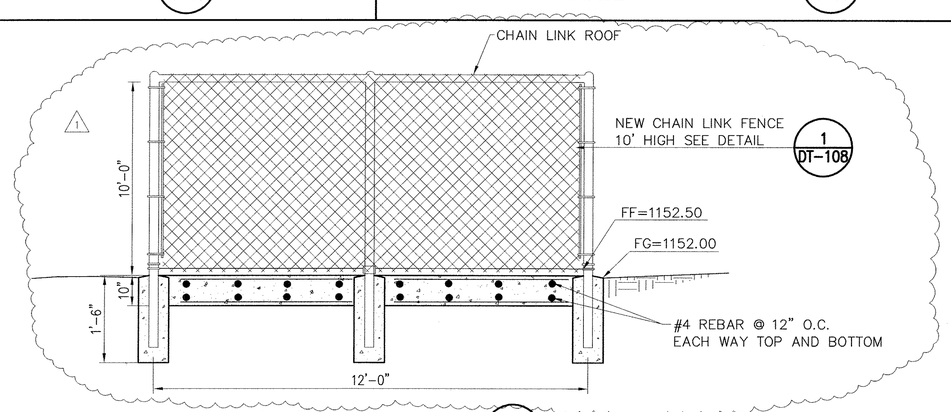


NOTES:

1. SLAB ON GRADE SHALL BE 10" CONCRETE W/ #4 @ 12" O.C. EACH WAY
2. REMOVE AND REPLACE ALL SOILS BELOW FOOTINGS W/ COMPACTED GRANULAR FILL FOR 12"
3. ALL EXTERIOR CONCRETE SHALL BE 4000 PSI WITH 6% AIR.
4. ALL REINFORCING BARS SHALL BE 60 GRADE CONFORMING TO ASTM A-615.

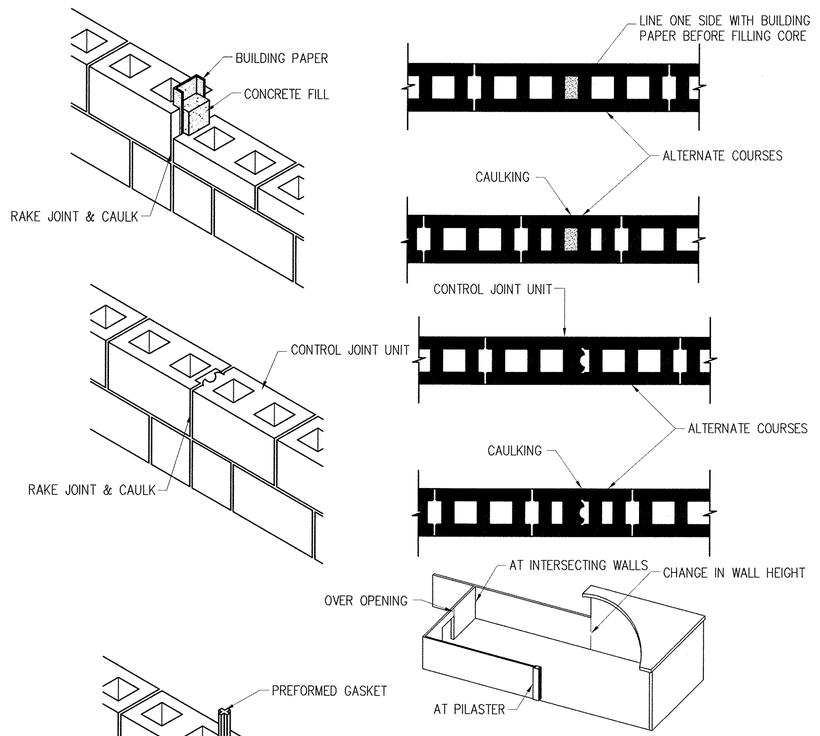
TYPICAL WALL SECTION 3 DT-107

NOT TO SCALE



12'x14' CONCRETE PAD 5 DT-107

NOT TO SCALE



TYPICAL CONTROL JOINT LOCATIONS

CONTROL JOINT SPACING FOR MOISTURE CONTROLLED TYPE 1 CMU				
RECOMMENDED SPACING OF CONTROL JOINTS	VERTICAL SPACING OF JOINT REINFORCEMENT			
	NONE	24"	16"	8"
EXPRESSED AS RATIO OF PANEL LENGTH TO HEIGHT L/H	2	2-1/2	3	4
WITH PANEL LENGTH (L) NOT TO EXCEED:	40'	45'	50'	60'

CONTROL JOINTS 4 DT-107

NOT TO SCALE

DT-107

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — 6/30/2010 — CIVIL — STATE OF CALIFORNIA

APPROVED BY: C. Shem Hawes 69578 2/25/08
CHRISTOPHER SHEM HAWES RCE — DATE
APPROVED: — DATE
APPROVED: — DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

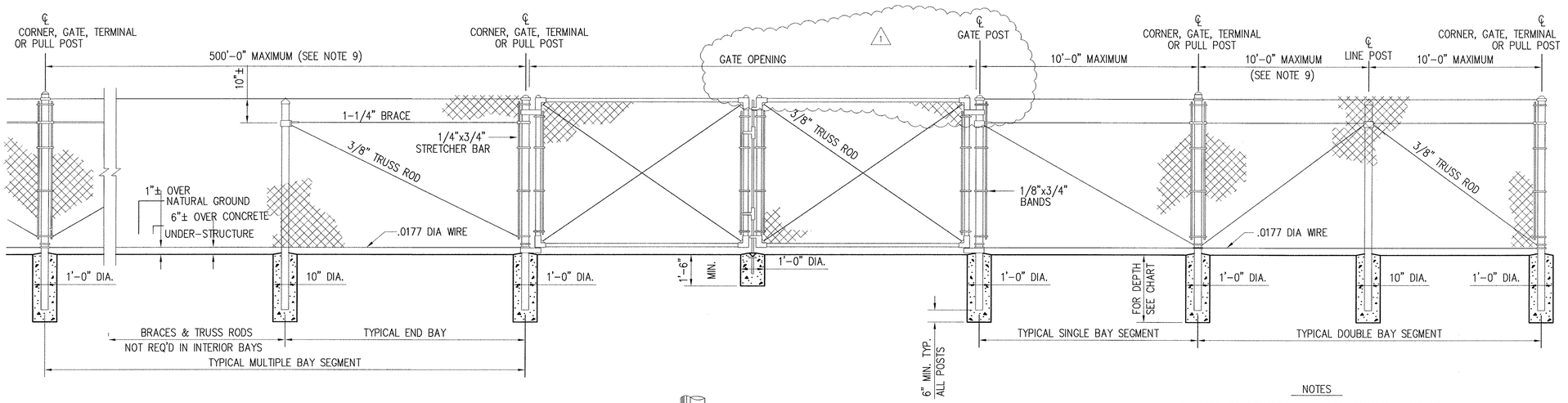
Battelle
The Business of Innovation

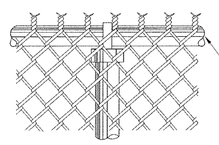
CITY OF PASADENA INCORPORATED JUNE 1886

D.S.-209 & 210A

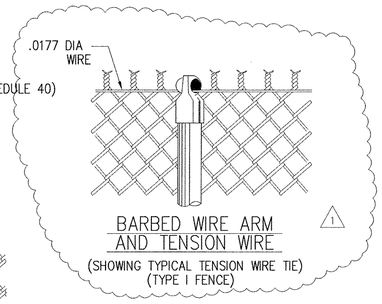
DATE	SCALE	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 50 OF 79 SHEETS
FEBRUARY 2009	AS SHOWN		
DRAWN BY CIVILTEC		MONK HILL TREATMENT SYSTEM GENERAL DETAILS	WORK ORDER 02557 / FILE NUMBER E-1670
DESIGNED BY CIVILTEC			
CHECKED BY CIVILTEC			
SUBMITTED BY CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED / REVISION

X:\2007\07145-P\...\MONHILL TREATMENT PLANT\DWG\SUBMITTALS\FINAL SUBMITTAL\07145-GEN2PDL DETAIL-DT-107.DWG (02-27-09 9:30:45AM)

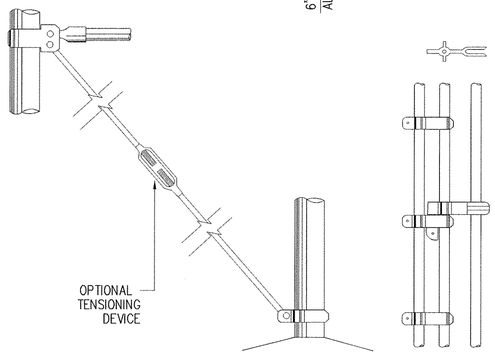




TWISTED AND BARBED SELVAGE
(TYPE II FENCE)

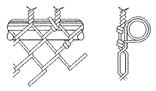


BARBED WIRE ARM AND TENSION WIRE
(SHOWING TYPICAL TENSION WIRE TIE)
(TYPE I FENCE)

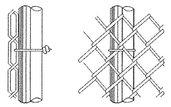


BRACE AND TRUSS CONNECTIONS

DROP ROD ASSEMBLY



RAIL TIE



PIPE POST TIE

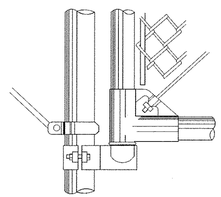
TYPICAL TIE DETAILS



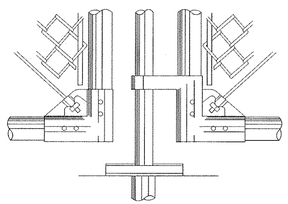
GATE HOLD BACK

GATES			
GATE POSTS AND GATE FRAMES			
HEIGHT	GATE OPENING	GATE POST	GATE FRAME
UNDER 6 FEET	SINGLE TO 6' OR DOUBLE TO 12'	2"	1"
	SINGLE OVER 6' TO 8' OR DOUBLE OVER 12' TO 16'	2-1/2"	1-1/2"
	SINGLE OVER 8' TO 12' OR DOUBLE 16' TO 24'	3-1/2"	
6 FEET AND OVER	SINGLE TO 6' OR DOUBLE TO 12'	2-1/2"	1-1/2"
	SINGLE OVER 6' TO 13' OR DOUBLE OVER 12' TO 24'	3-1/2"	
	SINGLE OVER 13' TO 18' OR DOUBLE OVER 24' TO 36'	6"	
	SINGLE OVER 18' OR DOUBLE OVER 36'	8"	

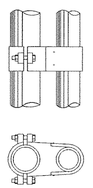
GAGE OF FABRIC	HEIGHT OF FABRIC	DEPTH OF POSTS	LENGTH OF END, CORNER OR PULL POSTS	LENGTH OF LINE POSTS	SIZE OF POSTS				
					END, CORNER & PULL		LINE POSTS (MIN SIZE)		GATE POST
					PIPE OPTION	RECTANGULAR OPTION	PIPE OPTION	H POST OPTION	
9	7'	3'	10'	9'-8"	2-1/2"	3-1/2"	2"	1-7/8"x1-5/8"	SEE GATE POST TABLE
9	6'	3'	9'	8'-8"	2-1/2"	3-1/2"	2"	1-7/8"x1-5/8"	
9	5'	3'	8'	7'-8"	2"	3-1/2"	1-1/2"	1-5/16"x1-1/2"	
9	4'	2'	6'	5'-8"	2"	3-1/2"	1-1/2"	1-5/16"x1-1/2"	
9	3'	2'	5'	4'-8"	2"	3-1/2"	1-1/2"	1-5/16"x1-1/2"	



BOTTOM GATE HINGE AND GATE DETAILS



CENTER GATE STOP AND GATE DETAILS



TOP GATE HINGE

(NOTE: OPTIONAL WELDED OR RIVETED CONSTRUCTION)

NOTES

(1) MATERIALS, CONSTRUCTION AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE WRITTEN SPECIFICATIONS.
(2) THE TYPE OF TOP SUPPORT IS SPECIFIED IN THE SPECIFICATIONS, TYPE I, TENSION WIRE AND TYPE II, TUBULAR RAIL.
(3) BARBED WIRE SHALL BE USED ONLY WHEN INDICATED ON THE PLANS AND IN THE SPECIFICATIONS.
(4) TWISTED AND BARBED SELVAGE, TOP AND BOTTOM, SHALL BE USED ON FENCES FIVE FEET OR GREATER IN HEIGHT.
(5) KNUCKLED SELVAGE ON TOP AND TWISTED AND BARBED SELVAGE ON BOTTOM SHALL BE USED ON FENCES LESS THAN FIVE FEET **IN HEIGHT.**
(6) ALL STEEL PIPE MEMBERS SHALL CONFORM TO THE REQUIREMENTS OF ASTM DESIGNATION A-120, SCHEDULE 40, HOT DIPPED ZINC COATED STEEL PIPE.
(7) OPTIONS EXERCISED SHALL BE UNIFORM THROUGHOUT THE **PROJECT.**
(8) LINE POSTS SHALL BE LOCATED AT EQUAL SPACING FOR EACH SEGMENT WITH MAXIMUM SPACING AS FOLLOWS:
  A. TANGENT SECTIONS TO 500 FEET RADIUS – NOT MORE THAN 10 FEET.
  B. UNDER 500 FEET RADIUS TO 200 FEET RADIUS – NOT MORE THAN 8 FEET.
  C. UNDER 200 FEET RADIUS TO 100 FEET RADIUS – NOT MORE THAN 6 FEET.
  D. UNDER 100 FEET RADIUS – NOT MORE THAN 5 FEET.
(9) THE MINIMUM HEIGHT OF FABRIC ON FENCES AND GATES SHALL **BE 6 FEET.**
(10) ALL CONCRETE SHALL HAVE A MINIMUM OF 5 SACKS OF CEMENT **PER CUBIC YARD.**
(11) FASTEN FABRIC TO TOP AND BOTTOM TENSION CABLE AT 24 INCH INTERVALS. FASTEN TO LINE POSTS AT 14 INCH INTERVALS.

CHAIN LINK FENCE DETAIL

NOT TO SCALE

1 DT-108

DT-108

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — CIVIL — STATE OF CALIFORNIA — 12/31/2010

APPROVED BY: C. Shem Haws 69578 2/25/08
CHRISTOPHER SHEM HAWES RCE — DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
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CITY OF PASADENA INCORPORATED JUNE 1886

D.S.-209 & 210A

DATE: FEBRUARY 2009	SCALE: AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 51 OF 79 SHEETS
DRAWN BY: CIVILTEC DESIGNED BY: CIVILTEC CHECKED BY: CIVILTEC SUBMITTED BY: CIVILTEC		MONK HILL TREATMENT SYSTEM GENERAL DETAILS	WORK ORDER 02557 / FILE NUMBER E-1670
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED / REVISION

X:\2007\27140-JR, MONKHILL TREATMENT PLANT\DWG\SUBMITTALS\FINAL SUBMITTAL\27140-GENERAL DETAIL-JF-108.DWG (02-27-09 9:31:05AM)

LEGEND

PROCESS LINES

- EXISTING PROCESS PIPING
- EXISTING SECONDARY PROCESS PIPING
- MISCELLANEOUS PIPING
- EXISTING MISCELLANEOUS PIPING
- ELECTRICAL SIGNAL
- HYDRAULIC SIGNAL
- ELECTRICAL DIRECTION ARROW
- SIGNAL CONNECTION POINT
- FLOW ARROW FOR PROCESS PIPING
- PROCESS OR SIGNAL LINE
- PROCESS LINES CROSSING (NOT CONNECTED)
- INTERNAL SYSTEM SIGNAL LINK (SOFTWARE OR SIGNAL LINK)
- PRIMARY PROCESS LINE
- SECONDARY PROCESS LINE
- BACKWASH LINE
- DRAIN LINE
- AIR LINE
- INSTRUMENT TUBING
- SKID LIMITS / BOUNDARIES
- INSULATED LINE
- HEAT TRACED LINE
- INSULATED AND HEAT TRACED LINE
- LINE BROKEN & CONTINUED or SPACE FOR COPIED EQUIPMENT

P&ID INTERFACE SYMBOLS

FIELD DEVICE | MOUNTED *ON* MAIN PANEL (ACCESSIBLE) | MOUNTED *ON* AUX. PANEL (ACCESSIBLE) | MOUNTED *IN* PANEL (INACCESSIBLE)

- INSTRUMENT
- HMI OR OIT FUNCTION/SCADA
- PROGRAMMABLE LOGIC CONTROL, REMOTE I/O
- COMPUTER FUNCTION

- AE – ANALYZER ELEMENT
- RUN / YL / G – INDICATING LIGHT
- HOA / HS – HAND SWITCH
- LS – FLOAT SWITCH
- LE – ULTRASONIC OR RADAR LEVEL TRANSDUCER
- AAA / BBB / X – PILOT LIGHT X= LENS COLOR R=RED, G=GREEN, A=AMBER, B=BLUE

- ANALOG INPUT
- ANALOG OUTPUT
- DISCRETE INPUT
- DISCRETE OUTPUT
- DUAL CHANNEL CURRENT ISOLATOR
- PULSE INPUT
- PULSE OUTPUT

EQUIPMENT

- AERATION ROTOR
- AIR COMPRESSOR
- BLOWER
- CENTRIFUGAL PUMP
- GAS INJECTIONS
- METERING/SAMPLING PUMP
- ROTARY LOBE PUMP
- SAMPLER
- SLUICE GATE
- SUBMERSIBLE MIXER
- SUBMERSIBLE PUMP

AI / TIC 01 / AI – INSTRUMENT TAG NUMBERS

TIC–01 –
- INSTRUMENT IDENTIFICATION
- LOOP NUMBER
- FUNCTIONAL IDENTIFICATION
- ADDITIONAL IDENTIFICATION SEE ABBREVIATIONS AND HAND SWITCH DESIGNATIONS

SIGNALS

- ELECTRICAL
- DCS–PLC
- PNEUMATIC

VALVES & SYMBOLS

- AIR RELEASE VALVE
- ANGLE
- BACKPRESSURE SUSTAINING
- BALL
- BALL CHECK VALVE
- BUTTERFLY
- CHECK
- DIAPHRAGM
- FLUME
- GATE
- GLOBE
- NEEDLE
- PLUG
- PLUG VALVE
- 3–WAY
- 4–WAY
- PRESSURE REDUCING
- RELIEF VALVE
- SOLENOID VALVE
- SWING CHECK VALVE
- WEIR
- WATER SURFACE
- Y–STRAINER

P&ID ABBREVIATIONS

A	AMPERE	I	CURRENT	PPH	POUNDS PER HOUR
AFD	ADJUSTABLE FREQUENCY DRIVE	ICR	INTERMITTENT CYCLE	PPM	PARTS PER MILLION
AI	ANALOG INPUT	IO	REACTORINPUT/OUPUT	PR	PAIR
AIC	AMPS INTERRUPTING CAPACITY	IOE	INTERNAL–OFF–EXTERNAL	PRES	PRESSURE
ARV	AIR RELIEF VALVE	JB	JUNCTION BOX	PS	PRESSURE SWITCH
AO	ANALOG OUTPUT	L, LO	LOW	PSI	POUNDS PER SQUARE INCH
AS	AIR SUPPLY	LAN	LOCAL AREA NETWORK	PV	PROCESS VARIABLE
ATS	AUTOMATIC TRANSFER SWITCH	LC	LOOP CONTROLLER	RAS	RETURN ACTIVATED SLUDGE
AUTO	AUTOMATIC	LCP	LOCAL CONTROL PANEL	RAW	RAW WATER
AFP	BELT FILTER PRESS	L/O/A/R	LOWER/OFF/AUTO/RAISE	REM	REMOTE
BWL	BOTTOM WATER LEVEL	LOS	LOCK–OFF–STOP	RF	RADIO FREQUENCY
CB	CIRCUIT BREAKER	LR	LOCAL/REMOTE	RIO	REMOTE INPUT OUTPUT
CL2	CHLORINE	LS	LEVEL SWITCH	RS	RAW SEWAGE
CPM	CUSTOMER POWER MONITORING UNIT	M	MOTOR	RSP	RAW SEWAGE PUMP
		MA	MANUAL/AUTO, MILLIAMP	RST	RESET
CON	CONTACTOR	MC	MANUFACTURE CABLE	RTU	REMOTE TELEMETRY UNIT
CU	COPPER, BARE	MCC	MOTOR CONTROL CENTER	RUNf	RUN (FAST SPEED)
CV	CONTROL VALVE	MCP	MOTOR CIRCUIT PROTECTOR	RUNs	RUN (SLOW SPEED)
DCS	DISTRIBUTED CONTROL SYSTEM	MFR(S)	MANUFACTURER(S)	SB	SLUDGE BLANKET
DI	DISCREET INPUT	MGD	MILLION GALLONS PER DAY	SEQ	SERVICE ENTRANCE EQUIPMENT
DO	DISSOLVED OXYGEN	MGL	MILLIGRAMS PER LITER	SES	SERVICE ENTRANCE SECTION
DP	DIFFERENTIAL PRESSURE	MH	MANHOLE	SLC	SINGLE LOOP CONTROLLER
DWG	DRAWING	MLR	MIXED LIQUOR RETURN	SLG	SLUICE GATE
ETM	ELAPSED TIME METER	MO	MOISTURE	SLOS	START–LOCK–OFF–STOP
ETMf	ELAPSED TIME METER (FAST SPEED)	MOD	MODULATED	SO2	SULFUR DIOXIDE
ETMs	ELAPSED TIME METER (SLOW SPEED)	MOG	MOTOR OPERATED GATE	SOV	SOLENOID OPERATED VALVE
EOL	ELECTRIC OVERLOAD	MS	MOISTURE SWITCH	SP	SET POINT
ES	EMERGENCY STOP	MTU	MASTER TELEMETRY UNIT	SPD	SPEED
EXIST	EXISTING	NPW	NON–POTABLE WATER	SPR	SPARE
FA	FOUL AIR	NS	NITROGEN SUPPLY	SS	START/STOP (MAINTAINED)
FC	FAIL CLOSED	NTU	TURBIDITY	SSS	SOLID STATE STARTER (SOFT START)
FE	FLOW ELEMENT	O/C	OPEN / CLOSE	TAH	TEMPERATURE ALARM HIGH
FLT	FILTER	OCA	OPEN–CLOSE–AUTO	T/M	TEMPERATURE AND/OR MOISTURE
FMR	FEEDER MANAGEMENT RELAY	OCR	OPEN–CLOSE–REMOTE	TEMP	TEMPERATURE
FR	FORWARD–REVERSE	OIT	OPERATOR INTERFACE TERMINAL	TS	TEMPERATURE SWITCH
FS	FLOW SWITCH	OL	OVERLOAD	TSS	TOTAL SUSPENDED SOLIDS
FVNR	FULL VOLTAGE NON–REVERSING	OO	ON/OFF (MAINTAINED)	TWL	TOP WATER LEVEL
FW	FINISHED WATER	OOA	ON–OFF–AUTO	UG	UNDERGROUND
GRN	GROUND	OOR	ON–OFF–REMOTE	USD	UP/STOP/DOWN
GAL	GALLONS	OSC	OPEN–STOP–CLOSE	V	VOLT
GCP	GENERATOR CONTROL PANEL	PAH	PRESSURE ALARM HIGH	V*	VENDOR EQUIPMENT
GPD	GALLONS PER DAY	PER	PERMISSIVE	VFD	VARIABLE FREQUENCY DRIVE
GPH	GALLONS PER HOUR	PID	PROPORTIONAL INTEGRAL DESIGN	VTP	VERTICAL TURBINE PUMP
GPM	GALLONS PER MINUTE	PLC	PROGRAMMABLE LOGIC CONTROLLER	W	WATT, WIRE
H, HI	HIGH	PNL	PANEL	WAS	WASTE ACTIVATED SLUDGE
H2S	HYDROGEN SULFIDE	PO	PULSE OUTPUT	ZS	POSITION (i.e. LIMIT) SWITCH
HMI	HUMAN MACHINE INTERFACE	POS	POSITION		
HOA	HAND–OFF–AUTO	POT	POTENTIOMETER		

FUNCTIONAL IDENTIFICATION

FIRST LETTER	OPTIONAL MIDDLE LETTER(S)	LAST LETTER
A – ANALYZING	A – ALARM	C – CONTROLLER
C – CONDUCTIVITY	C – CONTROL	E – ELEMENT
D – DIFFERENTIAL	I – INDICATING	H – HIGH
E – VOLTAGE	Q – TOTALIZING	I – INDICATOR
F – FLOW	P – PRESSURE	L – LOW
G – GAUGE	X – UNCLASSIFIED	Q – TOTALIZER
H – HAND	Y – EVENT, STATE, OR PRESENCE	R – RECORDER
I – CURRENT (ELECTRICAL)	Z – POSITION	S – SWITCH
K – TIME		T – TRANSMITTER
L – LEVEL		V – VALVE
M – MOTOR		
O – TORQUE		
P – PRESSURE		
R – RUN		
S – SPEED FREQUENCY		
T – TEMPERATURE		

HAND SWITCH DESIGNATIONS

ES	EMERGENCY STOP
HOA	HAND–OFF–AUTO
HOR	HAND–OFF–REMOTE
HORA	HAND–OFF–REMOTE–AUTO
JOA	JOG–OFF–AUTO
LOAR	LOWER–OFF–AUTO–RAISE
LOR	LOCAL–OFF–REMOTE
LR	LOCAL–REMOTE
OC	OPEN–CLOSE
OO	ON–OFF

VALVE ACCESSORIES

DIAPHRAGM ACTUATOR	PISTON ACTUATOR	MOTORIZED ACTUATOR
DOUBLE ACTING (AIR TO AIR) (FAIL LAST)		M – DOUBLE ACTING (POWER TO MOVE) (FAIL LAST)
SPRING TO OPEN (AIR TO CLOSE) (FAIL OPEN) (NORMALLY OPEN)		M – SPRING TO OPEN (POWER TO CLOSE) (FAIL OPEN) (NORMALLY OPEN)
SPRING TO CLOSE (AIR TO OPEN) (FAIL CLOSE) (NORMALLY CLOSED)		M – SPRING TO CLOSE (POWER TO OPEN) (FAIL CLOSE) (NORMALLY CLOSED)
w/ TRAVEL STOP		M – w/ TRAVEL STOP

- RELIEF
- REGULATED
- S – SOLENOID

PROCESS LINE ACCESSORIES

- FLOW DIRECTION
- DRAIN (TO GRADE, UNLESS OTHERWISE SPECIFIED)
- REDUCER
- OPEN SPECTACLE BLIND
- CLOSED SPECTACLE BLIND
- TANK CONNECTIONS (FRONT & SIDE VIEWS)
- FLEXIBLE COUPLING
- FLANGE
- QUICK CONNECT
- HOSE CONNECTION
- FLEXIBLE HOSE
- CAP
- RESIN TRAP

INSTRUMENT ACCESSORIES

- FLOW ORFICE
- M – MAGNETIC FLOW METER
- SONIC FLOW METER
- TURBINE FLOW METER
- VORTEX FLOW METER
- MCC – CONTROLLED BY MOTOR CONTROL CENTER
- IA / I/P – I/P CONVERTER
- RUPTURE DISC
- FI – ROTAMETER
- ISOLATION/SAMPLING BALL VALVE
- INTERLOCK
- VFD – CONTROLLED BY VARIABLE FREQUENCY DRIVE

PID–101

REVISION		
NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER – CHRISTOPHER SHEM HAWES – 69578 – CIVIL – STATE OF CALIFORNIA – 6/30/2010

APPROVED BY: C. Shem Hawes 69578 CHRISTOPHER SHEM HAWES RCE — 2/25/08 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
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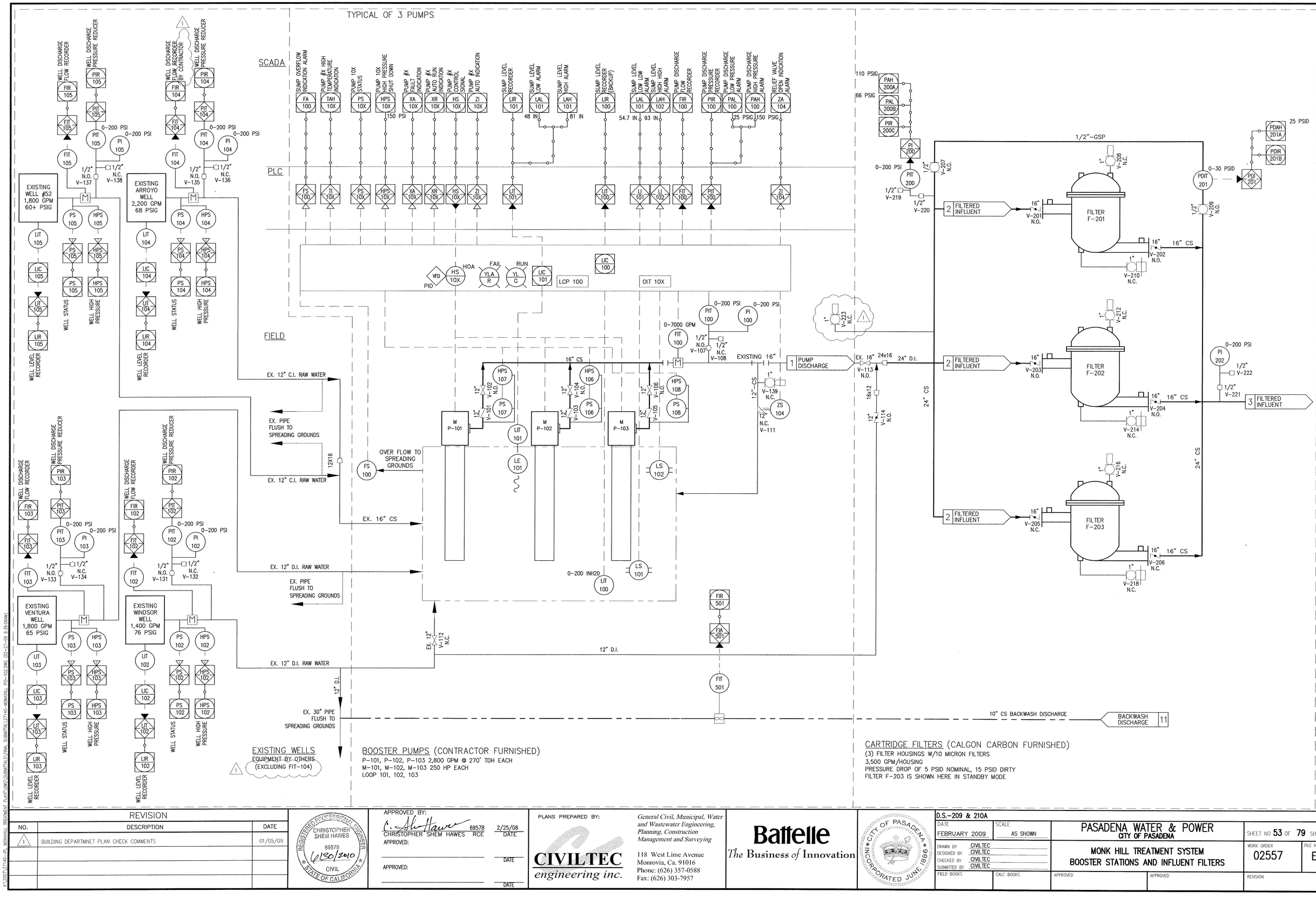
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The Business of Innovation

CITY OF PASADENA – INCORPORATED JUNE 1886

D.S.–209 & 210A

DATE: FEBRUARY 2009	SCALE: AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 52 OF 79 SHEETS
DRAWN BY CIVILTEC; DESIGNED BY CIVILTEC; CHECKED BY CIVILTEC; SUBMITTED BY CIVILTEC		MONK HILL TREATMENT SYSTEM LEDGEND/SYMBOLS/ ABBREVIATIONS	WORK ORDER 02557 / FILE NUMBER E–1670
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED / REVISION

X:\2007\27140–JR MONHILL TREATMENT PLANT\DWG\SUBMITTALS\PHASE SUBMITTALS\27140–MONHILL PID–101.DWG (02–27–09 9:38:16AM)



EXISTING WELLS
EQUIPMENT BY OTHERS (EXCLUDING FIT-104)

BOOSTER PUMPS (CONTRACTOR FURNISHED)
P-101, P-102, P-103 2,800 GPM @ 270' TDH EACH
M-101, M-102, M-103 250 HP EACH
LOOP 101, 102, 103

CARTRIDGE FILTERS (CALGON CARBON FURNISHED)
(3) FILTER HOUSINGS W/10 MICRON FILTERS
3,500 GPM/HOUSING
PRESSURE DROP OF 5 PSID NOMINAL, 15 PSID DIRTY
FILTER F-203 IS SHOWN HERE IN STANDBY MODE

PID-102

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMNET PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — 6/30/2010 — CIVIL — STATE OF CALIFORNIA

APPROVED BY: CHRISTOPHER SHEM HAWES 69578 RCE — 2/25/08 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
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CITY OF PASADENA INCORPORATED JUNE 1886

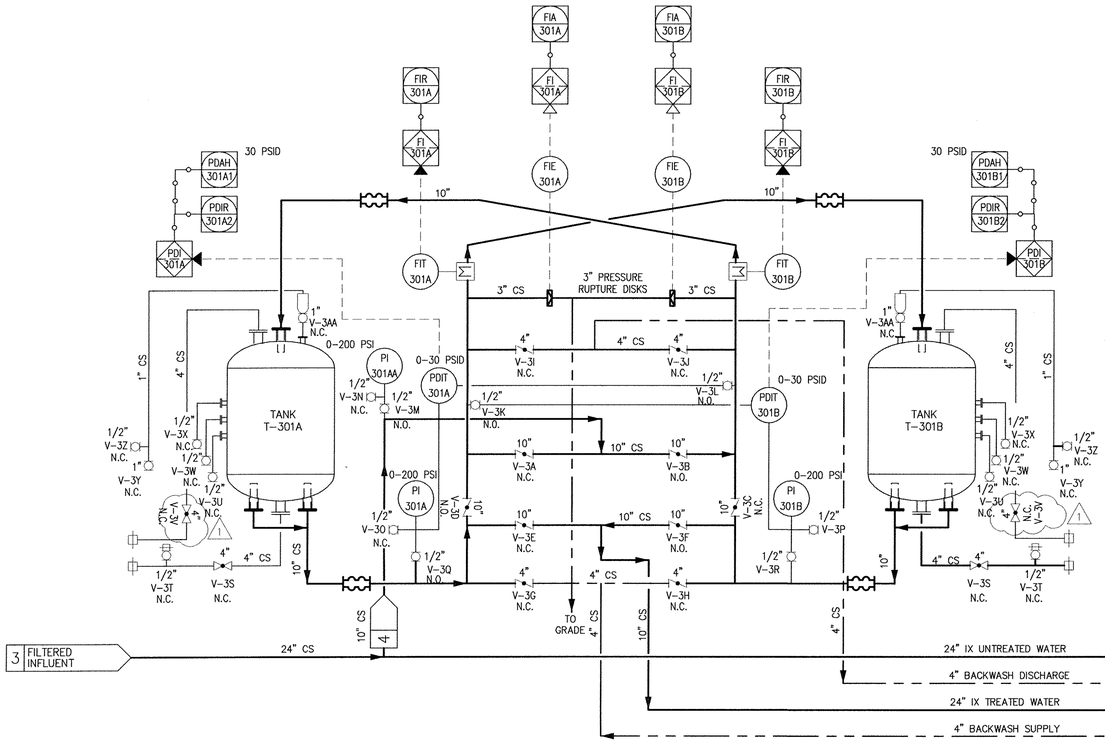
D.S.-209 & 210A
DATE: FEBRUARY 2009 — SCALE: AS SHOWN
DRAWN BY: CIVILTEC
DESIGNED BY: CIVILTEC
CHECKED BY: CIVILTEC
SUBMITTED BY: CIVILTEC
FIELD BOOKS — CALC BOOKS — APPROVED — APPROVED

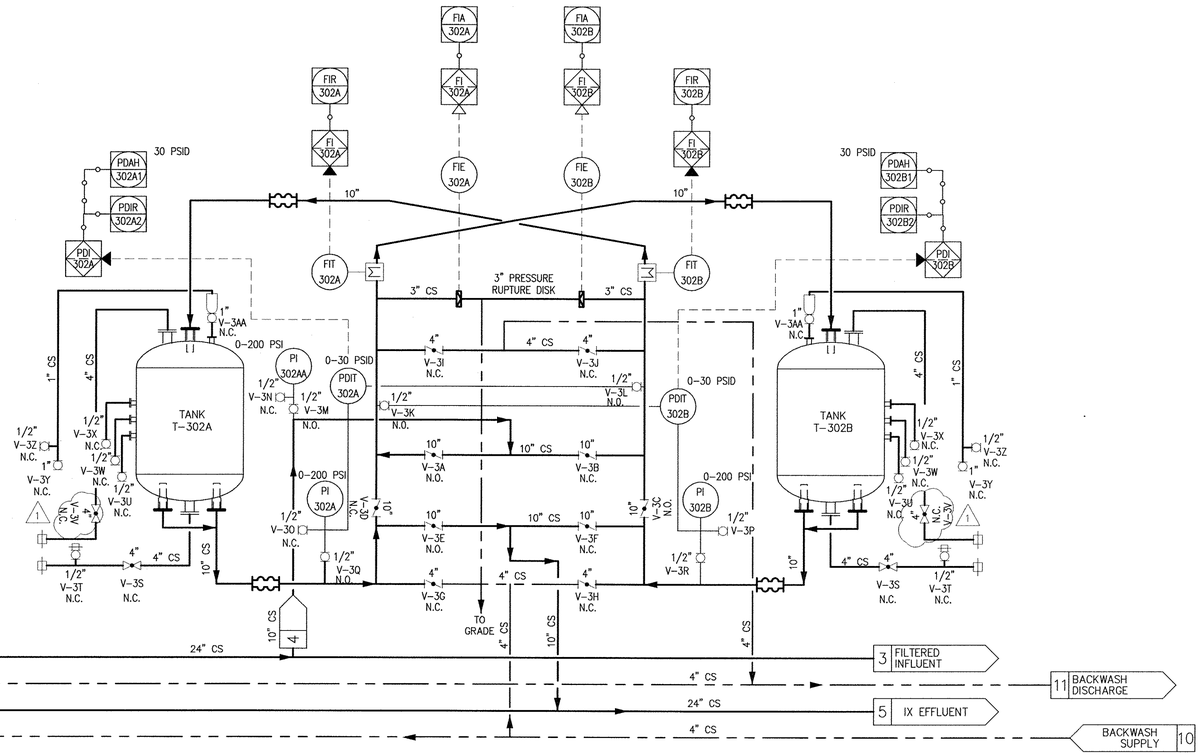
PASADENA WATER & POWER
CITY OF PASADENA

MONK HILL TREATMENT SYSTEM
BOOSTER STATIONS AND INFLUENT FILTERS

SHEET NO 53 OF 79 SHEETS
WORK ORDER 02557
FILE NUMBER E-1670
REVISION

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ION EXCHANGE TANKS T-301A & T-301B (CALGON CARBON FURNISHED)
(2) EXCHANGE VESSELS W/ 2109 RESIN
1,750 GPM/VESSEL
PRESSURE DROP OF 18.8 PSID NOMINAL, 30 PSID DIRTY
VESSELS ARE SHOWN IN NORMAL OPERATION TANK T-301A IS SHOWN HERE IN LEAD POSITION AND T-301B IS SHOWN IN LAG POSITION

ION EXCHANGE TANKS T-302A & T-302B (CALGON CARBON FURNISHED)
(2) EXCHANGE VESSELS W/ 2109 RESIN
1,750 GPM/VESSEL
PRESSURE DROP OF 18.8 PSID NOMINAL, 30 PSID DIRTY
VESSELS ARE SHOWN IN NORMAL OPERATION TANK T-302B IS SHOWN HERE IN LEAD POSITION AND T-302A IS SHOWN IN LAG POSITION

PID-103

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — CIVIL — STATE OF CALIFORNIA — 6/30/2010

APPROVED BY: C. Shem Hawes 69578 2/25/08
CHRISTOPHER SHEM HAWES RCE DATE
APPROVED: DATE
APPROVED: DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
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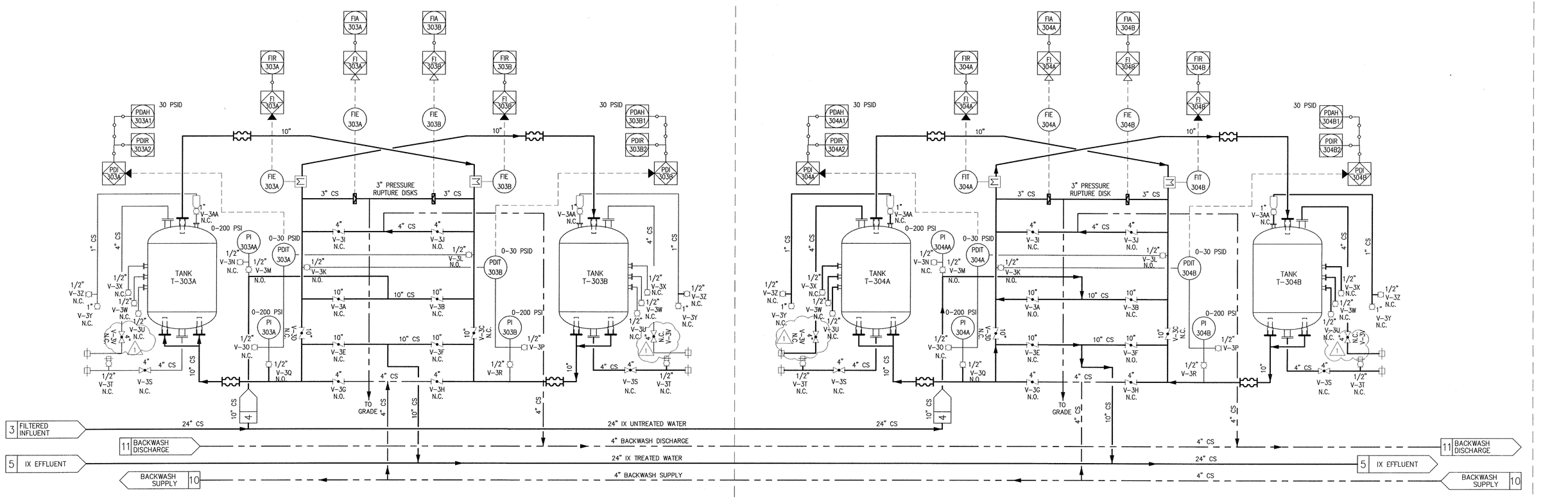
Battelle
The Business of Innovation

CITY OF PASADENA INCORPORATED JUNE 1886

D.S.-209 & 210A

DATE	SCALE		
FEBRUARY 2009	AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 54 OF 79 SHEETS
DRAWN BY CIVILTEC DESIGNED BY CIVILTEC CHECKED BY CIVILTEC SUBMITTED BY CIVILTEC		MONK HILL TREATMENT SYSTEM ION EXCHANGE TANKS	WORK ORDER 02557 / FILE NUMBER E-1670
FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

X:\2007\27140-PL MONKHILL TREATMENT PLANT\DWG\SUBMITTALS\FINAL SUBMITTAL\27140-MONKHIL PID-103.DWG (02-27-09 9:39:56AM)



ION EXCHANGE TANKS T-303A & T-303B (CALGON CARBON FURNISHED)
(2) EXCHANGE VESSELS W/ 2109 RESIN
1,750 GPM/VESSEL
PRESSURE DROP OF 18.8 PSID NOMINAL, 30 PSID DIRTY
VESSELS ARE SHOWN IN BACKWASH MODE TANK T-303A IS SHOWN HERE IN BACKWASH POSITION AND T-303B IS SHOWN AS ISOLATED.

ION EXCHANGE TANKS T-304A & T-304B (CALGON CARBON FURNISHED)
(2) EXCHANGE VESSELS W/ 2109 RESIN
1,750 GPM/VESSEL
PRESSURE DROP OF 18.8 PSID NOMINAL, 30 PSID DIRTY
VESSELS ARE SHOWN IN BACKWASH MODE TANK T-304A IS SHOWN HERE IN BACKWASH POSITION AND T-304B IS SHOWN IN NORMAL OPERATION.

PID-104

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — RCE 12/31/2010 — CIVIL — STATE OF CALIFORNIA

APPROVED BY: C. Shem Hawes 69578 2/25/08
CHRISTOPHER SHEM HAWES RCE — DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
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Phone: (626) 357-0588
Fax: (626) 303-7957

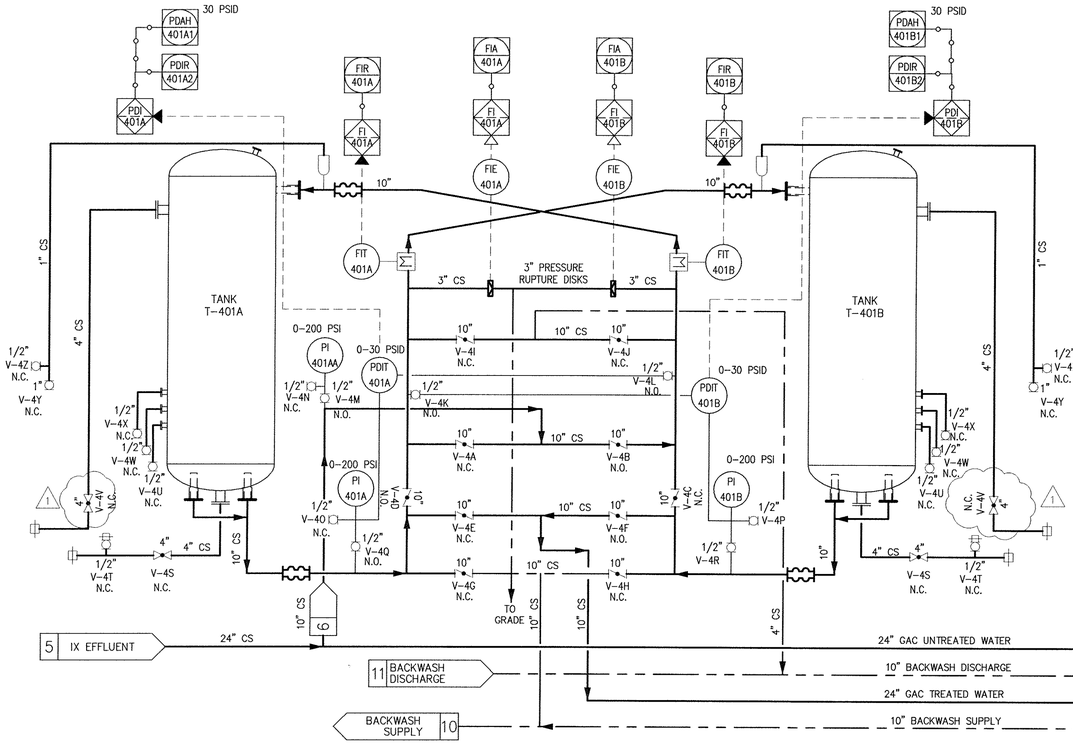
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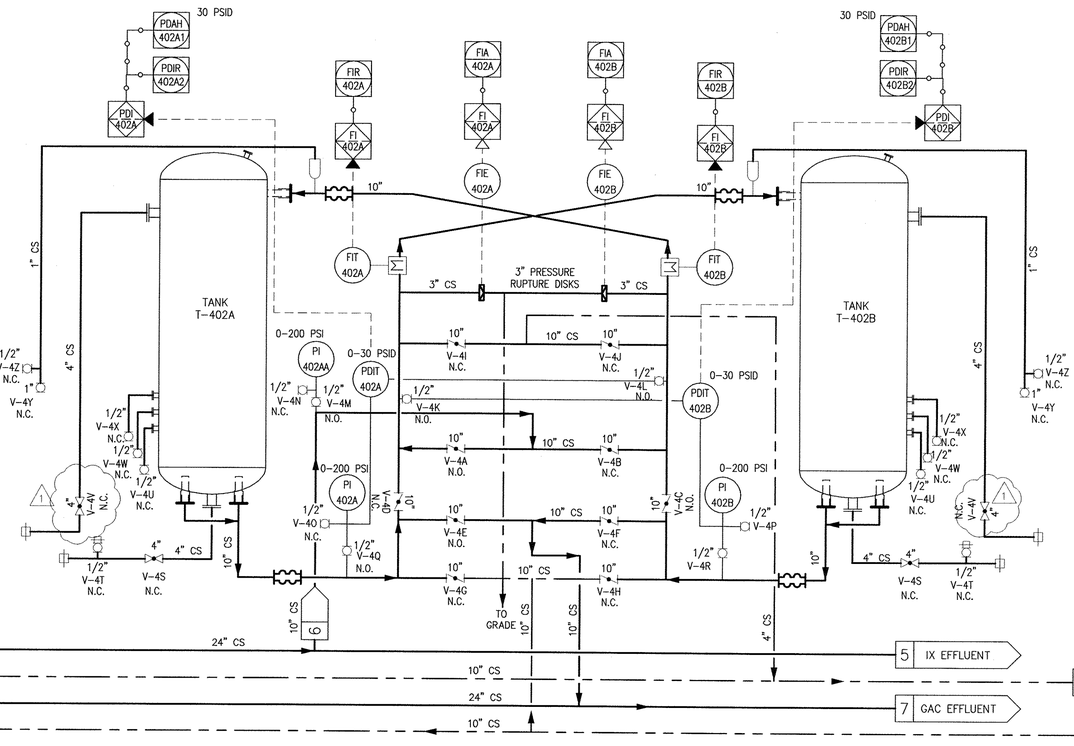
CITY OF PASADENA INCORPORATED JUNE 1886

D.S.-209 & 210A

DATE	SCALE		
FEBRUARY 2009	AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 55 OF 79 SHEETS
DRAWN BY CIVILTEC DESIGNED BY CIVILTEC CHECKED BY CIVILTEC SUBMITTED BY CIVILTEC		MONK HILL TREATMENT SYSTEM ION EXCHANGE TANKS	WORK ORDER 02557 / FILE NUMBER E-1670
FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

X:\2007\27140-JR_MONKHILL TREATMENT PLANT\DWGS\SUBMITTALS\FINAL SUBMITTAL\27140-MONKHILL PID-104.DWG (02-27-09 9:40:08AM)





GRANULAR ACTIVATED CARBON TANKS T-401A & T-401B (CALGON CARBON FURNISHED)
(2) VESSELS PER SYSTEM W/ FILTRASORB 300 GAC
1,400 GPM/SYSTEM
PRESSURE DROP OF 11.2 PSID NOMINAL, 30 PSID DIRTY
VESSELS ARE SHOWN IN NORMAL OPERATION TANK T-401A IS SHOWN HERE IN LEAD POSITION AND T-401B IS SHOWN IN LAG POSITION

GRANULAR ACTIVATED CARBON TANKS T-402A & T-402B (CALGON CARBON FURNISHED)
(2) VESSELS PER SYSTEM W/ FILTRASORB 300 GAC
1,400 GPM/SYSTEM
PRESSURE DROP OF 11.2 PSID NOMINAL, 30 PSID DIRTY
VESSELS ARE SHOWN IN NORMAL OPERATION TANK T-402B IS SHOWN HERE IN LEAD POSITION AND T-402A IS SHOWN IN LAG POSITION

PID-105

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — 6/30/2010 — CIVIL — STATE OF CALIFORNIA

APPROVED BY:
CHRISTOPHER SHEM HAWES 69578 RCE — 2/25/08 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

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CITY OF PASADENA INCORPORATED JUNE 1886

D.S.-209 & 210A

DATE	SCALE
FEBRUARY 2009	AS SHOWN

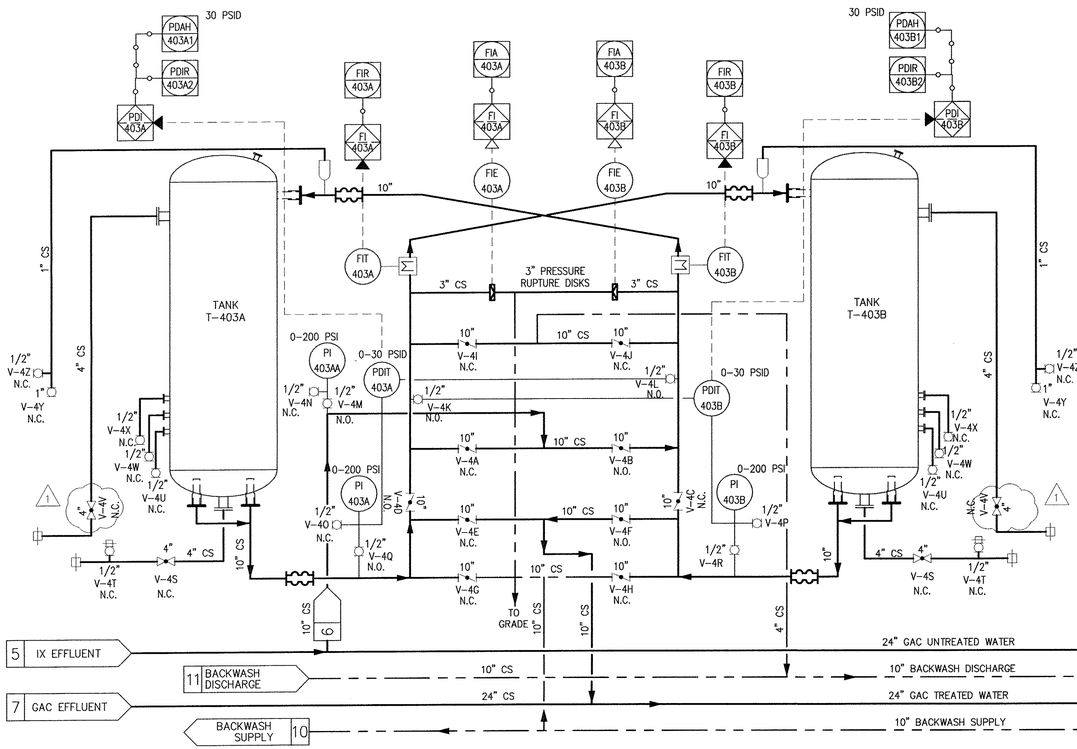
DRAWN BY CIVILTEC
DESIGNED BY CIVILTEC
CHECKED BY CIVILTEC
SUBMITTED BY CIVILTEC
FIELD BOOKS | CALC BOOKS | APPROVED | APPROVED

PASADENA WATER & POWER
CITY OF PASADENA

MONK HILL TREATMENT SYSTEM
LGAC TANKS

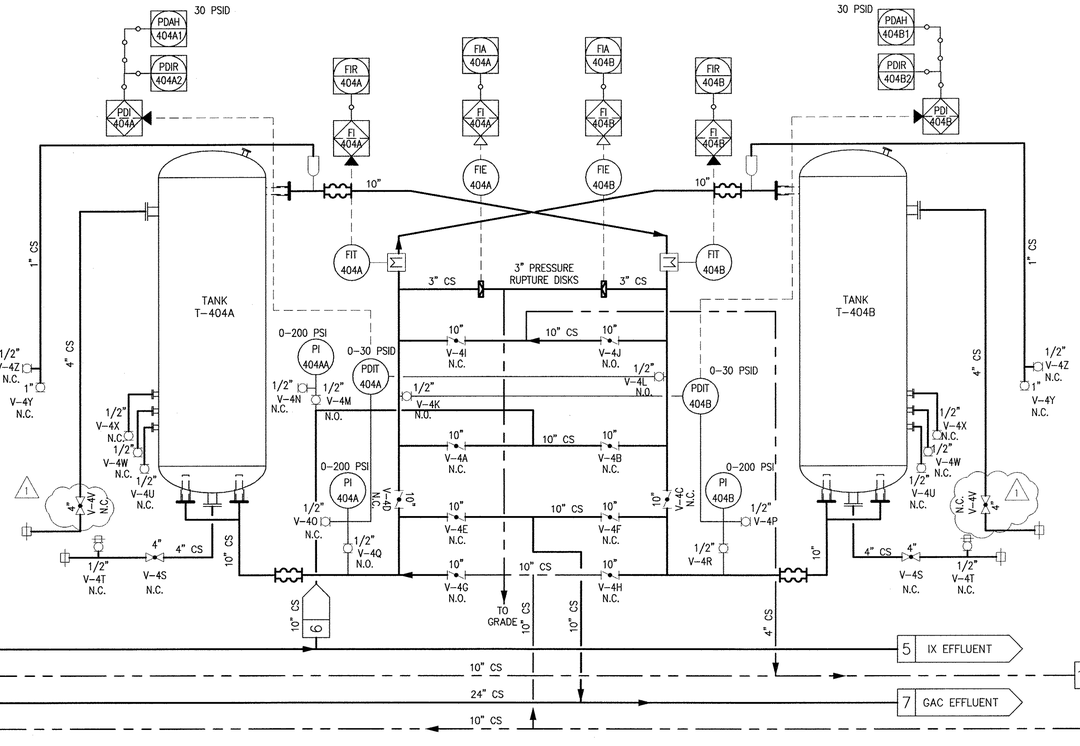
SHEET NO 56 OF 79 SHEETS
WORK ORDER 02557
FILE NUMBER E-1670
REVISION

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GRANULAR ACTIVATED CARBON TANKS T-403A & T-403B (CALGON CARBON FURNISHED)

(2) VESSELS PER SYSTEM W/ FILTRASORB 300 GAC
1,400 GPM/SYSTEM
PRESSURE DROP OF 11.2 PSID NOMINAL, 30 PSID DIRTY
VESSELS ARE SHOWN IN NORMAL OPERATION TANK T-403A IS SHOWN HERE IN LEAD POSITION AND T-403B IS SHOWN IN LAG POSITION



GRANULAR ACTIVATED CARBON TANKS T-404A & T-404B (CALGON CARBON FURNISHED)

(2) VESSELS PER SYSTEM W/ FILTRASORB 300 GAC
1,400 GPM/SYSTEM
PRESSURE DROP OF 11.2 PSID NOMINAL, 30 PSID DIRTY
VESSELS ARE SHOWN IN BACKWASH MODE TANK T-404A IS SHOWN HERE IN BACKWASH POSITION AND T-404B IS SHOWN AS ISOLATED.

PID-106

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — 6/30/2010 — CIVIL — STATE OF CALIFORNIA

APPROVED BY: CHRISTOPHER SHEM HAWES 69578 RCE 2/25/08 DATE
APPROVED: DATE
APPROVED: DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

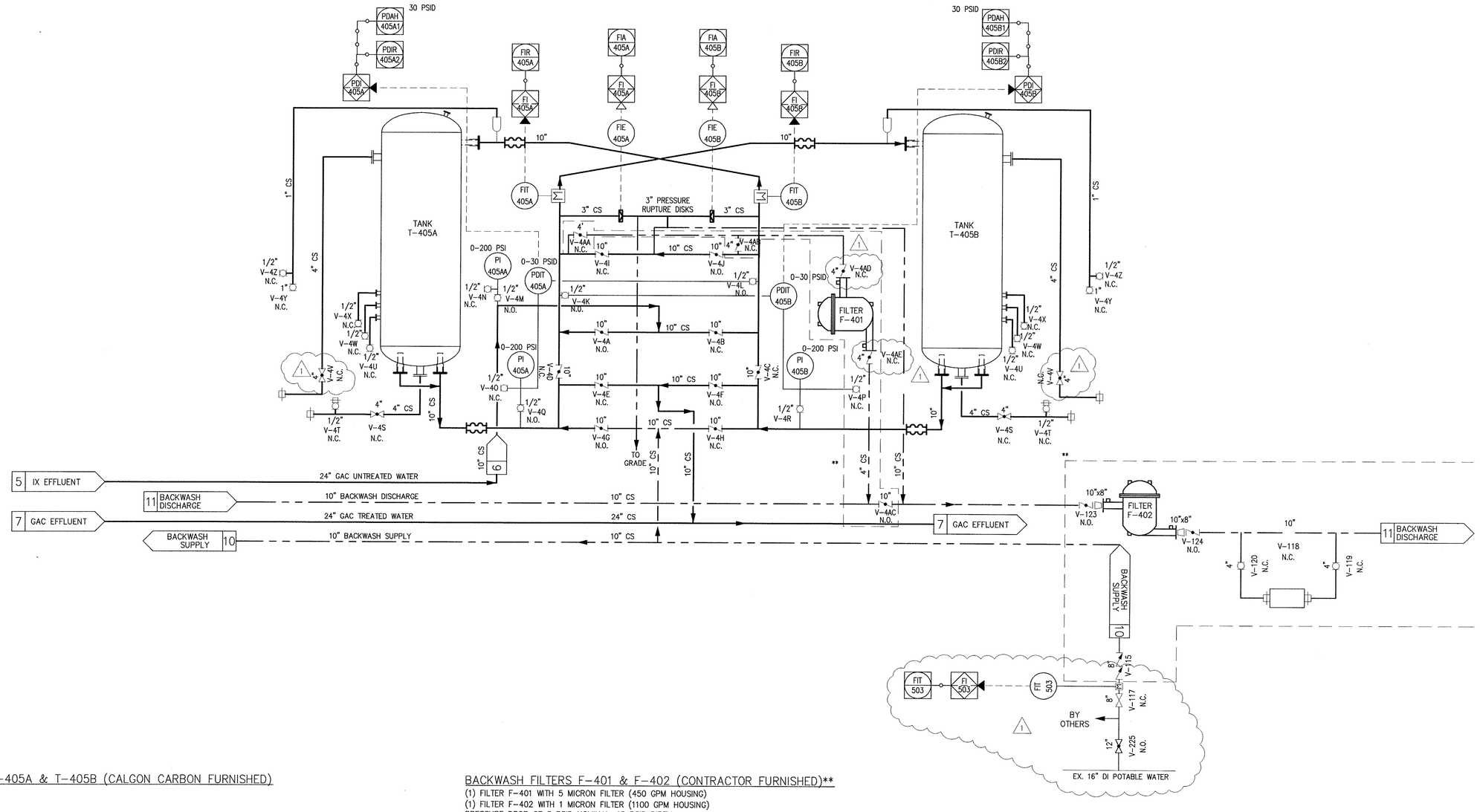
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CITY OF PASADENA — INCORPORATED JUNE 1886

D.S.-209 & 210A

DATE: FEBRUARY 2009	SCALE: AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 57 OF 79 SHEETS
DRAWN BY: CIVILTEC DESIGNED BY: CIVILTEC CHECKED BY: CIVILTEC SUBMITTED BY: CIVILTEC		MONK HILL TREATMENT SYSTEM LGAC TANKS	WORK ORDER 02557 / FILE NUMBER E-1670
FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

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GRANULAR ACTIVATED CARBON TANKS T-405A & T-405B (CALGON CARBON FURNISHED)

(2) VESSELS PER SYSTEM W/ FILTRASORB 300 GAC
1,400 GPM/SYSTEM
PRESSURE DROP OF 11.2 PSID NOMINAL, 30 PSID DIRTY
VESSELS ARE SHOWN IN BACKWASH MODE TANK T-405A IS SHOWN HERE IN BACKWASH POSITION AND T-405B IS SHOWN IN OPERATION.

BACKWASH FILTERS F-401 & F-402 (CONTRACTOR FURNISHED)**

(1) FILTER F-401 WITH 5 MICRON FILTER (450 GPM HOUSING)
(1) FILTER F-402 WITH 1 MICRON FILTER (1100 GPM HOUSING)
PRESSURE DROP OF 5 PSID NOMINAL, 15 PSID DIRTY

PID-107

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER SHEM HAWES — 69578 — 6/30/2010 — CIVIL — STATE OF CALIFORNIA

APPROVED BY: C. Shem Hawes 69578 CHRISTOPHER SHEM HAWES RCE — 2/25/08 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
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CITY OF PASADENA INCORPORATED JUNE 1886

D.S.-209 & 210A

DATE	SCALE
FEBRUARY 2009	AS SHOWN

DRAWN BY CIVILTEC
DESIGNED BY CIVILTEC
CHECKED BY CIVILTEC
SUBMITTED BY CIVILTEC
FIELD BOOKS | CALC BOOKS | APPROVED | APPROVED

PASADENA WATER & POWER
CITY OF PASADENA

MONK HILL TREATMENT SYSTEM
LGAC TANKS

SHEET NO 58 OF 79 SHEETS
WORK ORDER 02557
FILE NUMBER E-1670
REVISION

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24" IN
80" IN
LIR 800
LAL 800
LAH 800
LIC 800
LIT 800
VENT 4"
LE 800
2" FLEX HOSE
2" N.C.
V-705
T-801
1000 GALLON
2" OVERFLOW
1" V-706
19% AQUA AMMONIA STORAGE TANK
WHITE DOUBLE CONTAINED POLYETHYLENE
1" PVC PIPE
SC 801
SC 802
1/2" N.C.
CC-701 4000ml CALIBRATION COLUMN W/SEALED CAP
1/2" N.O.
1/2" TUBING
P-801 1.8 GPH (DUTY)
PI 801
1/2" PVC
BPV-701 GRIFFCO
CC-702 4000ml CALIBRATION COLUMN W/SEALED CAP
P-802 1.8 GPH (STANDBY)
PI 803
BPV-702 GRIFFCO
AQUA AMMONIA METERING PUMPS & STANDS
AAL 800
AAH 800
AIR 800
AIC 800
MONOCHLORAMINE ANALYZER
AIT 800
AE 800
AMMONIA
FIR 500
FIT 500
0-7000 GPM
24" V-121 N.O.
24" V-122 N.C.
AAL 801
AAH 801
AIR 801
AIC 801
TOTAL CHLORINE ANALYZER
AIT 801
AE 801
CLEAN WATER TO WINDSOR RES.
0-7000 GPM
FIT 502
DISCHARGE WATER TO SAND BOX
FIT 502
FIR 502
EFFLUENT METERING SYSTEM (BY CONTRACTOR)
FIT 500, FIT 502
1
7 GAC EFFLUENT P-107
24" D.I.
S-100
AE 700
AIT 700
FREE CHLORINE ANALYZER
AIC 700
AIR 700
AAH 700
AAL 700
CHLORINE
PS 600
INJECTION WATER SUPPLY
V-600 V-601 V-602
M-621
M-620
1/2" TUBING
SC 619
M-619
M-618
M-617
150 LB CYLINDERS
T-701 VR M-601
T-702 VR M-602
T-703 VR M-603
T-704 VR M-604
T-705 VR M-605
T-706 VR M-606
T-707 VR M-607
T-708 VR M-608
M-609 VR T-709
M-610 VR T-710
M-611 VR T-711
M-612 VR T-712
M-613 VR T-713
M-614 VR T-714
M-615 VR T-715
M-616 VR T-716
CHLORINE GAS SYSTEM
T-701 TO T-716 150 LB CHLORINE GAS CYLINDERS
S-100 STATIC MIXER
5 PPM
AAH 600
AIR 600
AIC 600
AIT 600
AE 600
AE 601
GAS DETECTOR SENSORS
MC 622
M-622
SCRUBBER BLOWER
CHLORINE GAS SCRUBBER
M-622 SEVERN TRENT
VENDOR SUPPLIED
AQUA AMMONIA METERING SYSTEM (BY OTHERS)
P-801 & P-802, 1.8 GPM METERING PUPMS
1,000 GALLON TANK
PID-108

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER
CHRISTOPHER SHEM HAWES
69578
6/30/2010
CIVIL
STATE OF CALIFORNIA

APPROVED BY:
CHRISTOPHER SHEM HAWES 69578 RCE 2/25/08 DATE
APPROVED: DATE
APPROVED: DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
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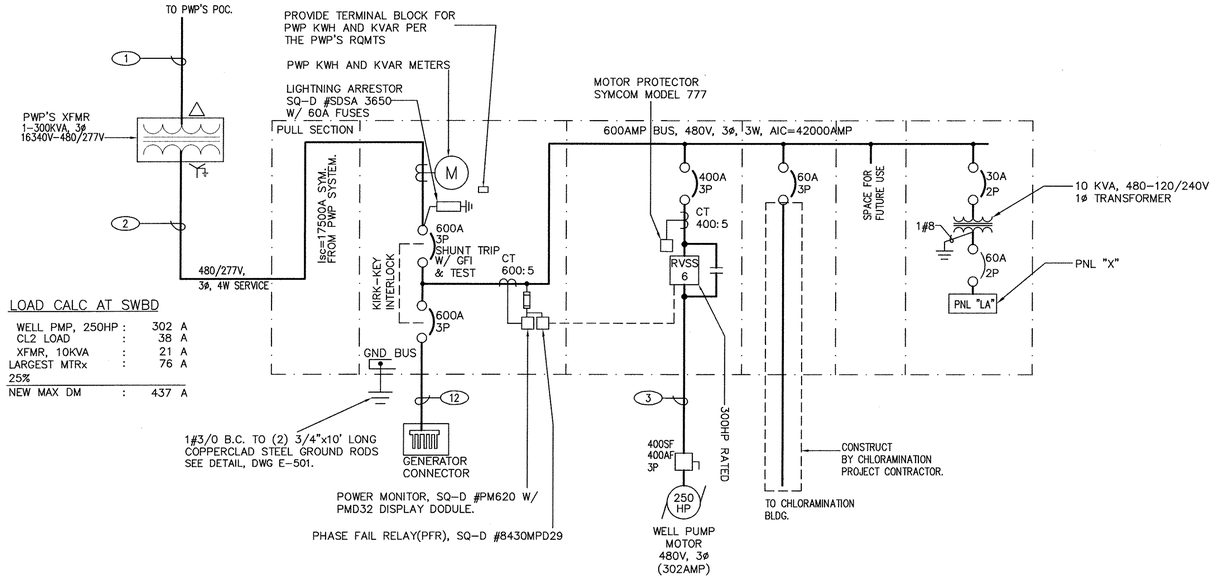
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CITY OF PASADENA INCORPORATED JUNE 1886

D.S.-209 & 210A
DATE: FEBRUARY 2009
SCALE: AS SHOWN
DRAWN BY
DESIGNED BY
CHECKED BY
SUBMITTED BY
FIELD BOOKS | CALC BOOKS | APPROVED | APPROVED

PASADENA WATER & POWER
CITY OF PASADENA
MONK HILL TREATMENT SYSTEM
LGAC TANKS
SHEET NO 59 OF 79 SHEETS
WORK ORDER 02557
FILE NUMBER E-1670
REVISION

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ALL CIRCUIT BREAKERS SHALL BE 100% RATED TYPE, IF AVAILABLE.

SINGLE LINE DIAGRAM

PANEL SCHEDULE

120/240 VOLTS 1 ø 3 W — PANELBOARD LA — FEED TOP
60A MAIN — LOCATION M.C.C. — MTG. INSIDE MCC

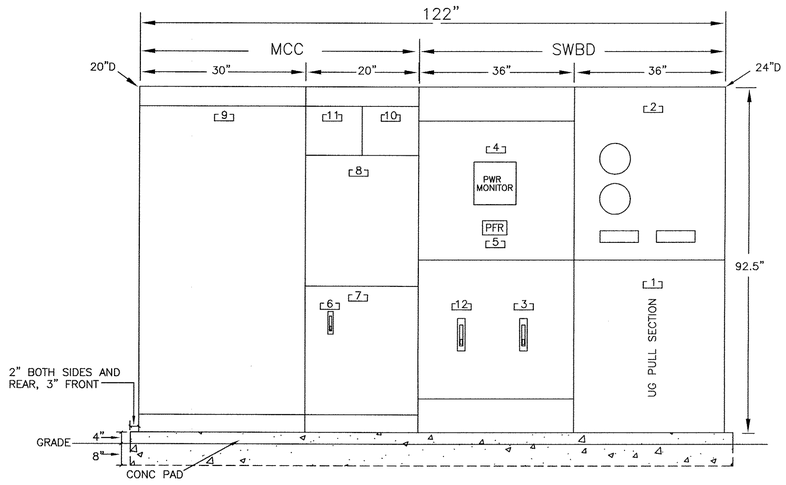
LOAD DESCRIPTIONS	WATTAGE ø A	WATTAGE ø B	LTG	REC	MISC	CIR	BKR	A	B	BKR	CIR	MISC	REC	LTG	WATTAGE ø A	WATTAGE ø B	LOAD DESCRIPTIONS
(E) YARD/EXT. LIGHTS	1000				1	1	20			20	2	1			500		SPARE
INT. LIGHTS		400			1	3	20			20	4		4			720	RECEPT
SPACE					1	5				20	6	1			120		(E) RTU
						7					8	1					SPACE
						9					10						
						11					12						
	1000	400				TOTAL				TOTAL					620	720	
	PHASE TOTAL		TOTAL LOAD														
	1620	1120	2.7KVA (11.4AMP)														

FEEDER SCHEDULE (X)

1. (2)4"C, FROM PWP'S POC TO PWP XFMR ENCLOSURE, PROVIDED PER THE PWP'S RQMTS.
2. (3) 5"C, FROM PWP XFMR ENCLOSURE TO SWBD, PROVIDED PER THE PWP'S RQMTS.
3. 3"C-2(3#250MCM)+1#1GND. FROM MCC TO WELL PUMP MOTOR.
4. 3/4"C-12#14+1#14GND. FROM MCC TO "PS/HPS", "T-STAT", "SOLENOID", "SPC HTR, AT FIELD. (CONTROL)
5. 1"C-XDCR & XMTR CABLE, FROM "LIT101", "PIT101", "FIT102" TO RTU. PROVIDE THE XDCR & XMTR CABLES PER THE EQUIPMENT MFR'S INSTRUCTIONS. (SIGNAL)
6. 3/4"C-3#12+1#12GND, FROM MCC TO RTU.
7. 3/4"C-15#14+1#14GND, FROM MCC TO RTU. (D/I, D/O)
8. 3/4"C-2#8+1#10GND, FROM MCC TO FLOOD LIGHTS.
9. 3"C-6OPR#18, INDIVIDUALLY TWST SHLD, FROM SCADA INTERFACE BOX TO RTU. (A/I FROM GAC)
10. 3/4"C-3PR#18, INDIVIDUALLY TWST SHLD, FROM "FIT501", "FIT502" TO RTU.
11. 3/4"C-2PR#18, INDIVIDUALLY TWST SHLD, FROM "FIT500" TO RTU.
12. 2(3"C-3#300MCM+1#1GND), FROM SWBD TO GEN CONNECTOR.

CONSTRUCTION NOTES

1. REMOVE UNUSED CONDUITS AND WIRING COMPLETELY. EXIST SECURITY RELATED SYSTEM, EQUIPMENT, CONDUITS AND WIRING TO REMAIN.
2. REMOVE UNUSED ELECTRICAL EQUIPMENT AND COMPONENTS IN THE ROOM COMPLETELY.
3. REMOVE EXIST MCC AND RELATED CONDUITS AND WIRING COMPLETELY.
4. PROVIDE UNDERGROUND PULLBOX, 10"X17"X36"D, 3 1/2(T) PB BY BROOKS.
5. EXIST RTU(PLC), LIQ-5 OF TESCO. MODIFY THE RTU BY FURNISHING NECESSARY MODULES PER THE DWG E-104. CONSULT THE MFR AS NECESSARY.
6. LIGHT FIXTURE, PENDANT, GENERAL PURPOSE, INDUSTRIAL, (4)-32W TUBES, 10% HARMONIC ELECTRONIC BALLAST, EJ232-120GEB10 BY LITHONIA. TYP 4 EA.
7. WELL LEVEL (DEPTH) TRANSDUCER LOCATED AT BUTTOM OF THE WELL. SUBMERCIBLE PRESSURE TRANSDUCER BY KPSI W/ CABLE AND CABLE HANGER. (BY OTHERS)
8. 250W HPS AREA LIGHT FIXTURE ON 30' POLE. SEE DETAIL, DWG E-501. TYP 4 EA.
9. PROVIDE UNDERGROUND PULLBOX, 9 5/8"X16"X12"D, 1 PB BY BROOKS.
10. 70W HIGH PRESSURE SODIUM LAMP W/ INTERNAL REFLECTOR, PRISMATIC POLYCARBONATED REFRACTOR, BUILT-IN 0-20FC ADJ PHOTOCELL CONTROL, UL APPROVED FOR WET LOCATION. HUBBELL #NRG-307 OR APPROVED EQUAL.
11. PROVIDE SURFACE PWR RECEPTACLE OUTLET, 125V, 20AMP, NEMA 5-20R IN CAST ALUM BOX SST COVERPLATE. TYP OF 4 EA.



SWBD AND MCC ELEVATION

NO SCALE

CONSTRUCTION NOTES FOR SWBD AND MCC

(SEE DWG E-1 FOR OTHER NOTES.)

1. APPROXIMATE DIMENSIONS ARE SHOWN FOR REFERENCE ONLY. VERIFY THE DIMENSIONS THROUGH THE EQUIPMENT MFRS.
2. SWBD SHALL BE NEMA 1 TYPE CONSTRUCTION. MCC SHALL BE NEMA 12 TYPE CONSTRUCTION. WIRING NEMA CLASS IIS, TYPE B
3. SWBD BUS VOLTAGE SHALL BE 3ø, 4W HERTZ 60HZ MCC BUS VOLTAGE SHALL BE 3ø, 3W HERTZ 60HZ
4. GROUND BUS 1/4" X 1" TIN PLATED COPPER(TPC)
5. MCC BUS RATING. VERT. 400A HORIZ. 600A TPC
6. BUS BRACING AND BKR RATINGS AT MIN. 42,000 RMS SYM. AMP.
7. INDIVIDUAL 480/120V CTRL PWR XFMR FOR EACH STARTER
8. INCLUDE SURGE PROTECTOR AT EACH MOTOR STARTER.
9. CKT BKR TYPE MCP FOR EACH STARTER, THERMAL MAGNETIC TYPE BKR FOR EACH FEEDER BKR'S.
10. PROVIDE NAMEPLATE FOR EACH COMPARTMENT.
11. OVERLOAD HEATER ELEMENTS FOR EACH STARTER.
12. ANSI #61 FINISH.
13. ALL CONTROL/SIGNAL CONDUCTORS SHALL BE ENCLOSED IN PVC WIRE DUCTS W/ COVER.
14. SWBD AND MCC SHALL BE ANCHORED TO MEET SEISMIC ZONE 4 RQMTS. SUBMIT THE REGISTERED STRUCTURAL ENGINEER'S CALC. AS THE PART OF THE SHOP DRAWING SUBMITTAL, FOR AN APPROVAL..
16. SITE AMBIENT TEMP IS 125°F, HUMIDITY IS 20 TO 95%, ELEVATION IS ABOUT 2000 FT.
17. SQ-D MODEL 6, OR APPROVED EQUAL.
18. UG PULL SECTION & UTILITY METER SECTION SHALL MEET EUSERC RQMTS.

NAMEPLATE SCHEDULE

1. UNDERGROUND PULL SECTION
2. UTILITY METER SECTION
3. MAIN BREAKER, 600AT
4. DIGITAL POWER METER
5. PHASE FAILURE RELAY
6. 30A/2P XFMR PRI BKR
7. 10KVA XFMR, 480-240/120V, 1ø, 3W
8. PNL "P", 240/120V, 1ø, 3W
9. WINDSOR WELL PUMP STARTER
10. 60A/2P BKR FOR PNL "PA",
11. SPACE(FUTURE USE)
12. STANDBY PWR BKR, 600AT

E-101

REVISION NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER — CHAE YOUNG LEE — No E 12266 — EXP. 09-30-2010 — ELECTRICAL — STATE OF CALIFORNIA

APPROVED BY: CHAE YOUNG LEE 12266 EE — 5/2/09 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
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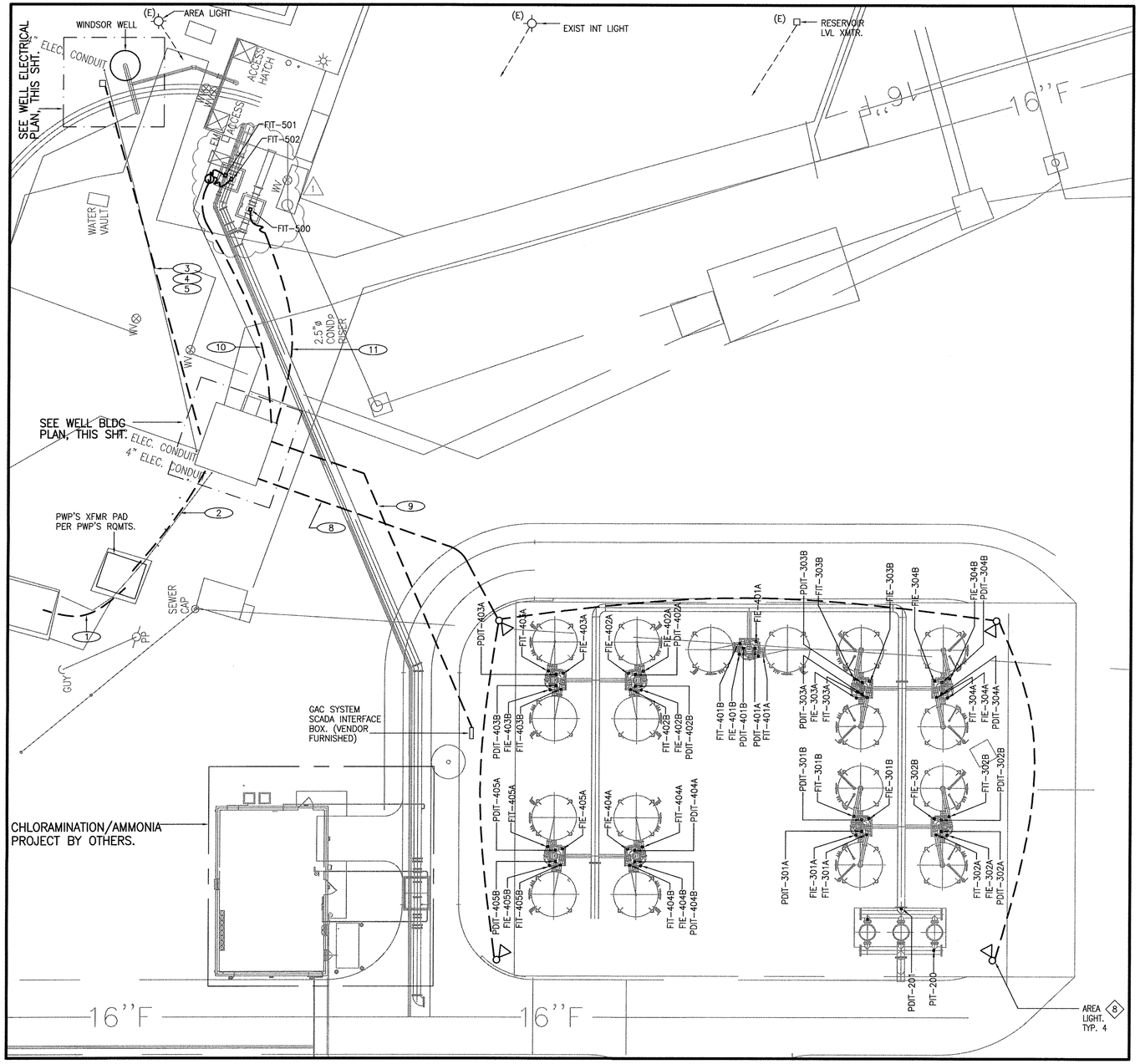
Battelle
The Business of Innovation

CITY OF PASADENA — INCORPORATED JUNE 1886

D.S.-209 & 210A

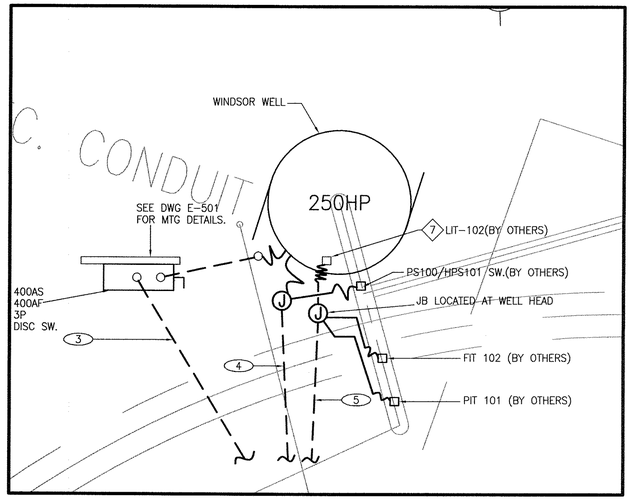
DATE	SCALE		
NOVEMBER 2008	AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 61 OF 79 SHEETS
DRAWN BY CALPOWER		WINDSOR WELL SINGLE LINE DIAGRAM, ELEVATION, SCHEDULE	WORK ORDER 02557 / FILE NUMBER E-1670
DESIGNED BY CALPOWER			
CHECKED BY CIVILTEC			
SUBMITTED BY CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED / REVISION

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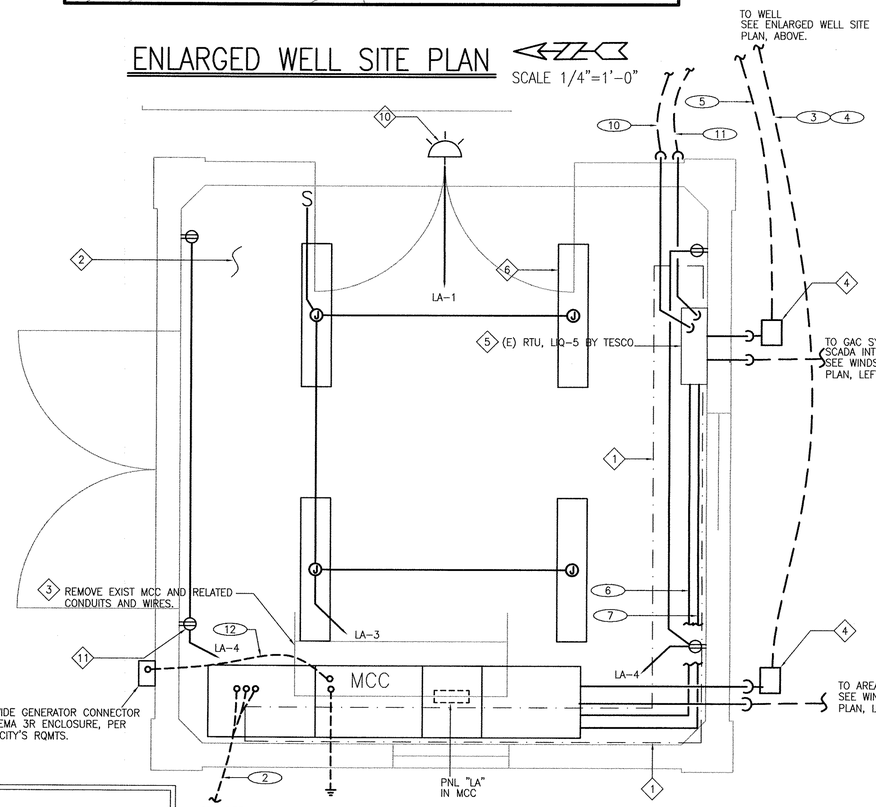
WINDSOR SITE PLAN – ELECTRICAL

SCALE 1/16"=1'-0"



ENLARGED WELL SITE PLAN

SCALE 1/4"=1'-0"



ELECTRICAL BLDG PLAN

SCALE 1/2"=1'-0"

SPECIAL NOTE

ALL THE ELECTRICAL DRAWINGS ARE SCHEMATIC. CONDUITS OR WIRINGS ARE NOT SHOWN FOR SOME EQUIPMENT/DEVICES. IT SHALL BE CONTRACTOR'S RESPONSIBILITY TO COMPLETE THE PROJECT CONSTRUCTION PER DRAWINGS AND SPEC AT HIS DISCRETION AT NO ADDITIONAL COST TO THE CITY. FOR ANY DESCREPACIES, CONTRACTOR SHALL SUBMIT REQUESTS FOR CLARIFICATION DURING BIDDING PHASE.

NOTES

SEE DWG E-101 FOR FEEDER SCHEDULE AND CONSTRUCTION NOTES.

E-102

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER — CHAE YOUNG LEE — No. E 12266 — EXP. 09-30-2010 — ELECTRICAL — STATE OF CALIFORNIA

APPROVED BY:
CHAE YOUNG LEE 12266 EE — 3/2/09 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
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Phone: (626) 357-0588
Fax: (626) 303-7957

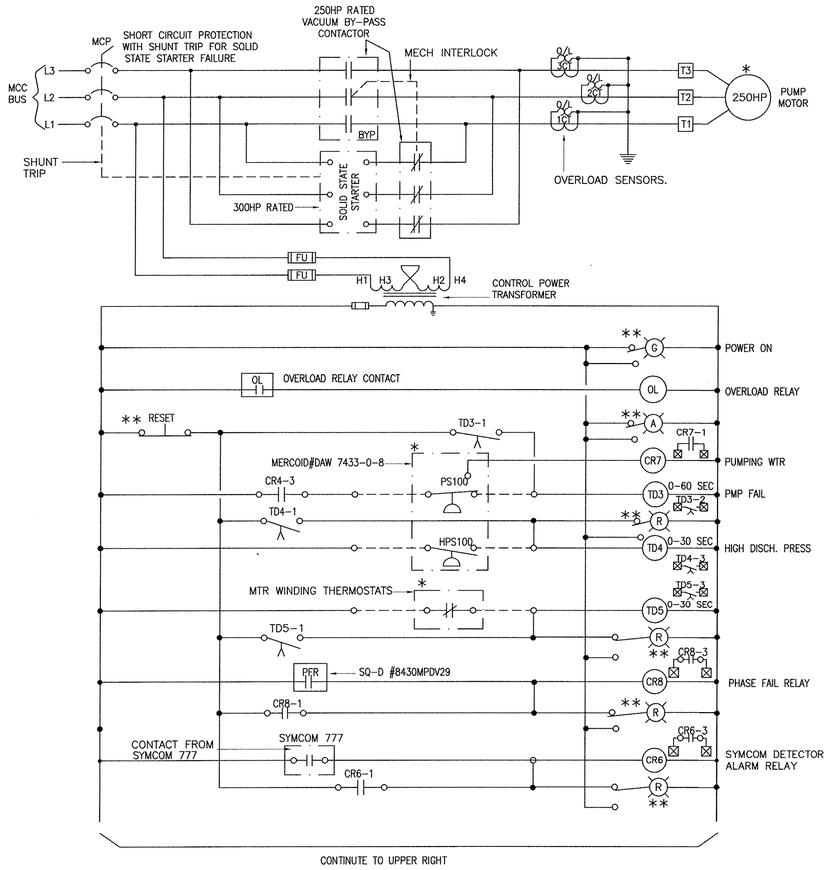
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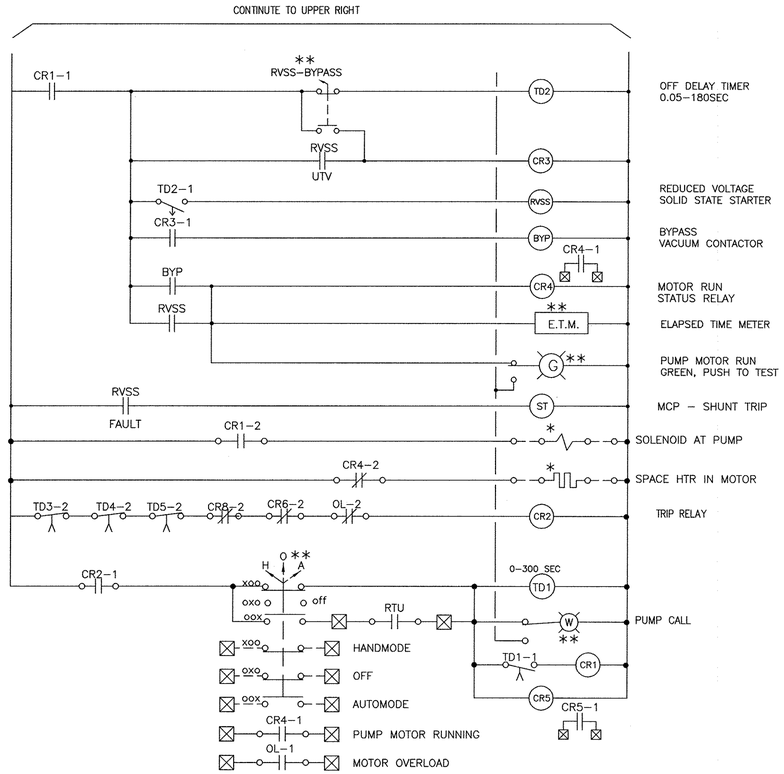
CITY OF PASADENA — INCORPORATED JUNE 1886

D.S.-209 & 210A

DATE: NOVEMBER 2008	SCALE: AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 62 OF 79 SHEETS
DRAWN BY: CALPOWER		WINDSOR WELL	
DESIGNED BY: CALPOWER		SITE, BLDG PLANS – ELECTRICAL	WORK ORDER 02557 / FILE NUMBER E-1670
CHECKED BY: CIVILTEC			
SUBMITTED BY: CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED / REVISION

X:\2007\27140-JR, MONWELL TREATMENT PLANT\DWG\SUBMITTALS\FINAL SUBMITTALS\E-102.DWG (02-27-09 9:46:15AM)





WINDSOR WELL PUMP MOTOR

* : DEVICE AT FIELD AND FIELD WIRING (BY THE EQUIPMENT INSTALLATION CONTRACTOR)

**: DEVICE AT FRONT SURFACE OF MCC.

☒ : TERMINAL IN THE TELEMETRY SECTION FOR RTU INTERFACE.
PROVIDE THE TERMINAL NUMBERS IN THE SHOP DWG
FOR AN APPROVAL.
CONTRACTOR SHALL CONSULT THE CITY FOR ADDITIONAL I/O OTHER THAN THE SHOWN
ON THIS SCHEMATIC. PROVIDE SPARE TERMINALS (50EA) IN ADDITION TO THE TERMINALS SHOWN.
TERMINALS SHALL BE ARRANGED ON ONE SIDE OF THE BACK PANEL IN THE TELEMETRY
SECTION NOT TO INTERFERE WITH THE RTU EQUIPMENT INSTALLATION.

SPECIAL NOTES

THIS DIAGRAM IS PREPARED FOR THE CONTROL REFERENCE ONLY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PREPARATION OF THE FINAL DIAGRAM AND SUBMITTING THE DIAGRAM AS A PART OF THE SHOP DRAWING SUBMITTAL BASED ON THE CITY AND THE PUMP SYSTEM MFR'S RQMTS AND THE DEVICES MFR'S INSTRUCTIONS, PRIOR TO ANY ACTIVITIES.

E-103

REVISION		
NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER — CHAE YOUNG LEE — No E 12266 — EXP 09/30/2010 — ELECTRICAL — STATE OF CALIFORNIA

APPROVED BY: CHAE YOUNG LEE 12266 EE — DATE 5/12/09
APPROVED: — DATE
APPROVED: — DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

Battelle — The Business of Innovation

CITY OF PASADENA — INCORPORATED JUNE 1886

D.S.-209 & 210A

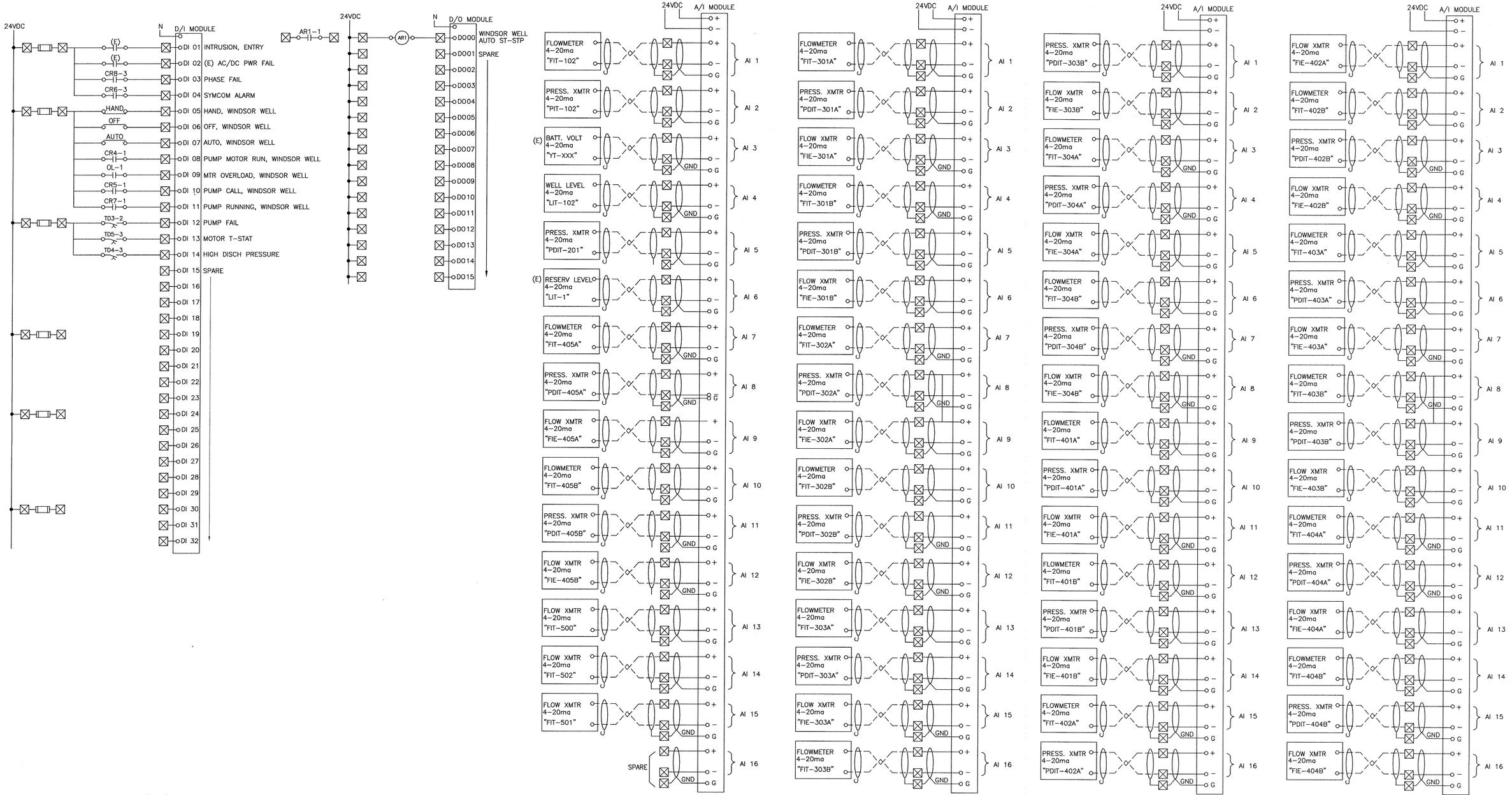
DATE	NOVEMBER 2008
SCALE	AS SHOWN
DRAWN BY	CALPOWER
DESIGNED BY	CALPOWER
CHECKED BY	CIVILTEC
SUBMITTED BY	CIVILTEC
FIELD BOOKS	
CALC BOOKS	
APPROVED	
APPROVED	

PASADENA WATER & POWER
CITY OF PASADENA

WINDSOR WELL
WELL PUMP CONTROL SCHEMATIC

SHEET NO 63 OF 79 SHEETS
WORK ORDER 02557
FILE NUMBER E-1670
REVISION

K:\2007\2710-JPL MONKHILL TREATMENT PLANT\DWG SUBMITTALS\FINAL SUBMITTAL\E-103.DWG (02-27-09 9:58:48AM)



NOTES FOR RTU(PLC) SYSTEM

1. MODIFY EXIST RTU BY PROVIDING NECESSARY MODULES AND ACCESSORIES TO ACCOMMODATE I/O'S AS SHOWN.
2. RTU AND SCADA SYSTEM PROGRAMMING BY THE CITY.

SYMBOLS

(SEE DWG E–100 FOR OTHER SYMBOLS)

- ☒ TERMINAL FOR RTU(PLC) CONNECTION
- – – FIELD WIRING (BY CONTRACTOR OR RESPONSIBLE VENDOR)
- ▭ FUSE AT TERMINAL BLOCK

WINDSOR WELL

E–104

REVISION		
NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER — CHAE YOUNG LEE — No. E 12266 — EXP. 09/30/2010 — ELECTRICAL — STATE OF CALIFORNIA

APPROVED BY:
CHAE YOUNG LEE 12266 EE — 3/12/09 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
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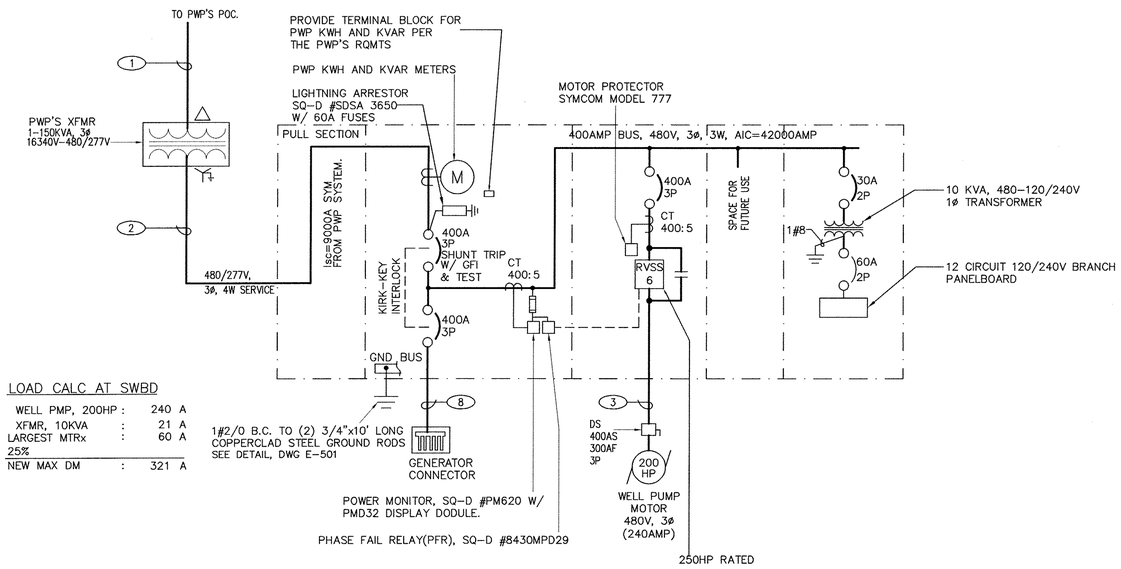
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The Business of Innovation

CITY OF PASADENA — INCORPORATED JUNE 1886

D.S.–209 & 210A

DATE	SCALE	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 64 OF 79 SHEETS
NOVEMBER 2008	AS SHOWN		
DRAWN BY CALPOWER		WINDSOR WELL PLC INPUT/OUTPUT DIAGRAM	WORK ORDER 02557 / FILE NUMBER E–1670
DESIGNED BY CALPOWER			
CHECKED BY CIVILTEC			
SUBMITTED BY CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

K:\2007\27140-PE_MONKHALL TREATMENT PLANT\DWG\SUBMITTALS\FINAL SUBMITTAL\E-104.DWG (02-27-09 9:57:27AM)

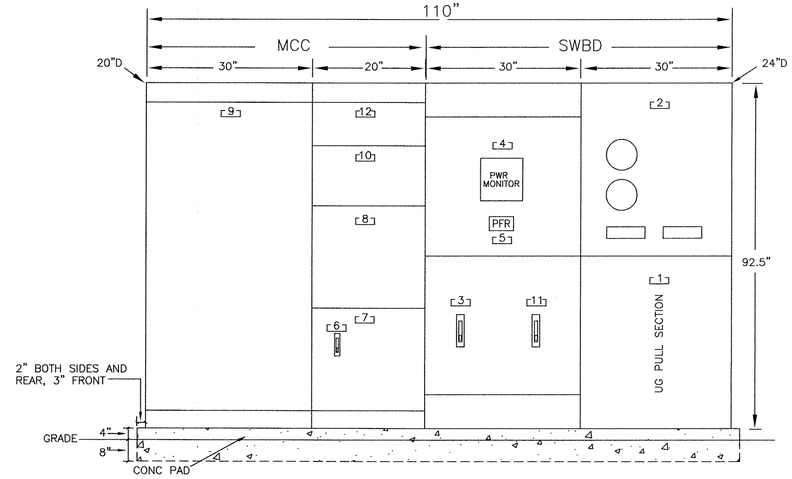


LOAD CALC AT SWBD

WELL PMP, 200HP	:	240 A
XFMR, 10KVA	:	21 A
LARGEST MTRx 25%	:	60 A
NEW MAX DM	:	321 A

ALL CIRCUIT BREAKERS SHALL BE 100% RATED TYPE.

SINGLE LINE DIAGRAM



SWBD AND MCC ELEVATION

NO SCALE

PANEL SCHEDULE

120/240 VOLTS 1 ø 3 W — PANELBOARD P — FEED TOP
60A MAIN — LOCATION M.C.C. — MTG. INSIDE MCC

LOAD DESCRIPTIONS	WATTAGE ø A	WATTAGE ø B	LTG	REC	MISC	CIR	BKR	A	B	BKR	CIR	MISC	REC	LTG	WATTAGE ø A	WATTAGE ø B	LOAD DESCRIPTIONS
(E) YARD/EXT. LIGHTS	1000				1	1	20			20	2		4		720		RECEPT
INT. LIGHTS		600	6			3	20			20	4	1				800	(E) EXH FAN
SPARE	500				1	5	20			20	6	1			120		(E) RTU
SPACE						7				20	8	1				500	SPARE
						9					10						SPACE
						11					12						
	1500	600				TOTAL				TOTAL					820	1300	
	PHASE TOTAL		TOTAL LOAD														
	2320	1900	4.2KVA (17.6AMP)														

CONSTRUCTION NOTES FOR SWBD AND MCC

(SEE DWG E-1 FOR OTHER NOTES.)

1. APPROXIMATE DIMENSIONS ARE SHOWN FOR REFERENCE ONLY. VERIFY THE DIMENSIONS THROUGH THE EQUIPMENT MFRS.
2. SWBD SHALL BE NEMA 1 TYPE CONSTRUCTION. MCC SHALL BE NEMA 12 TYPE CONSTRUCTION. WIRING NEMA CLASS IIS, TYPE B
3. SWBD BUS VOLTAGE SHALL BE 3ø, 4W HERTZ 60HZ MCC BUS VOLTAGE SHALL BE 3ø, 3W HERTZ 60HZ
4. GROUND BUS 1/4" X 1" TIN PLATED COPPER(TPC)
5. MCC BUS RATING. VERT. 300A HORIZ. 600A TPC
6. BUS BRACING AND BKR RATINGS AT MIN. 42,000 RMS SYM. AMP.
7. INDIVIDUAL 480/120V CTRL PWR XFMR FOR EACH STARTER
8. INCLUDE SURGE PROTECTOR AT EACH MOTOR STARTER.
9. CKT BKR TYPE MCP FOR EACH STARTER, THERMAL MAGNETIC TYPE BKR FOR EACH FEEDER BKR'S.
10. PROVIDE NAMEPLATE FOR EACH COMPARTMENT.
11. OVERLOAD HEATER ELEMENTS FOR EACH STARTER.
12. ANSI #61 FINISH.
13. ALL CONTROL/SIGNAL CONDUCTORS SHALL BE ENCLOSED IN PVC WIRE DUCTS W/ COVER.
14. SWBD AND MCC SHALL BE ANCHORED TO MEET SEISMIC ZONE 4 RQMTS. SUBMIT THE REGISTERED STRUCTURAL ENGINEER'S CALC. AS THE PART OF THE SHOP DRAWING SUBMITTAL, FOR AN APPROVAL..
16. SITE AMBIENT TEMP IS 125°F, HUMIDITY IS 20 TO 95%, ELEVATION IS ABOUT 2000 FT.
17. SQ-D MODEL 6, OR APPROVED EQUAL.
18. UG PULL SECTION & UTILITY METER SECTION SHALL MEET EUSERC RQMTS.

NAMEPLATE SCHEDULE

[1] UNDERGROUND PULL SECTION
[2] UTILITY METER SECTION
[3] MAIN BREAKER, 400AT
[4] DIGITAL POWER METER
[5] PHASE FAILURE RELAY
[6] 30A/2P XFMR PRI BKR
[7] 10KVA XFMR, 480-240/120V, 1ø, 3W
[8] PNL "P", 240/120V, 1ø, 3W
[9] WELL PUMP NO.52 STARTER
[10] CONTROL RELAYS
[11] STANBY PWR BKR, 400AT
[12] SPACE FOR FUTURE USE

E-201

REVISION NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER — CHAE YOUNG LEE — No. E 12266 — EXP. SEP 30, 2010 — ELECTRICAL — STATE OF CALIFORNIA

APPROVED BY:
CHAE YOUNG LEE 12266 EE — 3/2/09 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

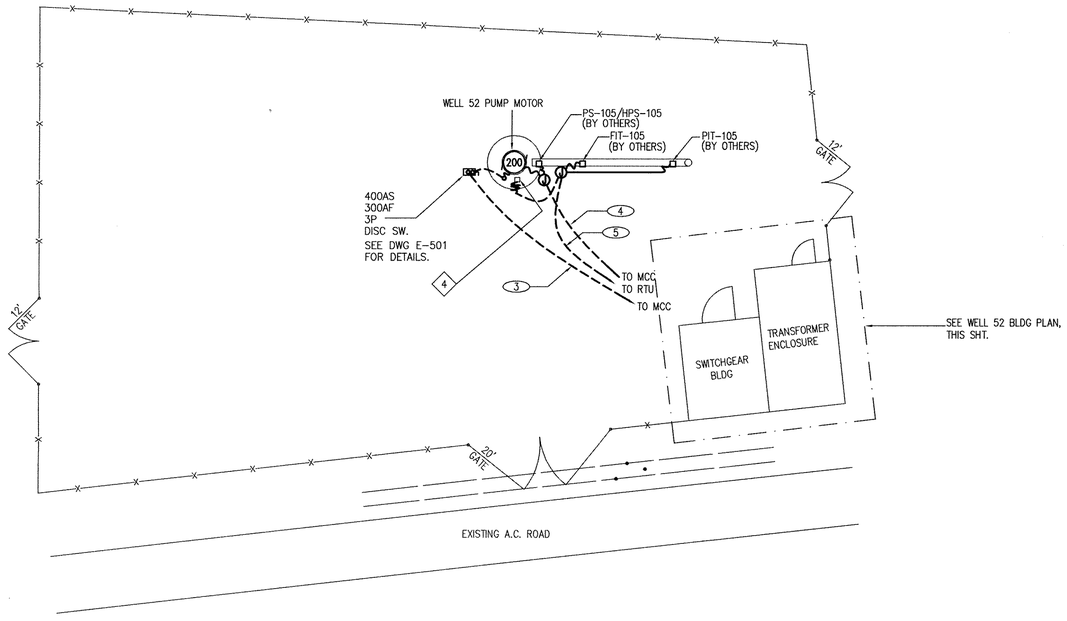
Battelle — The Business of Innovation

CITY OF PASADENA — INCORPORATED JUNE 1886

D.S.-209 & 210A

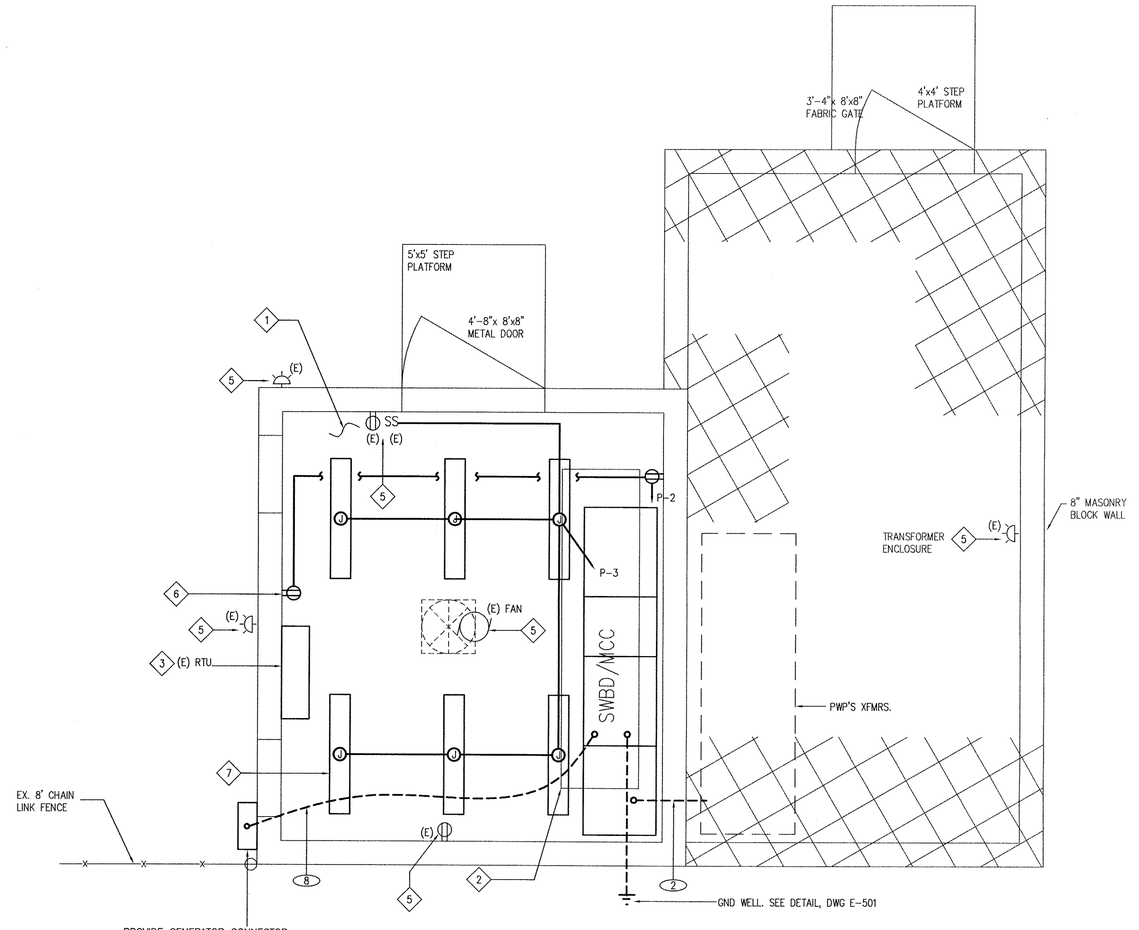
DATE: NOVEMBER 2008	SCALE: AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 65 OF 79 SHEETS
DRAWN BY: CALPOWER DESIGNED BY: CALPOWER CHECKED BY: CIVILTEC SUBMITTED BY: CIVILTEC		WELL 52 SINGLE LINE DIAGRAM, ELEVATION, SCHEDULE	WORK ORDER: 02557 — FILE NUMBER: E-1670
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED — REVISION

V:\2007\27403-PL MONROVIL TREATMENT PLANT\DWG\SUBMITTALS\FINAL SUBMITTAL\E-201.DWG (02-27-09 9:55:10AM)



ELECTRICAL SITE PLAN – WELL 52

SCALE: 1"=10'-0"



WELL 52 BLDG PLAN – ELECTRICAL

SCALE: 1/2"=1'-0"

FEEDER SCHEDULE (X)

1. (2)4"C, FROM PWP'S POC TO PWP XFMR ENCLOSURE, PROVIDED PER THE PWP'S RQMTS.
2. (2) 5"C, FROM PWP XFMR ENCLOSURE TO SWBD, PROVIDED PER THE PWP'S RQMTS.
3. 3"C–3#350MCM+1#3GND. FROM MCC TO WELL PUMP MOTOR.
4. 3/4"C–12#14+1#14GND. FROM MCC TO "PS/HPS", "T-STAT", "SOLENOID", "SPC HTR, 3/4"C–XDCR CABLE, FROM XDCR TO RTU, PROVIDE XDCR CABLE PER THE MFR'S INSTRUCTIONS. AT FIELD. (CONTROL)
5. 1"C–XDCR & XMTR CABLE, FROM "LIT101", "PIT101", "FIT102" TO RTU. PROVIDE THE XDCR & XMTR CABLES PER THE EQUIPMENT MFR'S INSTRUCTIONS. (SIGNAL)
6. 3/4"C–3#12+1#12GND. FROM MCC TO RTU.
7. 3/4"C–15#14+1#14GND. FROM MCC TO RTU. (D/I, D/O)
8. 3"C–3#500MCM+1#3GND. FROM MCC TO GEN CONNECTOR.

CONSTRUCTION NOTES

1. REMOVE UNUSED ELECTRICAL EQUIPMENT AND COMPONENTS IN THE ROOM COMPLETELY. ALL THE REMAINING EQUIPMENT OR COMPONENTS ARE NOT NECESSARILY SHOWN.
2. REMOVE EXIST MCC AND RELATED CONDUITS AND WIRING COMPLETELY. MODIFY/EXTEND CONDUITS AND WIRING TO NEW MCC FOR THE REMAINING EQUIPMENT OR COMPONENTS.
3. EXIST RTU(PLC), LIQ-5 OF TESCO. MODIFY THE RTU BY FURNISHING NECESSARY MODULES PER THE DWG E-204. CONSULT THE MFR AS NECESSARY.
4. WELL LEVEL (DEPTH) TRANSDUCER LOCATED AT BUTTOM OF THE WELL. SUBMERCIBLE PRESSURE TRANSDUCER BY KPSI W/ CABLE AND CABLE HANGER. (BY OTHERS)
5. EXTEND CONDUITS AND WIRING OF EXIST LIGHT FIXTURES, RECEPTACLE OUTLETS, FANS, SWITCHES TO NEW MCC.
6. PROVIDE SURFACE PWR RECEPTACLE OUTLET, 125V, 20AMP, NEMA 5-20R IN CAST ALUM BOX SST COVERPLATE. TYP OF 2 EA.
7. LIGHT FIXTURE, PENDANT, GENERAL PURPOSE, INDUSTRIAL, (4)-32W TUBES, 10% HARMONIC ELECTRONIC BALLAST, EJ232-120GEB10 BY LITHONIA. TYP 6 EA.

SPECIAL NOTE

ALL THE ELECTRICAL DRAWINGS ARE SCHEMATIC. CONDUITS OR WIRINGS ARE NOT SHOWN FOR SOME EQUIPMENT/DEVICES. IT SHALL BE CONTRACTOR'S RESPONSIBILITY TO COMPLETE THE PROJECT CONSTRUCTION PER DRAWINGS AND SPEC AT HIS DISCRETION AT NO ADDITIONAL COST TO THE CITY. FOR ANY DESCREPACIES, CONTRACTOR SHALL SUBMIT REQUESTS FOR CLARIFICATION DURING BIDDING PHASE.

E-202

REVISION		
NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER — CHAE YOUNG LEE — No E 12266 EXP. 09.30.2010 — ELECTRICAL — STATE OF CALIFORNIA

APPROVED BY:
CHAE YOUNG LEE 12266 EE — DATE 3/2/09
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

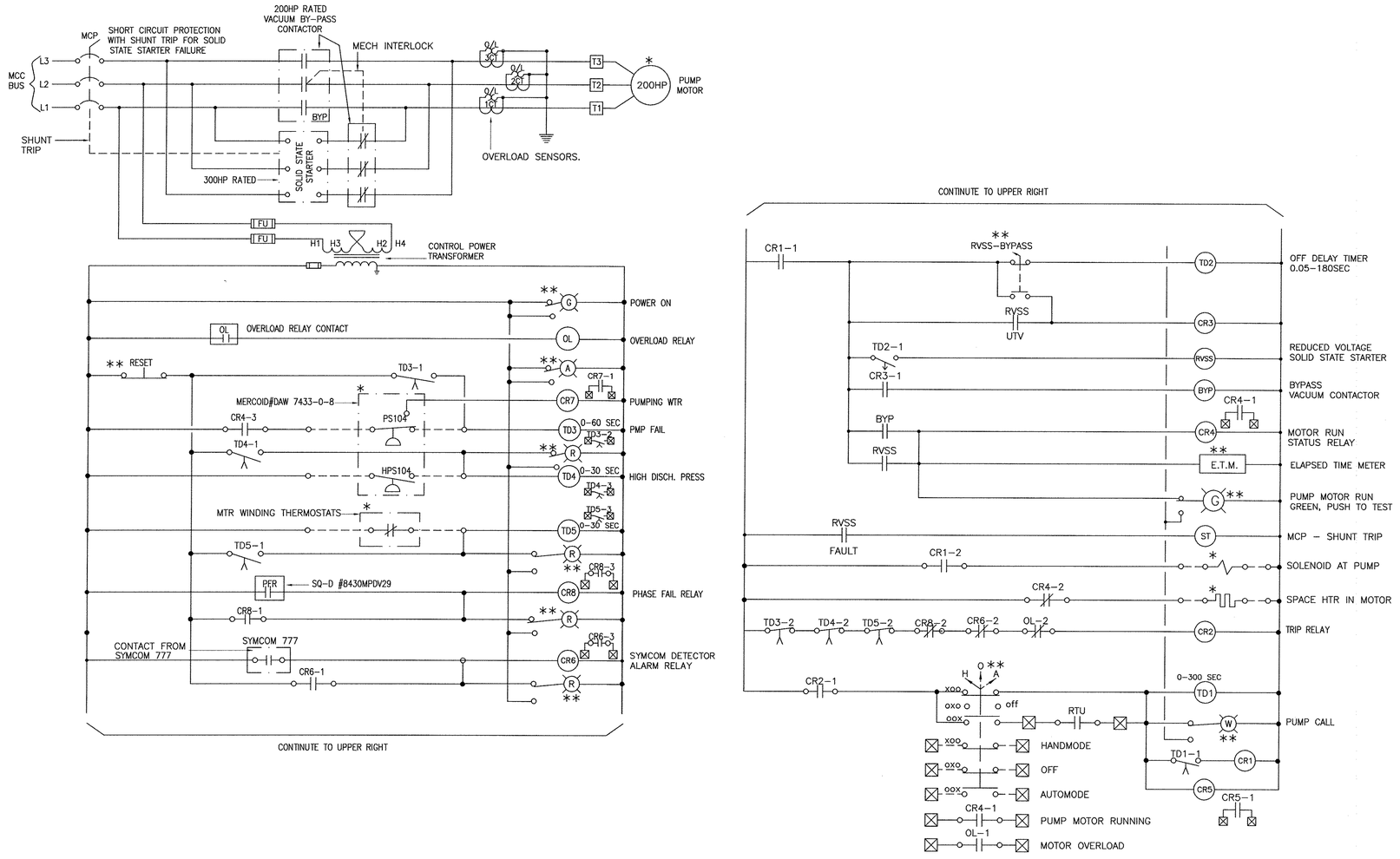
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The Business of Innovation

CITY OF PASADENA — INCORPORATED JUNE 1886

D.S.–209 & 210A

DATE	SCALE	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 66 OF 79 SHEETS	
NOVEMBER 2008	AS SHOWN			
DRAWN BY CALPOWER		WELL 52 SITE PLAN AND BUILDING PLAN ELECTRICAL	WORK ORDER 02557	FILE NUMBER E-1670
DESIGNED BY CALPOWER				
CHECKED BY CIVILTEC				
SUBMITTED BY CIVILTEC				
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED	REVISION

K:\2007\07446-JR MUNIRAL TREATMENT PLANT\DWGS\SUBMITTALS\FINAL SUBMITTAL\E-202.DWG (02-27-09 4:29:18PM)



WELL 52 PUMP MOTOR

* : DEVICE AT FIELD AND FIELD WIRING (BY THE EQUIPMENT INSTALLATION CONTRACTOR)

**: DEVICE AT FRONT SURFACE OF MCC.

⊠ : TERMINAL IN THE TELEMETRY SECTION FOR RTU INTERFACE.
PROVIDE THE TERMINAL NUMBERS IN THE SHOP DWG
FOR AN APPROVAL.
CONTRACTOR SHALL CONSULT THE CITY FOR ADDITIONAL I/O OTHER THAN THE SHOWN
ON THIS SCHEMATIC. PROVIDE SPARE TERMINALS (50EA) IN ADDITION TO THE TERMINALS SHOWN.
TERMINALS SHALL BE ARRANGED ON ONE SIDE OF THE BACK PANEL IN THE TELEMETRY
SECTION NOT TO INTERFERE WITH THE RTU EQUIPMENT INSTALLATION.

SPECIAL NOTES

THIS DIAGRAM IS PREPARED FOR THE CONTROL REFERENCE ONLY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PREPARATION OF THE FINAL DIAGRAM AND SUBMITTING THE DIAGRAM AS A PART OF THE SHOP DRAWING SUBMITTAL BASED ON THE CITY AND THE PUMP SYSTEM MFR'S RQMTS AND THE DEVICES MFR'S INSTRUCTIONS, PRIOR TO ANY ACTIVITIES.

E-203

REVISION		
NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER — CHAE YOUNG LEE — No. E 12266 — EXP. Sept. 30, 2010 — ELECTRICAL — STATE OF CALIFORNIA

APPROVED BY: CHAE YOUNG LEE 12266 EE — DATE 3/3/09
APPROVED: — DATE
APPROVED: — DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

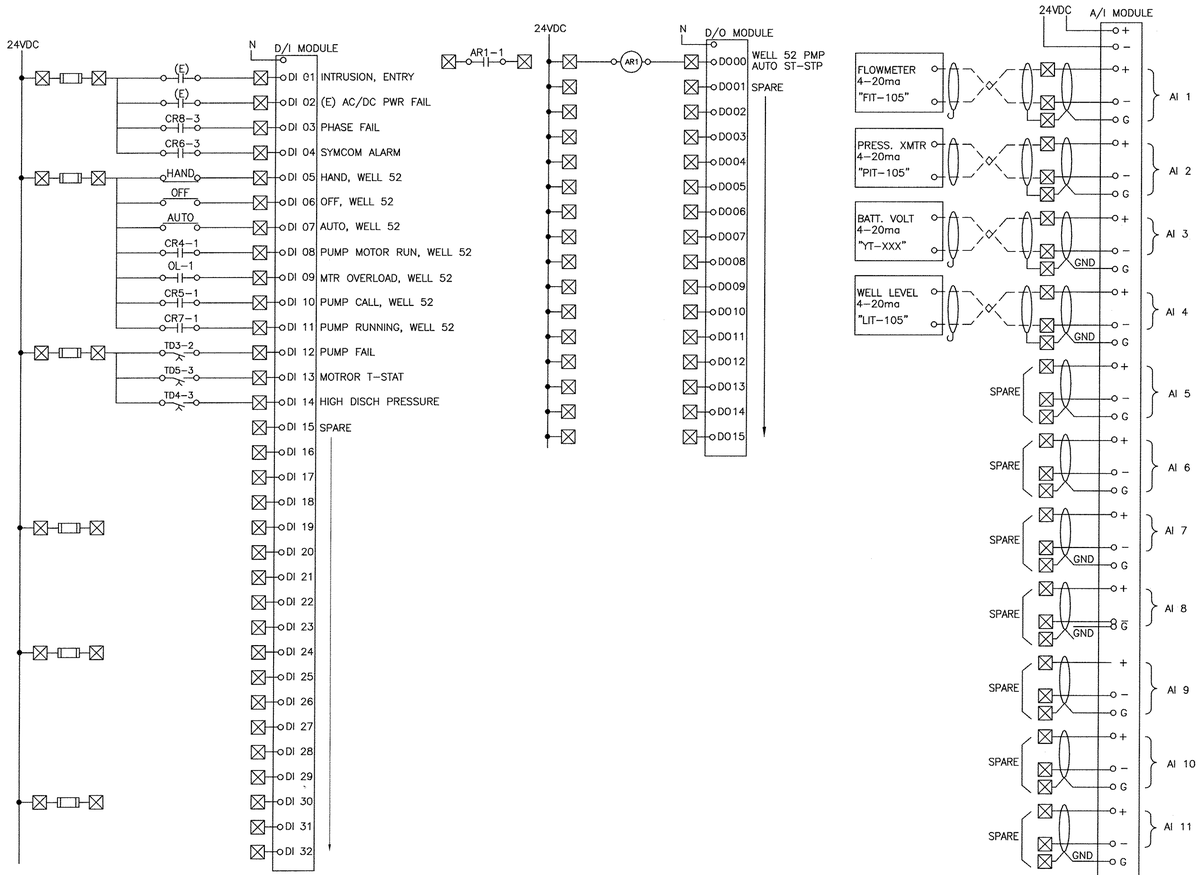
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The Business of Innovation

CITY OF PASADENA — INCORPORATED JUNE 1886

D.S.-209 & 210A

DATE	SCALE		
NOVEMBER 2008	AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 67 OF 79 SHEETS
DRAWN BY CALPOWER		WELL 52 WELL PUMP CONTROL SCHEMATIC	WORK ORDER 02557 / FILE NUMBER E-1670
DESIGNED BY CALPOWER			
CHECKED BY CIVILTEC			
SUBMITTED BY CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED / REVISION

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NOTES FOR RTU(PLC) SYSTEM

1. MODIFY EXIST RTU BY PROVIDING NECESSARY MODULES AND ACCESSORIES TO ACCOMMODATE I/O'S AS SHOWN.
2. RTU AND SCADA SYSTEM PROGRAMMING BY THE CITY.

SYMBOLS

(SEE DWG E-001 FOR OTHER SYMBOLS)

- ☒ TERMINAL FOR RTU(PLC) CONNECTION
- – – FIELD WIRING (BY CONTRACTOR OR RESPONSIBLE VENDOR)
- ▭ FUSE AT TERMINAL BLOCK

WELL 52

E-204

REVISION		
NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER — CHAE YOUNG LEE — No E 12266 — EXP Sept 30, 2010 — ELECTRICAL — STATE OF CALIFORNIA

APPROVED BY:
CHAE YOUNG LEE 12266 EE — DATE 3/2/09
APPROVED: — DATE
APPROVED: — DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

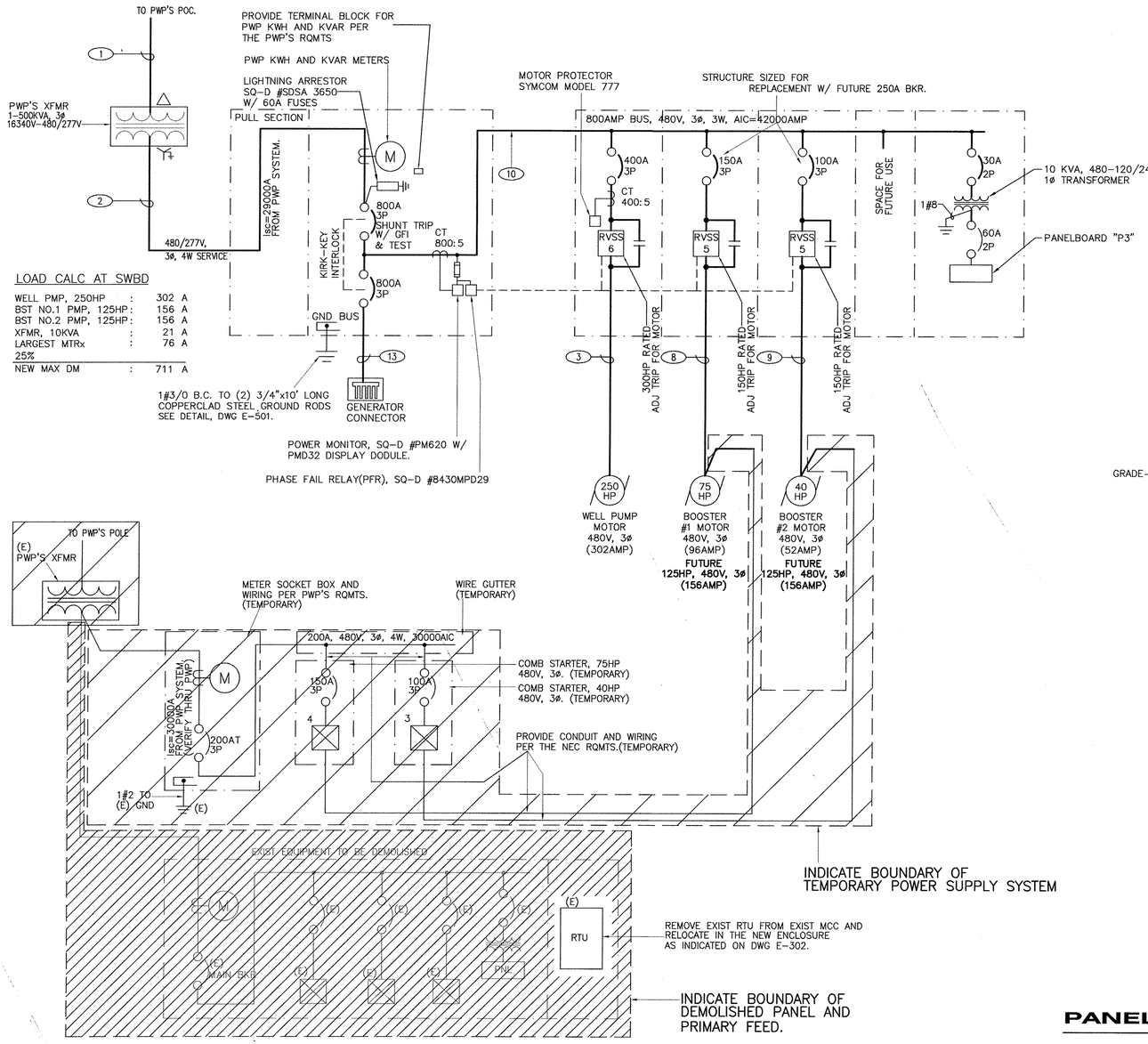
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The Business of Innovation

CITY OF PASADENA ★ INCORPORATED JUNE 1886 ★

D.S.-209 & 210A

DATE	SCALE	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 68 OF 79 SHEETS
NOVEMBER 2008	AS SHOWN		
DRAWN BY CALPOWER DESIGNED BY CALPOWER CHECKED BY CIVILTEC SUBMITTED BY CIVILTEC		WELL 52 PLC INPUT/OUTPUT DIAGRAM	WORK ORDER 02557 / FILE NUMBER E-1670
FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

X:\2007\07140-PA MONHALL TREATMENT PLANT\DWG\SUBMITTALS\FINAL SUBMITTALS\E-204.DWG (02-27-09 10:00:34AM)

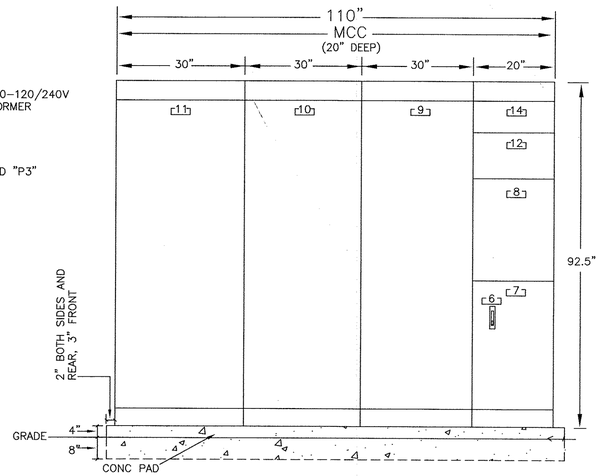


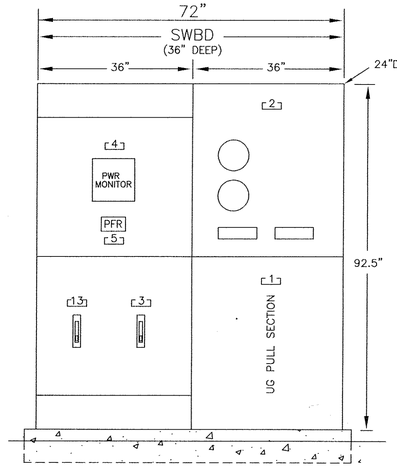
CONSTRUCTION SEQUENCE

1. PROVIDE TEMPORARY POWER SUPPLY SYSTEM AND COMPONENTS FOR THE BOOSTER PUMPS AS INDICATED ON THE DIAGRAM.
2. DEMOLISH EXIST ELECTRICAL EQUIPMENT AND COMPONENTS AS INDICATED ON THE DRAWINGS.
3. PROVIDE PERMANENT POWER DISTRIBUTION SYSTEM AND COMPONENTS AS INDICATED ON THE DIAGRAM.
4. PWP TO DEMOLISH EXISTING PWP TRANSFORMER ENCLOSURE. △1
5. DOWNTIME OF THE BOOSTER PUMPS SHALL NOT BE PERMITTED DURING THE CONSTRUCTION.

ALL CIRCUIT BREAKERS SHALL BE 100% RATED TYPE, IF AVAILABLE.

SINGLE LINE DIAGRAM





SWBD AND MCC ELEVATION

NO SCALE

CONSTRUCTION NOTES FOR SWBD AND MCC

(SEE DWG E-1 FOR OTHER NOTES.)

1. APPROXIMATE DIMENSIONS ARE SHOWN FOR REFERENCE ONLY. VERIFY THE DIMENSIONS THROUGH THE EQUIPMENT MFRS.
2. SWBD SHALL BE NEMA 1 TYPE CONSTRUCTION. MCC SHALL BE NEMA 12 TYPE CONSTRUCTION. WIRING NEMA CLASS IIS, TYPE B
3. SWBD BUS VOLTAGE SHALL BE 3ø, 4W HERTZ 60HZ MCC BUS VOLTAGE SHALL BE 3ø, 3W HERTZ 60HZ
4. GROUND BUS 1/4" X 1" TIN PLATED COPPER(TPC)
5. MCC BUS RATING. VERT. 300A HORIZ. 600A TPC
6. BUS BRACING AND BKR RATINGS AT MIN. 42,000 RMS SYM. AMP.
7. INDIVIDUAL 480/120V CTRL PWR XFMR FOR EACH STARTER
8. INCLUDE SURGE PROTECTOR AT EACH MOTOR STARTER.
9. CKT BKR TYPE MCP FOR EACH STARTER, THERMAL MAGNETIC TYPE BKR FOR EACH FEEDER BKR'S.
10. PROVIDE NAMEPLATE FOR EACH COMPARTMENT.
11. OVERLOAD HEATER ELEMENTS FOR EACH STARTER.
12. ANSI #61 FINISH.
13. ALL CONTROL/SIGNAL CONDUCTORS SHALL BE ENCLOSED IN PVC WIRE DUCTS W/ COVER.
14. SWBD AND MCC SHALL BE ANCHORED TO MEET SEISMIC ZONE 4 RQMTS. SUBMIT THE REGISTERED STRUCTURAL ENGINEER'S CALC. AS THE PART OF THE SHOP DRAWING SUBMITTAL, FOR AN APPROVAL..
16. SITE AMBIENT TEMP IS 125°F, HUMIDITY IS 20 TO 95%, ELEVATION IS ABOUT 2000 FT.
17. SQ-D MODEL 6, OR APPROVED EQUAL.
18. UG PULL SECTION & UTILITY METER SECTION SHALL MEET EUSERC RQMTS.

NAMEPLATE SCHEDULE

[1] UNDERGROUND PULL SECTION
[2] UTILITY METER SECTION
[3] MAIN BREAKER, 800AT
[4] DIGITAL POWER METER
[5] PHASE FAILURE RELAY
[6] 30A/2P XFMR PRI BKR
[7] 10KVA XFMR, 480-240/120V, 1ø, 3W
[8] PNL "P", 240/120V, 1ø, 3W
[9] ARROYO WELL PUMP STARTER
[10] BST NO.1 STARTER
[11] BST NO.2 STARTER
[12] CONTROL RELAYS
[13] STANDBY PWR BKR, 800AT
[14] SPACE FOR FUTURE USE

PANEL SCHEDULE

120/240 VOLTS 1 ø 3 W — PANELBOARD P — FEED TOP
60A MAIN — LOCATION M.C.C. — MTG. INSIDE MCC

LOAD DESCRIPTIONS	WATTAGE ø A	WATTAGE ø B	LTG	REC	MIS	CIR	BKR	A	B	BKR	CIR	MIS	REC	LTG	WATTAGE ø A	WATTAGE ø B	LOAD DESCRIPTIONS
(E) EXT. LIGHTS	1000				1	1	20			20	2	1			500		SPARE
INT. LIGHTS		700	7			3	20			20	4		5			900	RECEPT.
SPACE					1	5				20	6	1			120		(E) RTU
						7					8						SPACE
						9					10						
						11					12						
	1000	700				TOTAL				TOTAL					620	900	
	PHASE TOTAL		TOTAL LOAD														
	1620	1600	3.2KVA (13.4AMP)														

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER — CHAE YOUNG LEE — No E 12266 — EXP 06-30-2010 — ELECTRICAL — STATE OF CALIFORNIA

APPROVED BY:
CHAE YOUNG LEE 12266 EE — DATE 3/2/09
APPROVED: — DATE
APPROVED: — DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

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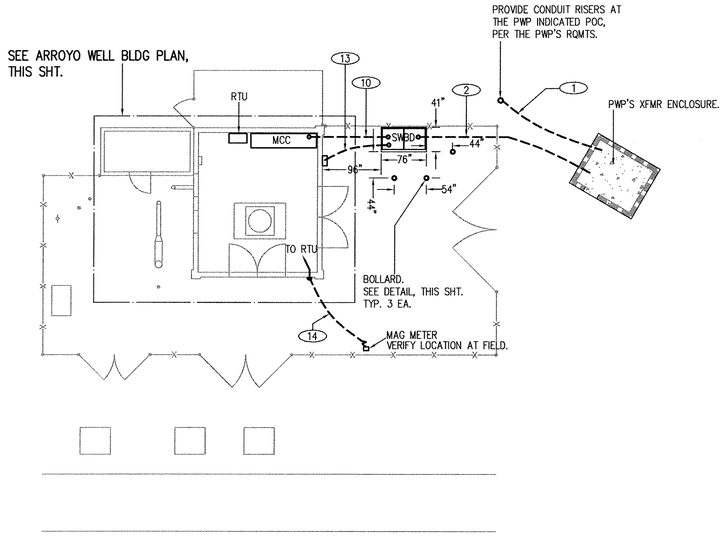
CITY OF PASADENA INCORPORATED JUNE 1886

D.S.-209 & 210A

DATE	SCALE	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 69 OF 79 SHEETS
NOVEMBER 2008	AS SHOWN	ARROYO WELL SINGLE LINE DIAGRAM, ELEVATION, SCHEDULE	WORK ORDER 02557 / FILE NUMBER E-1670
DRAWN BY CALPOWER			
DESIGNED BY CALPOWER			
CHECKED BY CIVILTEC			
SUBMITTED BY CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

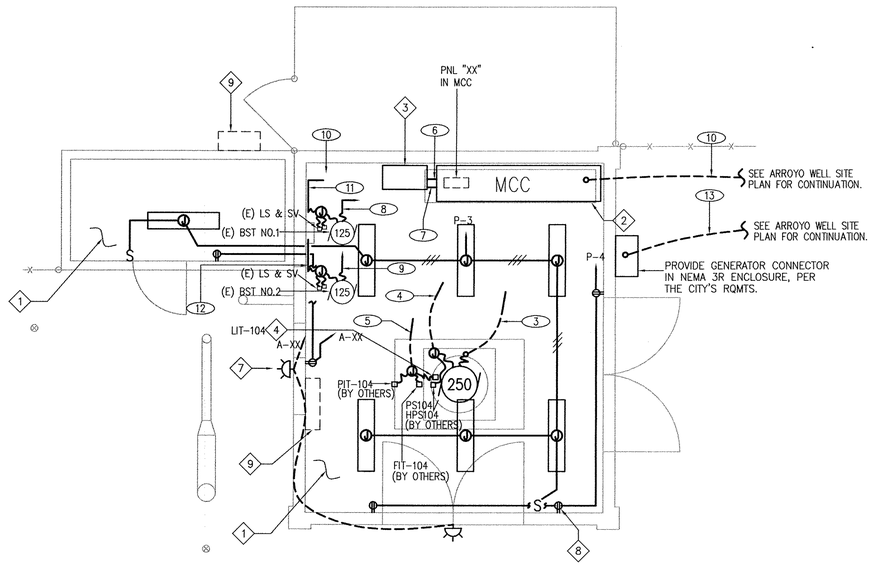
E-301

X:\2007\27140-JR MCNEIL TREATMENT PLANT\DWG\SUBMITTAL\E-301.DWG (02-27-09 10:01:52AM)



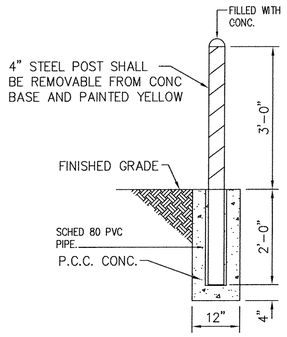
ARROYO WELL SITE PLAN – ELECTRICAL

NOT TO SCALE



ARROYO WELL BLDG PLAN – ELECTRICAL

SCALE: 1/4"=1'-0"



BARRIER POST

N.T.S.

FEEDER SCHEDULE (X)

(1) (2)4"C, FROM PWP'S POC TO PWP XFMR ENCLOSURE, PROVIDED PER THE PWP'S RQMTS.

(2) (3) 5"C, FROM PWP XFMR ENCLOSURE TO SWBD, PROVIDED PER THE PWP'S RQMTS.

(3) 3"C–2(3#250MCM),+1#3GND. FROM MCC TO WELL PUMP MOTOR.

(4) 3/4"C–12#14+1#14GND. FROM MCC TO "PS/HPS", "T–STAT", "SOLENOID", "SPC HTR, AT FIELD. (CONTROL)

(5) 1"C–XDCR & XMTR CABLE, FROM "LIT101", "PIT101", "FIT102" TO RTU. PROVIDE THE XDCR & XMTR CABLES PER THE EQUIPMENT MFR'S INSTRUCTIONS. (SIGNAL)

(6) 3/4"C–12#14+1#14GND. FROM MCC TO "PS/HPS", "T–STAT", "SOLENOID", "SPC HTR, AT FIELD. (CONTROL)

(7) 1"C–XDCR & XMTR CABLE, FROM "LIT101", "PIT101", "FIT102" TO RTU. PROVIDE THE XDCR & XMTR CABLES PER THE EQUIPMENT MFR'S INSTRUCTIONS. (SIGNAL)

(8) 2"C–3#3/0+1#4GND), FROM MCC TO (E) BST PMP NO.1.

(9) 2"C–3#3/0+1#4GND), FROM MCC TO (E) BST PMP NO.2.

(10) 2(3"C–3#350MCM+1#1GND), FROM SWBD TO MCC.

(11) 3/4"C–10#14+1#14GND. FROM MCC TO (E) "LS", "SV", "T–STAT", "SPC HTR, AT (E) BST NO.1. (CONTROL)

(12) 3/4"C–10#14+1#14GND. FROM MCC TO (E) "LS", "SV", "T–STAT", "SPC HTR, AT (E) BST NO.2. (CONTROL)

(13) 2(3"C–3#500MCM+1#1/0GND). FROM MCC TO GEN CONNECTOR.

(14) 3/4"C–W/ SIGNAL CABLE PER THE MFR'S SPEC, FROM MAG METER TO RTU.

CONSTRUCTION NOTES

1. REMOVE UNUSED ELECTRICAL EQUIPMENT AND COMPONENTS IN THE ROOM COMPLETELY. ALL THE REMAINING EQUIPMENT OR COMPONENTS ARE NOT NECESSARILY SHOWN.
2. REMOVE EXIST MCC AND RELATED CONDUITS AND WIRING COMPLETELY. MODIFY/EXTEND CONDUITS AND WIRING TO NEW MCC FOR THE REMAINING EQUIPMENT OR COMPONENTS.
3. PROVIDE 30"x30"x12"D NEMA 12 ENCL BY HOFFMAN (MFR). ASSEMBLE RTU BY RELOCATING EXIST RTU(PLC) LIO–5 OF TESCO TO MATCH EXIST RTU IN OTHER WELLS. MODIFY THE RTU BY FURNISHING NECESSARY MODULE PER THE DWG E–306. CONSULT THE MFR AS NECESSARY.
4. WELL LEVEL (DEPTH) TRANSDUCER LOCATED AT BUTTOM OF THE WELL. SUBMERCIBLE PRESSURE TRANSDUCER BY KPSI W/ CABLE AND CABLE HANGER.
5. LIGHT FIXTURE, PENDANT, GENERAL PURPOSE, INDUSTRIAL, (4)–32W TUBES, 10% HARMONIC ELECTRONIC BALLAST, EJ432–120GEB10 BY LITHONIA. TYP 5 EA.
6. PROVIDE UNDERGROUND PULLBOX, 10"X17"X36"D, 3 1/2(T) PB BY BROOKS.
7. 70W HIGH PRESSURE SODIUM LAMP W/ INTERNAL REFLECTOR, PRISMATIC POLYCARBONATED REFRACTOR, BUILT–IN 0–20FC ADJ PHOTOCELL CONTROL, UL APPROVED FOR WET LOCATION. HUBBELL #NRG–307 OR APPROVED EQUAL. TYP. 2 EA.
8. PROVIDE SURFACE PWR RECEPTACLE OUTLET, 125V, 20AMP, NEMA 5–20R IN CAST ALUM BOX SST COVERPLATE. TYP OF 2 EA.
9. PROVIDE TEMPORARY PWR EQUIPMENT, CONDUIT AND WIRING. PROVIDE SERVICE EQUIPMENT AND CONDUIT TO MEET THE PWP'S RQMTS.

SPECIAL NOTE

1. ALL THE ELECTRICAL DRAWINGS ARE SCHEMATIC. CONDUITS OR WIRINGS ARE NOT SHOWN FOR SOME EQUIPMENT/DEVICES. IT SHALL BE CONTRACTOR'S RESPONSIBILITY TO COMPLETE THE PROJECT CONSTRUCTION PER DRAWINGS AND SPEC AT HIS DISCRETION AT NO ADDITIONAL COST TO THE CITY. FOR ANY DESCREPACIES, CONTRACTOR SHALL SUBMIT REQUESTS FOR CLARIFICATION DURING BIDDING PHASE.
2. CONTRACTOR MUST WORK CLOSELY WITH PWP IN COORDINATING ELECTRICAL WORK DUE TO ENERGIZED SYSTEM.
3. PROVIDE A STANDBY POWER GENERATOR FOR CONTINUOUS OPERATION OF THE BOOSTER PUMPS.

E–302

REVISION		
NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER CHAE YOUNG LEE No E 12266 EXP Sept 30 2010 ELECTRICAL STATE OF CALIFORNIA

APPROVED BY:
CHAE YOUNG LEE 12266 EE — 3/2/09 DATE
APPROVED: — DATE
APPROVED: — DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

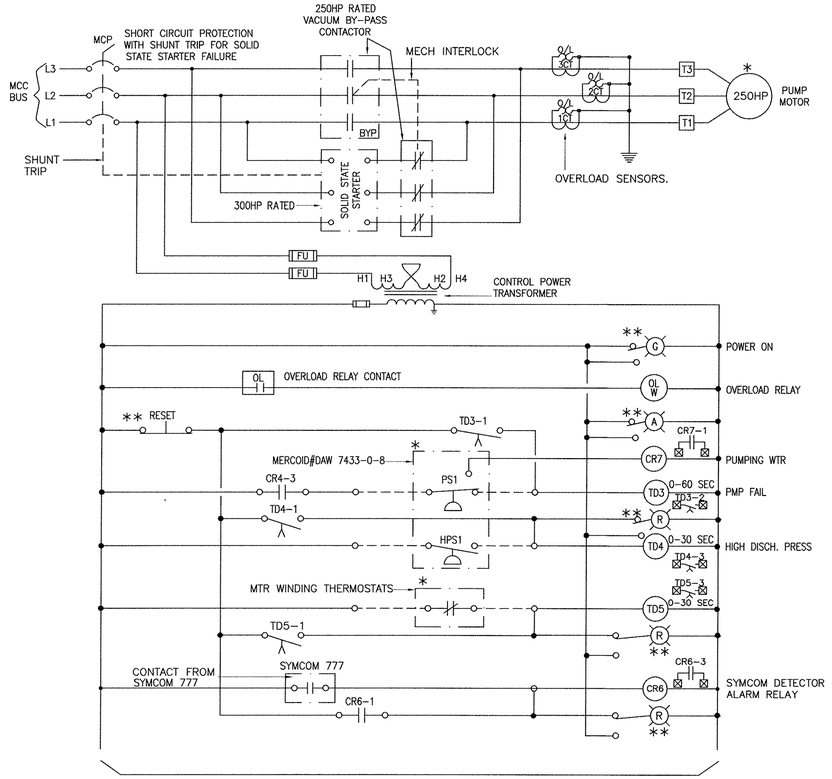
Battelle
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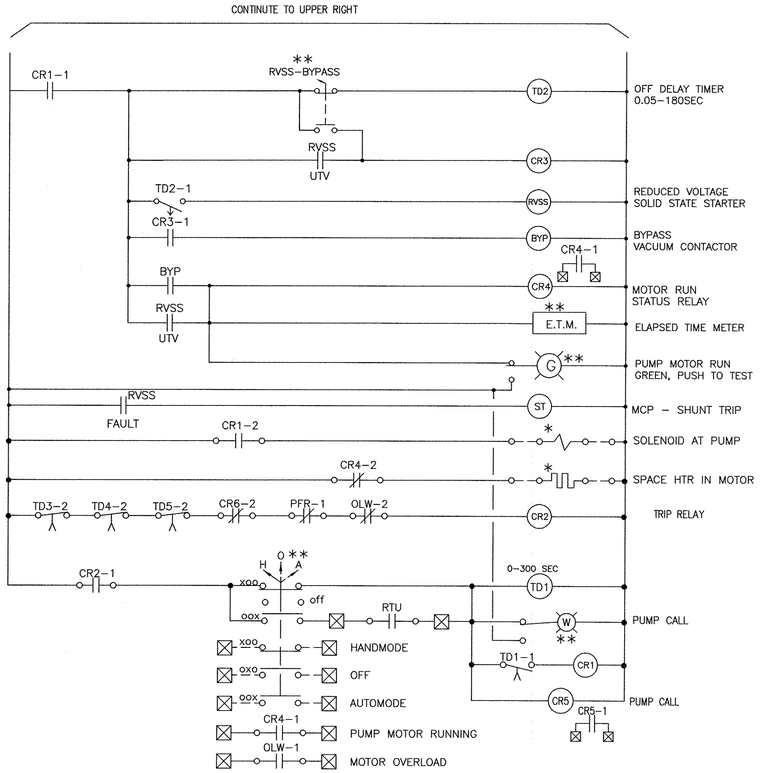
CITY OF PASADENA INCORPORATED JUNE 1886

D.S.–209 & 210A

DATE: NOVEMBER 2008	SCALE: AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 70 OF 79 SHEETS
DRAWN BY: CALPOWER DESIGNED BY: CALPOWER CHECKED BY: CIVILTEC SUBMITTED BY: CIVILTEC		ARROYO WELL SITE PLAN AND BUILDING PLAN ELECTRICAL	WORK ORDER: 02557 / FILE NUMBER: E–1670
FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

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ARROYO WELL PUMP MOTOR

* : DEVICE AT FIELD AND FIELD WIRING (BY THE EQUIPMENT INSTALLATION CONTRACTOR)

**: DEVICE AT FRONT SURFACE OF MCC.

⊠ : TERMINAL IN THE TELEMETRY SECTION FOR RTU INTERFACE.
PROVIDE THE TERMINAL NUMBERS IN THE SHOP DWG
FOR AN APPROVAL.
CONTRACTOR SHALL CONSULT THE CITY FOR ADDITIONAL I/O OTHER THAN THE SHOWN ON THIS SCHEMATIC. PROVIDE SPARE TERMINALS (50EA) IN ADDITION TO THE TERMINALS SHOWN. TERMINALS SHALL BE ARRANGED ON ONE SIDE OF THE BACK PANEL IN THE TELEMETRY SECTION NOT TO INTERFERE WITH THE RTU EQUIPMENT INSTALLATION.

SPECIAL NOTES

THIS DIAGRAM IS PREPARED FOR THE CONTROL REFERENCE ONLY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PREPARATION OF THE FINAL DIAGRAM AND SUBMITTING THE DIAGRAM AS A PART OF THE SHOP DRAWING SUBMITTAL BASED ON THE CITY AND THE PUMP SYSTEM MFR'S RQMTS AND THE DEVICES MFR'S INSTRUCTIONS, PRIOR TO ANY ACTIVITIES.

E-303

REVISION		
NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER — CHAE YOUNG LEE — No E 12266 — EXP. 10-30-2010 — ELECTRICAL — STATE OF CALIFORNIA

APPROVED BY:
CHAE YOUNG LEE 12266 EE — 3/2/09 DATE
APPROVED: _____ DATE
APPROVED: _____ DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

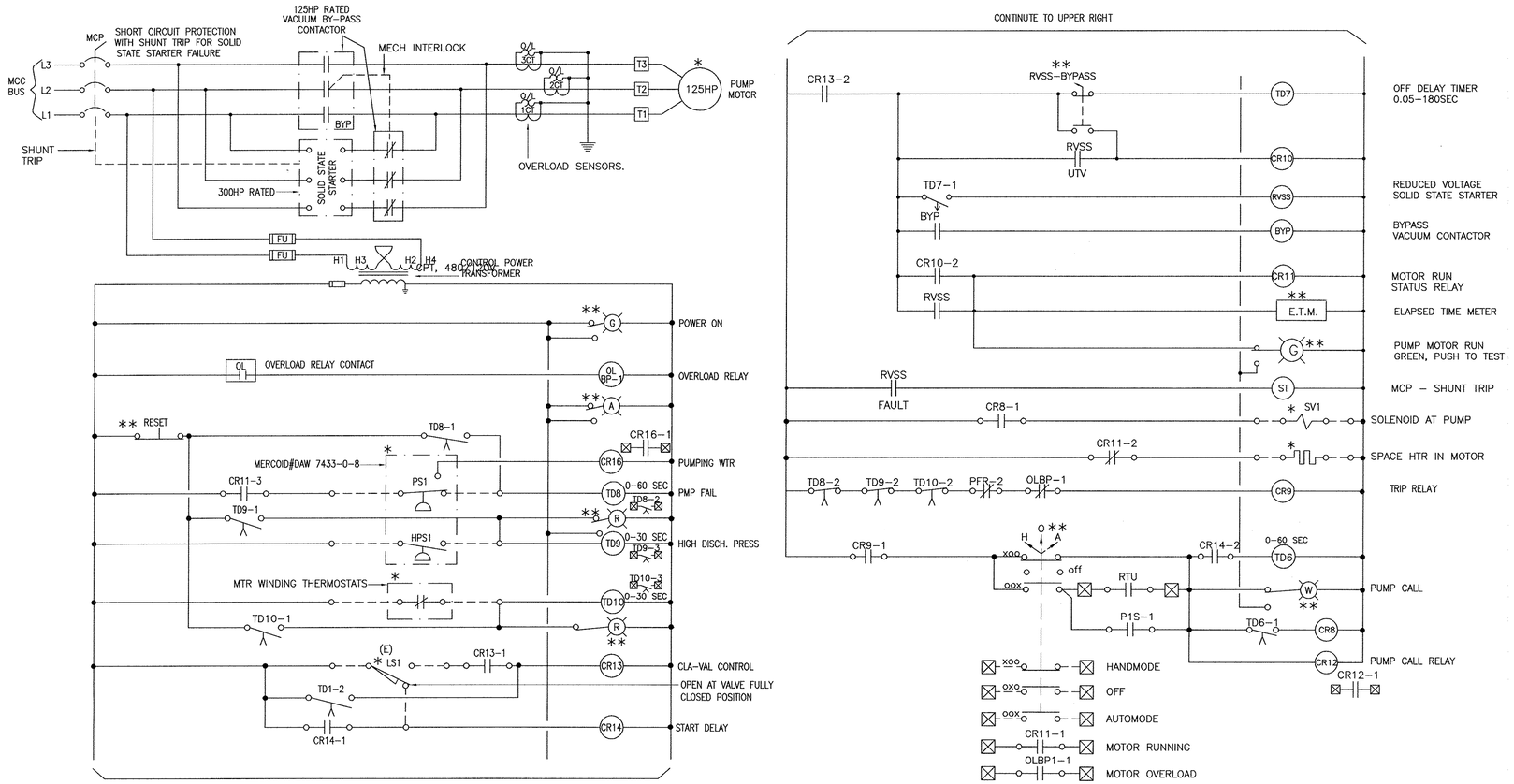
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The Business of Innovation

CITY OF PASADENA * INCORPORATED JUNE 1886 *

D.S.-209 & 210A

DATE	SCALE	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 71 OF 79 SHEETS
NOVEMBER 2008	AS SHOWN		
DRAWN BY CALPOWER		ARROYO	WORK ORDER 02557 / FILE NUMBER E-1670
DESIGNED BY CALPOWER		WELL PUMP CONTROL SCHEMATICS	
CHECKED BY CIVILTEC			
SUBMITTED BY CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

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MISCELLANEOUS CONTROL SCHEMATIC

ARROYO BOOSTER PUMP MOTOR NO.1

TYPICAL FOR BOOSTER PUMP MOTOR NO.2 EXCEPT DEVICE NUMBERS VARY ACCORDINGLY.

SPECIAL NOTES

THIS DIAGRAM IS PREPARED FOR THE CONTROL REFERENCE ONLY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PREPARATION OF THE FINAL DIAGRAM AND SUBMITTING THE DIAGRAM AS A PART OF THE SHOP DRAWING SUBMITTAL BASED ON THE CITY AND THE PUMP SYSTEM MFR'S RQMTS AND THE DEVICES MFR'S INSTRUCTIONS, PRIOR TO ANY ACTIVITIES.

* : DEVICE AT FIELD AND FIELD WIRING (BY THE EQUIPMENT INSTALLATION CONTRACTOR)

**: DEVICE AT FRONT SURFACE OF MCC.

☒ : TERMINAL IN THE TELEMETRY SECTION FOR RTU INTERFACE. PROVIDE THE TERMINAL NUMBERS IN THE SHOP DWG FOR AN APPROVAL. CONTRACTOR SHALL CONSULT THE CITY FOR ADDITIONAL I/O OTHER THAN THE SHOWN ON THIS SCHEMATIC. PROVIDE SPARE TERMINALS (50EA) IN ADDITION TO THE TERMINALS SHOWN. TERMINALS SHALL BE ARRANGED ON ONE SIDE OF THE BACK PANEL IN THE TELEMETRY SECTION NOT TO INTERFERE WITH THE RTU EQUIPMENT INSTALLATION.

E-304

REVISION		
NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER — CHAE YOUNG LEE — No E 12266 — EXP 6/30/2010 — ELECTRICAL — STATE OF CALIFORNIA

APPROVED BY:
CHAE YOUNG LEE 12266 EE 2/2/09 DATE
APPROVED: DATE
APPROVED: DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

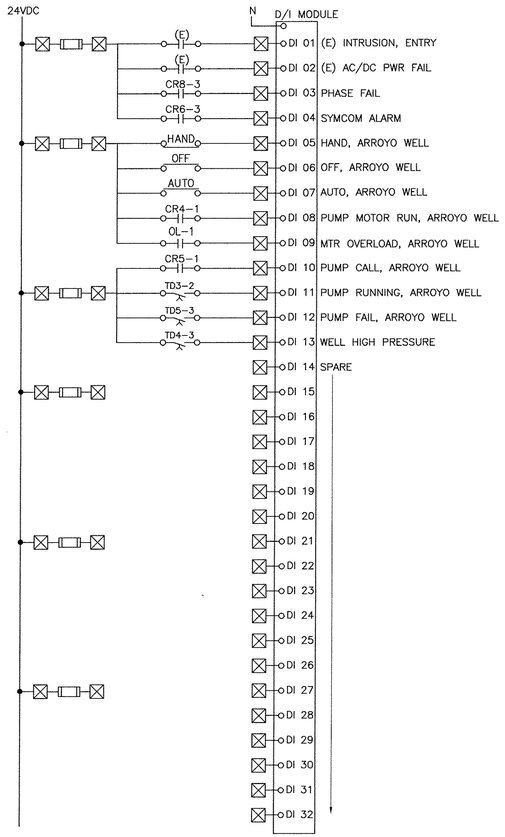
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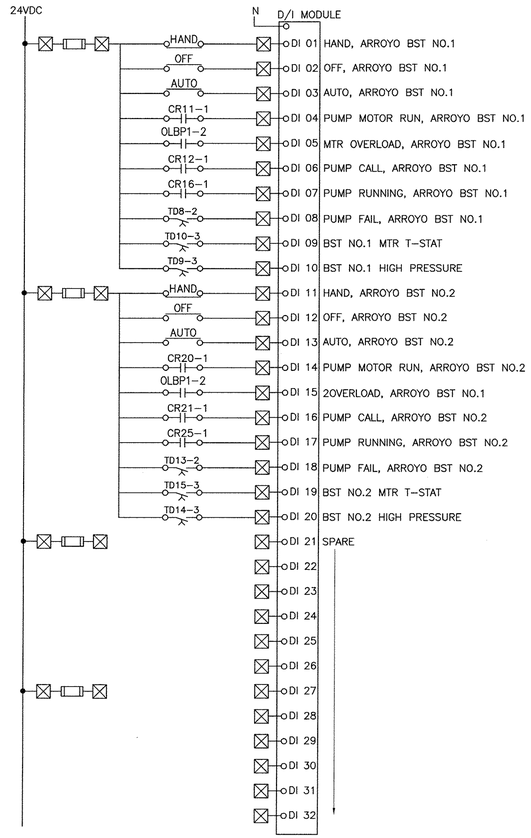
CITY OF PASADENA INCORPORATED JUNE 1886

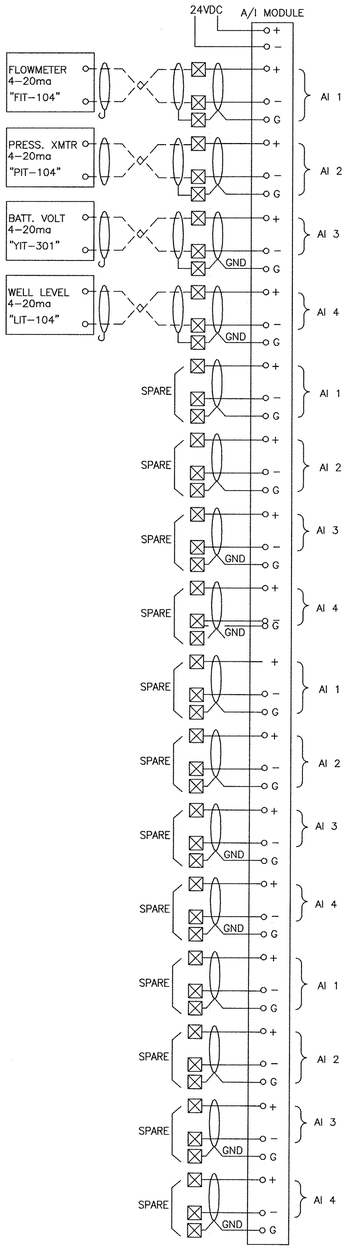
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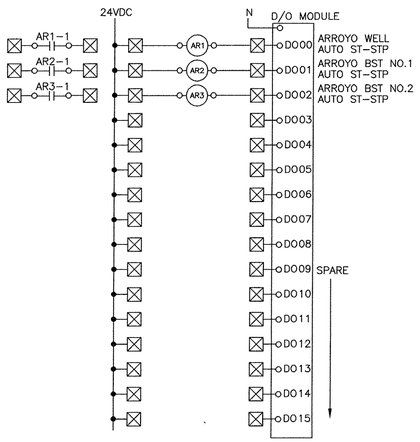
DATE: NOVEMBER 2008	SCALE: AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 72 OF 79 SHEETS
DRAWN BY: CALPOWER DESIGNED BY: CALPOWER CHECKED BY: CIVILTEC SUBMITTED BY: CIVILTEC		ARROYO BOOSTER PUMP CONTROL SCHEMATICS	WORK ORDER 02557 / FILE NUMBER E-1670
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED / REVISION

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ARROYO WELL

NOTES FOR RTU(PLC) SYSTEM

1. MODIFY EXIST RTU BY PROVIDING NECESSARY MODULES AND ACCESSORIES TO ACCOMMODATE I/O'S AS SHOWN.
2. RTU AND SCADA SYSTEM PROGRAMMING BY THE CITY.

SYMBOLS

(SEE DWG E-001 FOR OTHER SYMBOLS)

- ☒ TERMINAL FOR RTU(PLC) CONNECTION
- – – FIELD WIRING (BY CONTRACTOR OR RESPONSIBLE VENDOR)
- ▭ FUSE AT TERMINAL BLOCK

E-305

REVISION		
NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER — CHAE YOUNG LEE — No E 12268 — EXP. 12-31-09 — ELECTRICAL — STATE OF CALIFORNIA

APPROVED BY:
CHAE YOUNG LEE 12266 EE — DATE 3/2/09
APPROVED: _____ DATE _____
APPROVED: _____ DATE _____

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

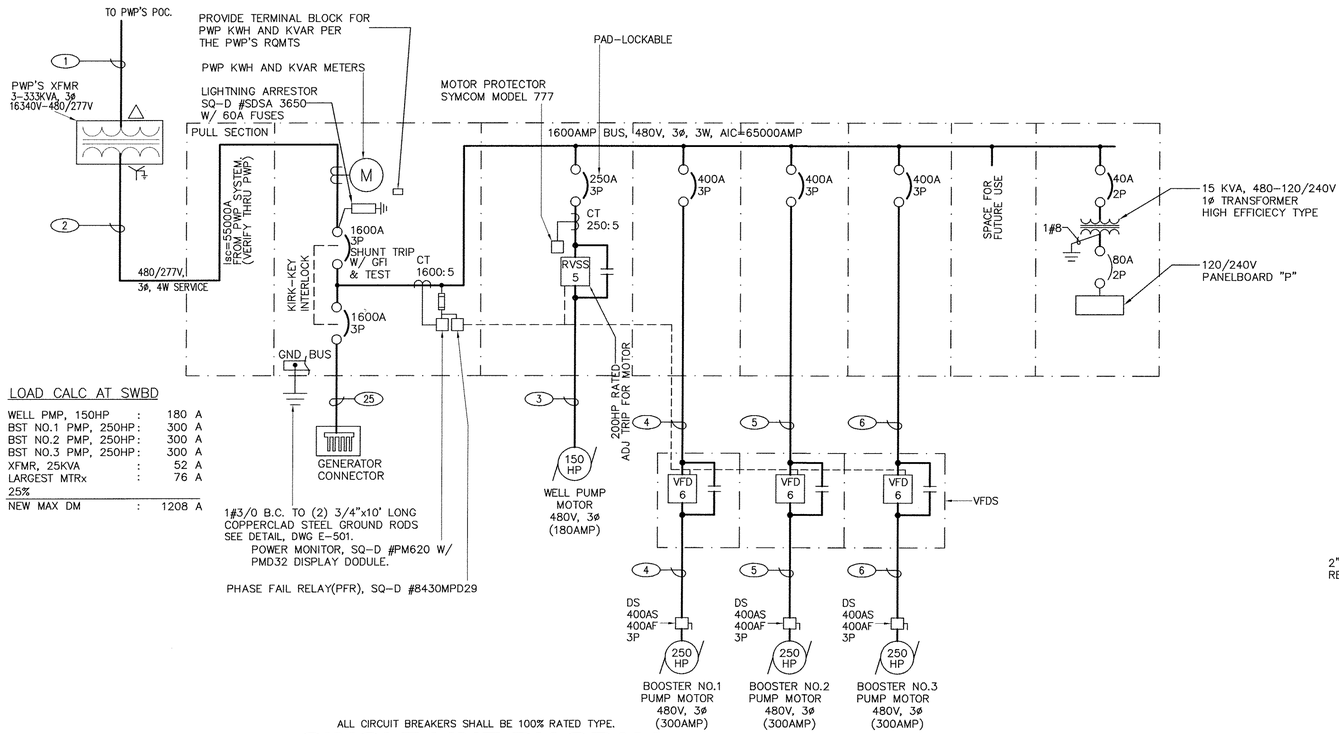
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CITY OF PASADENA — INCORPORATED JUNE 1886

D.S.-209 & 210A

DATE: NOVEMBER 2008	SCALE: AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 73 OF 79 SHEETS
DRAWN BY: CALPOWER DESIGNED BY: CALPOWER CHECKED BY: CIVILTEC SUBMITTED BY: CIVILTEC		ARROYO PLC INPUT/OUTPUT DIAGRAM	WORK ORDER 02557 / FILE NUMBER E-1670
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED / REVISION

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LOAD CALC AT SWBD

WELL PMP, 150HP	:	180 A
BST NO.1 PMP, 250HP	:	300 A
BST NO.2 PMP, 250HP	:	300 A
BST NO.3 PMP, 250HP	:	300 A
XFMR, 25KVA	:	52 A
LARGEST MTRx	:	76 A
25%		
NEW MAX DM	:	1208 A

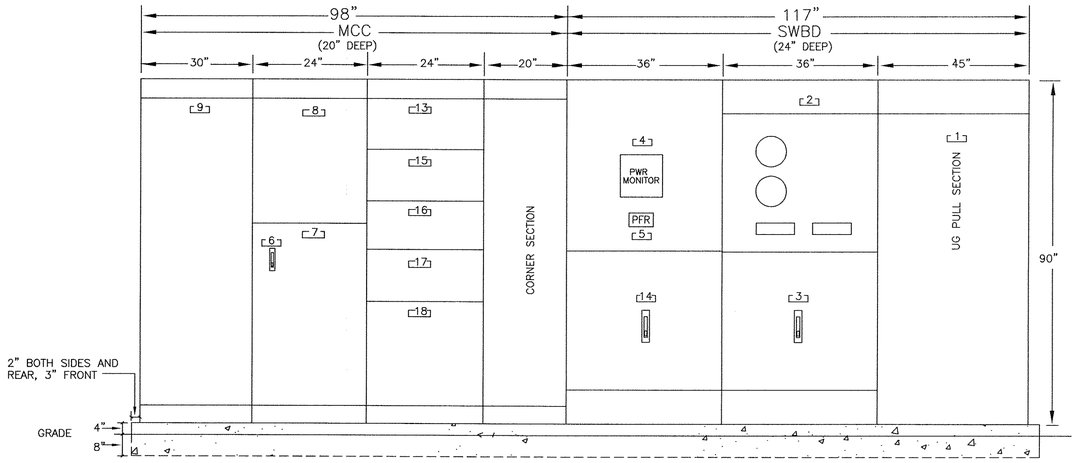
ALL CIRCUIT BREAKERS SHALL BE 100% RATED TYPE.

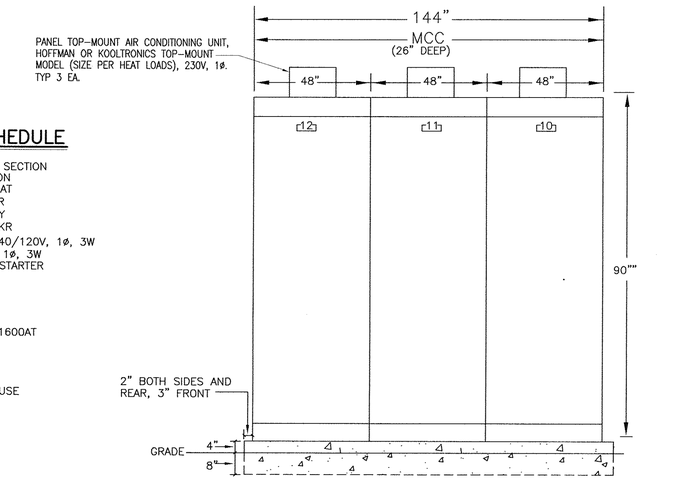
SINGLE LINE DIAGRAM

PANEL SCHEDULE

120/240 VOLTS 1 ø 3 W — PANELBOARD P — FEED TOP
80A MAIN — LOCATION M.C.C. — MTG. INSIDE MCC

LOAD DESCRIPTIONS	WATTAGE ø A	WATTAGE ø B	LTG	REC	MISC	CIR	BKR	A	B	BKR	CIR	MIS	REC	LTG	WATTAGE ø A	WATTAGE ø B	LOAD DESCRIPTIONS
(E) YARD. LIGHTS	500				1	1	20			20	2		9		1620		RECEPT
(E) INT. LIGHTS		1600	16			3	20			20	4	1				600	(E) FAN#1
(E) RTU	120				1	5	20			20	6	1			600		(E) FAN#2
A/C UNIT#3		1100		1		7	20/2			20	8	1				600	(E) FAN#3
–	1100				–	9				20/2	10	1			1100		A/C UNIT#1
SPARE		500		1		11					12	–				1100	–
SPACE						13				20/2	14	1			1100		A/C UNIT#2
						15					16	–				1100	–
						17					18						SPACE
	1720	3200				TOTAL				TOTAL					4429	3400	
	PHASE TOTAL		TOTAL LOAD														
	6149	6600	12.8KVA (53AMP)														





SWBD AND MCC ELEVATION

NO SCALE

CONSTRUCTION NOTES FOR SWBD, MCC, AND VFDS

(SEE DWG E-1 FOR OTHER NOTES.)

1. APPROXIMATE DIMENSIONS ARE SHOWN FOR REFERENCE ONLY. VERIFY THE DIMENSIONS THROUGH THE EQUIPMENT MFRS.
2. SWBD SHALL BE NEMA 1 TYPE CONSTRUCTION. MCC/VFD SHALL BE NEMA 12 TYPE CONSTRUCTION. WIRING NEMA CLASS IIS, TYPE B
3. SWBD BUS VOLTAGE SHALL BE 3ø, 4W HERTZ 60HZ MCC BUS VOLTAGE SHALL BE 3ø, 3W HERTZ 60HZ
4. GROUND BUS 1/4" X 1" TIN PLATED COPPER(TPC)
5. MCC BUS RATING. VERT. 400A HORIZ. 1600A TPC
6. BUS BRACING AND BKR RATINGS AT MIN. 42,000 RMS SYM. AMP.
7. INDIVIDUAL 480/120V CTRL PWR XFMR FOR EACH STARTER
8. INCLUDE SURGE PROTECTOR AT EACH MOTOR STARTER.
9. CKT BKR TYPE MCP FOR EACH STARTER, THERMAL MAGNETIC TYPE BKR FOR EACH FEEDER BKR'S.
10. PROVIDE NAMEPLATE FOR EACH COMPARTMENT.
11. OVERLOAD HEATER ELEMENTS FOR EACH STARTER.
12. ANSI #61 FINISH.
13. ALL CONTROL/SIGNAL CONDUCTORS SHALL BE ENCLOSED IN PVC WIRE DUCTS W/ COVER.
14. SWBD AND MCC SHALL BE ANCHORED TO MEET SEISMIC ZONE 4 RQMTS. SUBMIT THE REGISTERED STRUCTURAL ENGINEER'S CALC. AS THE PART OF THE SHOP DRAWING SUBMITTAL, FOR AN APPROVAL..
16. SITE AMBIENT TEMP IS 125°F, HUMIDITY IS 20 TO 95%, ELEVATION IS ABOUT 2000 FT.
17. SQ-D MODEL 6, OR APPROVED EQUAL.
18. UG PULL SECTION & UTILITY METER SECTION SHALL MEET EUSERC RQMTS.

NAMEPLATE SCHEDULE

[1] UNDERGROUND PULL SECTION
[2] UTILITY METER SECTION
[3] MAIN BREAKER, 1600AT
[4] DIGITAL POWER METER
[5] PHASE FAILURE RELAY
[6] 40A/2P XFMR PRI BKR
[7] 15KVA XFMR, 480-240/120V, 1ø, 3W
[8] PNL "P", 240/120V, 1ø, 3W
[9] VENTURA WELL PMP STARTER
[10] BST NO.1 VFD
[11] BST NO.2 VFD
[12] BST NO.3 VFD
[13] CONTROL RELAYS
[14] STANDBY PWR BKR, 1600AT
[15] BST#1 BKR, 400AT
[16] BST#2 BKR, 400AT
[17] BST#3 BKR, 400AT
[18] SPACE FOR FUTURE USE

REVISION		
NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER — CHAE YOUNG LEE — No E 12266 — EXP. SEP. 30, 2010 — ELECTRICAL — STATE OF CALIFORNIA

APPROVED BY:
CHAE YOUNG LEE 12266 EE 3/2/09 DATE
APPROVED: DATE
APPROVED: DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

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The Business of Innovation

CITY OF PASADENA INCORPORATED JUNE 1886

D.S.-209 & 210A

DATE	SCALE
NOVEMBER 2008	AS SHOWN

DRAWN BY CALPOWER
DESIGNED BY CALPOWER
CHECKED BY CIVILTEC
SUBMITTED BY CIVILTEC
FIELD BOOKS | CALC BOOKS | APPROVED | APPROVED

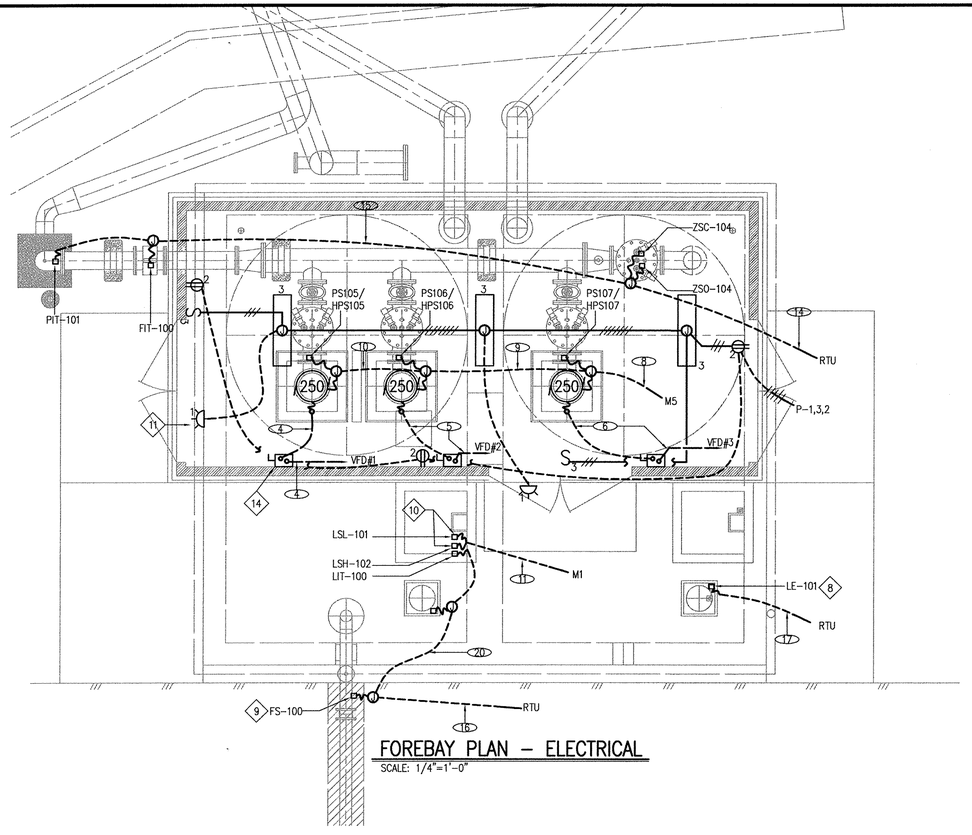
PASADENA WATER & POWER
CITY OF PASADENA

VENTURA WELL
VENTURA WELL BUILDING PLAN
ELECTRICAL

SHEET NO 74 OF 79 SHEETS
WORK ORDER 02557
FILE NUMBER E-1670
REVISION

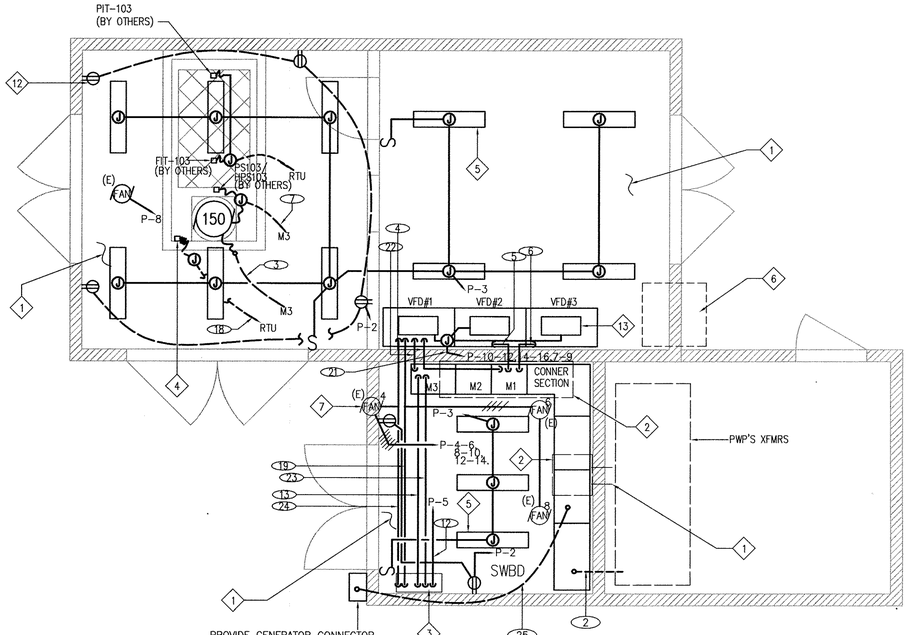
E-401

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FOREBAY PLAN – ELECTRICAL

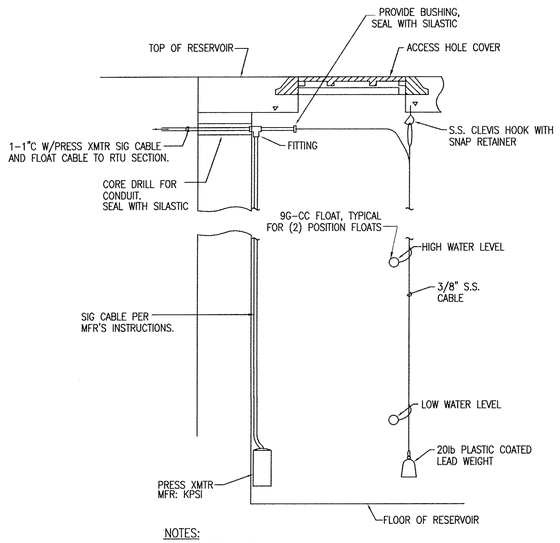
SCALE: 1/4"=1'-0"



PROVIDE GENERATOR CONNECTOR IN NEMA 3R ENCLOSURE, PER THE CITY'S RQMTS.

BLDG PLAN – ELECTRICAL

SCALE: 1/4"=1'-0"

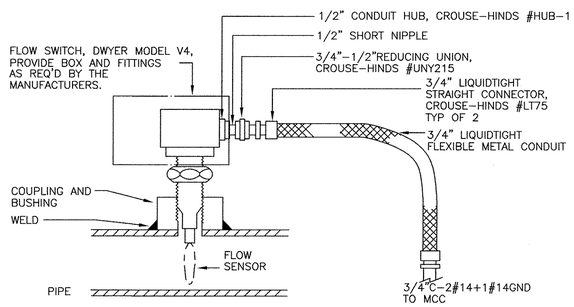


NOTES:

1. ALL MATERIALS SHALL BE 316 S.S.
2. RESEAL RESERVOIR TO MANUFACTURERS RECOMMENDATIONS.
3. ADJUST THE DEVICE LOCATIONS AT FIELD.

LEVEL SENSOR MTG IN RESERVOIR

NOT TO SCALE



MANUFACTURER

FLOW SENSOR: W.E.ANDERSON #V4-SS-2-U
FLOW ELEMENT: SIGNET #P51530-P2

FLOW SWITCH MTG DETAILS

NOT TO SCALE

FEEDER SCHEDULE (X)

(1) (2)4"C, FROM PWP'S POC TO PWP XFMR ENCLOSURE, PROVIDED PER THE PWP'S RQMTS.
(2) (5) 5"C, FROM PWP XFMR ENCLOSURE TO SWBD, PROVIDED PER THE PWP'S RQMTS.
(3) 2"C-3#4/0+1#4GND, FROM MCC TO WELL PUMP MOTOR.
(4) 3"C-6#250MCM+1#3GND, FROM MCC TO BOOSTER NO.1 PUMP MOTOR.
(5) 3"C-6#250MCM+1#3GND, FROM MCC TO BOOSTER NO.2 PUMP MOTOR.
(6) 3"C-6#250MCM+1#3GND, FROM MCC TO BOOSTER NO.3 PUMP MOTOR.
(7) 3/4"C-12#14+1#14GND. FROM "PS102/HPS102", "T-STAT", "SOLENOID", "SPC HTR, AT FIELD TO WELL PMP STARTER, MCC SECTION 2(M2). (CONTROL)
(8) 1"C-36#14+1#14GND. FROM "PS/HPS", "T-STAT", "SOLENOID", "SPC HTR, AT BOOSTERS THRU MCC SECTION 5(M5), TO M2, M3, M4. (CONTROL)
(9) 1"C-26#14+1#14GND. FROM "PS/HPS", "T-STAT", "SOLENOID", "SPC HTR, AT BOOSTERS BP-1 AND BP-2, THRU MCC SECTION 5(M5), TO M3, M4. (CONTROL)
(10) 3/4"C-16#14+1#14GND. FROM "PS/HPS", "T-STAT", "SOLENOID", "SPC HTR, AT BOOSTERS BP-1, THRU MCC SECTION 5(M5), TO M2. (CONTROL)
(11) 3/4"C-6#14+1#14GND. FROM "LSH" "LSL" TO M1. (CONTROL)
(12) 3/4"C-3#12 (PWR), 10#14(CONTROL),+1#12GND. FROM MCC TO RTU. (POWER)
(13) 1"C-30#14+1#14GND. FROM MCC TO RTU. (D/I/O)
(14) 1"C-4PR#18 IND TWST, SHLD CABLES, 6#14 (ZSO, ZSC), FROM FIELD TO RTU.
(15) 3/4"C-4PR#18 IND TWST, SHLD CABLES, FIELD CONDUIT.
(16) 1"C-4PR#18 IND TWST, SHLD CABLES, "LIT100&101", 4#14(FS-100), FROM FIELD JB TO RTU.
(17) 3/4"C-XMTR CABLE, FROM "LE101" TO RTU. PROVIDE THE XDCR CABLE PER THE EQUIPMENT MFR'S INSTRUCTIONS. (SIGNAL)
(18) 1"C-XMTR CABLE, FROM "LIT102" TO RTU. PROVIDE THE XMTR CABLE PER THE EQUIPMENT MFR'S INSTRUCTIONS. (SIGNAL)
(19) 1 1/2"C-8PR#18 IND TWST, SHLD CABLES, FROM VFD TO RTU. (A/I/O OF VFD)
(20) 1"C-2PR#18 IND TWST, SHLD CABLES, AND SIG CABLE, FROM LIT-100 THRU JB TO RTU.
(21) 3/4"C-6#12 (PWR), +1#12GND. FROM MCC(PNL "P") TO A/C UNITS. (POWER)
(22) 3/4"C-6#14+1#14GND. FROM MCC TO VFDS. (PHASE FAIL RELAY CONTACTS)
(23) (NOT USED)
(24) 2"C-150#14+1#14GND. FROM VFD TO RTU. (D/I/O)
(25) 4(3"C-3#500MCM(THWN-2)+1#4/0GND), FROM SWBD TO GEN CONNECTOR.

CONSTRUCTION NOTES

(1) REMOVE UNUSED ELECTRICAL EQUIPMENT AND COMPONENTS IN THE ROOM COMPLETELY. ALL THE REMAINING EQUIPMENT OR COMPONENTS ARE NOT NECESSARILY SHOWN.
(2) REMOVE EXIST MCC AND RELATED CONDUITS AND WIRING COMPLETELY. MODIFY/EXTEND CONDUITS AND WIRING TO NEW MCC FOR THE REMAINING EQUIPMENT OR COMPONENTS.
(3) NEW LOCATION OF RELOCATED EXIST RTU(PLC), LIQ-5 OF TESCO. MODIFY THE RTU BY FURNISHING NECESSARY MODULES PER THE DWG E-405. CONSULT THE MFR AS NECESSARY. MODIFY THE PNL TO PROVIDE THE MULTIRANGER PLUS BY MILLTRONICS PER THE MFR'S INSTRUCTIONS.
(4) WELL LEVEL (DEPTH) TRANSDUCER LOCATED AT BUTTOM OF THE WELL. SUBMERCIBLE PRESSURE TRANSDUCER BY KPSI W/ CABLE AND CABLE HANGER. (BY OTHERS)
(5) LIGHT FIXTURE, PENDANT, GENERAL PURPOSE, INDUSTRIAL, (2)-32W TUBES, 10% HARMONIC ELECTRONIC BALLAST, EJ232-120GEB10 BY LITHONIA. TYP 16 EA.
(6) REMOVE UNUSED ELECTRICAL EQUIPMENT AND COMPONENTS IN THIS AREA COMPLETELY.
(7) PROVIDE NEW CONDUITS, WIRES, AND THERMOSTAT CONTROLS FOR EXIST FANS.
(8) PROVIDE ULTRA SONIC XDCR (DEPTH SENSOR) BY MILLTRONICS XDCR, PER THE MFR'S INSTRUCTIONS.
(9) FLOW SWITCH. SEE THIS SHT FOR DETAIL.
(10) FLOAT SWITCH. SEE THIS SHT FOR DETAIL.
(11) 70W HIGH PRESSURE SODIUM LAMP W/ INTERNAL REFLECTOR, PRISMATIC POLYCARBONATED REFRACTOR, BUILT-IN 0-20FC ADJ PHOTOCELL CONTROL, UL APPROVED FOR WET LOCATION. HUBBELL #NRG-307 OR APPROVED EQUAL. TYP 2 EA.
(12) PROVIDE PWR RECEPTACLE OUTLET, 125V, 20AMP, NEMA 5-20R IN CAST ALUM BOX SST COVERPLATE. TYP OF 9 EA.
(13) PROVIDE PNL TOP-MTD A/C UNIT. MOUNT THE UNIT TO DRAIN CONDENSED WATER OUTSIDE THE PNL. TYP. 3 EA.
(14) PROVIDE DISCONNECT SWITCH, 400AS, 400AF, HEAVY-DUTY, NEMA 1 TYPE, MTD ON WALL. TYP. 3 EA.

SPECIAL NOTE

ALL THE ELECTRICAL DRAWINGS ARE SCHEMATIC. CONDUITS OR WIRINGS ARE NOT SHOWN FOR SOME EQUIPMENT/DEVICES. IT SHALL BE CONTRACTOR'S RESPONSIBILITY TO COMPLETE THE PROJECT CONSTRUCTION PER DRAWINGS AND SPEC AT HIS DISCRETION AT NO ADDITIONAL COST TO THE CITY. FOR ANY DESCREPACIES, CONTRACTOR SHALL SUBMIT REQUESTS FOR CLARIFICATION DURING BIDDING PHASE.

E-402

REVISION		
NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER — CHAE YOUNG LEE — No E 12266 — EXP 12-31-2010 — ELECTRICAL — STATE OF CALIFORNIA

APPROVED BY:

CHAE YOUNG LEE 12266 EE 3/2/09
DATE

APPROVED: _____ DATE

APPROVED: _____ DATE

PLANS PREPARED BY:

CIVILTEC engineering inc.

General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying

118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

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The Business of Innovation

CITY OF PASADENA * INCORPORATED JUNE 1886 *

D.S.-209 & 210A

DATE	SCALE
NOVEMBER 2008	AS SHOWN

DRAWN BY CALPOWER
DESIGNED BY CALPOWER
CHECKED BY CIVILTEC
SUBMITTED BY CIVILTEC

FIELD BOOKS | CALC BOOKS | APPROVED | APPROVED

PASADENA WATER & POWER
CITY OF PASADENA

VENTURA WELL
VENTURA WELL BUILDING PLAN
ELECTRICAL

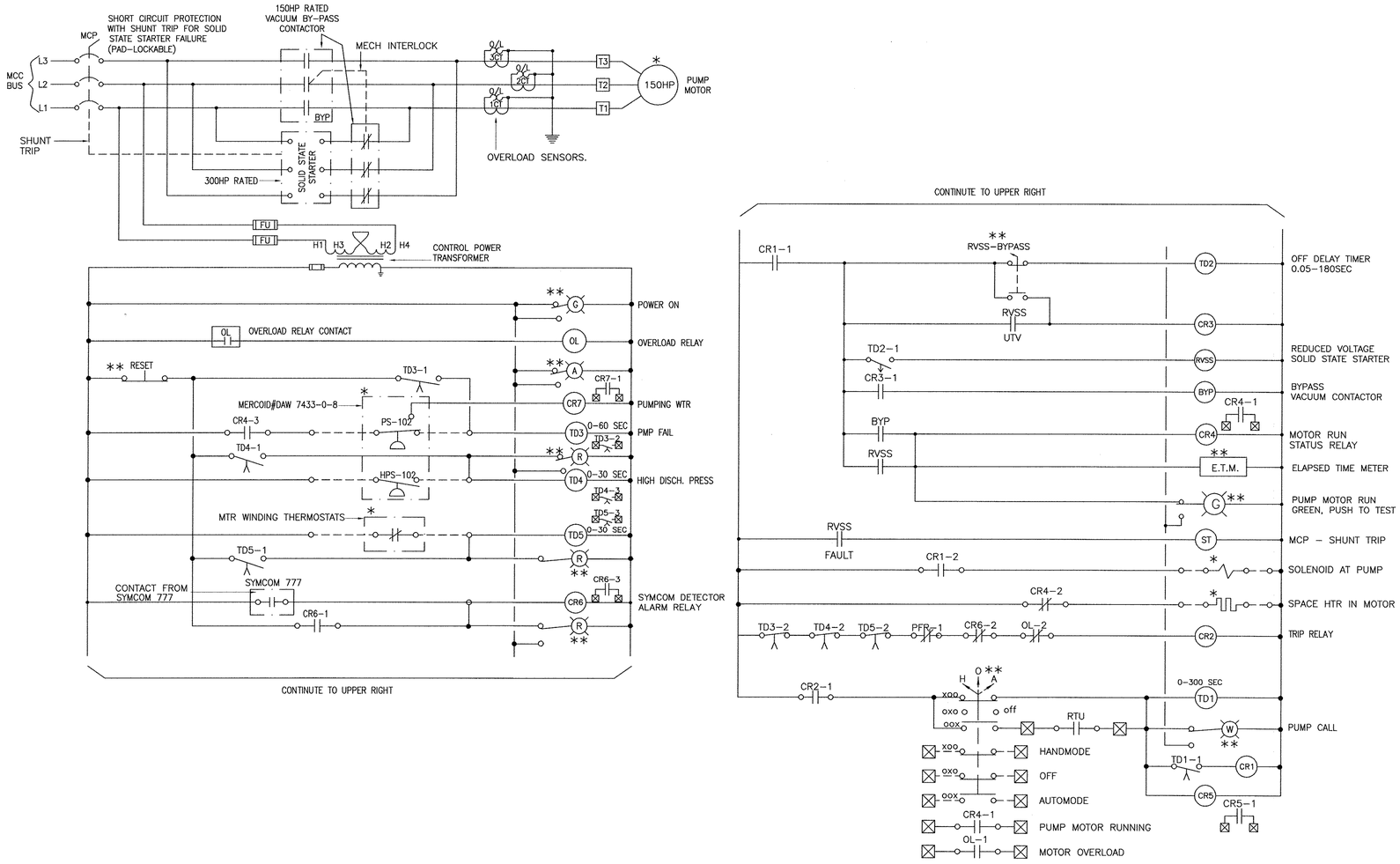
SHEET NO 75 OF 79 SHEETS

WORK ORDER 02557

FILE NUMBER E-1670

REVISION

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VENTURA WELL PUMP MOTOR

* : DEVICE AT FIELD AND FIELD WIRING (BY THE EQUIPMENT INSTALLATION CONTRACTOR)

**: DEVICE AT FRONT SURFACE OF MCC.

☒ : TERMINAL IN THE TELEMETRY SECTION FOR RTU INTERFACE.
PROVIDE THE TERMINAL NUMBERS IN THE SHOP DWG
FOR AN APPROVAL.
CONTRACTOR SHALL CONSULT THE CITY FOR ADDITIONAL I/O OTHER THAN THE SHOWN ON THIS SCHEMATIC. PROVIDE SPARE TERMINALS (50EA) IN ADDITION TO THE TERMINALS SHOWN. TERMINALS SHALL BE ARRANGED ON ONE SIDE OF THE BACK PANEL IN THE TELEMETRY SECTION NOT TO INTERFERE WITH THE RTU EQUIPMENT INSTALLATION.

SPECIAL NOTES

THIS DIAGRAM IS PREPARED FOR THE CONTROL REFERENCE ONLY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PREPARATION OF THE FINAL DIAGRAM AND SUBMITTING THE DIAGRAM AS A PART OF THE SHOP DRAWING SUBMITTAL BASED ON THE CITY AND THE PUMP SYSTEM MFR'S RQMTS AND THE DEVICES MFR'S INSTRUCTIONS, PRIOR TO ANY ACTIVITIES.

E-403

REVISION		
NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER — CHAE YOUNG LEE — No E 12266 — EXP 12-31-2010 — ELECTRICAL — STATE OF CALIFORNIA

APPROVED BY:
CHAE YOUNG LEE 12266 EE 3/2/09 DATE
APPROVED: DATE
APPROVED: DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

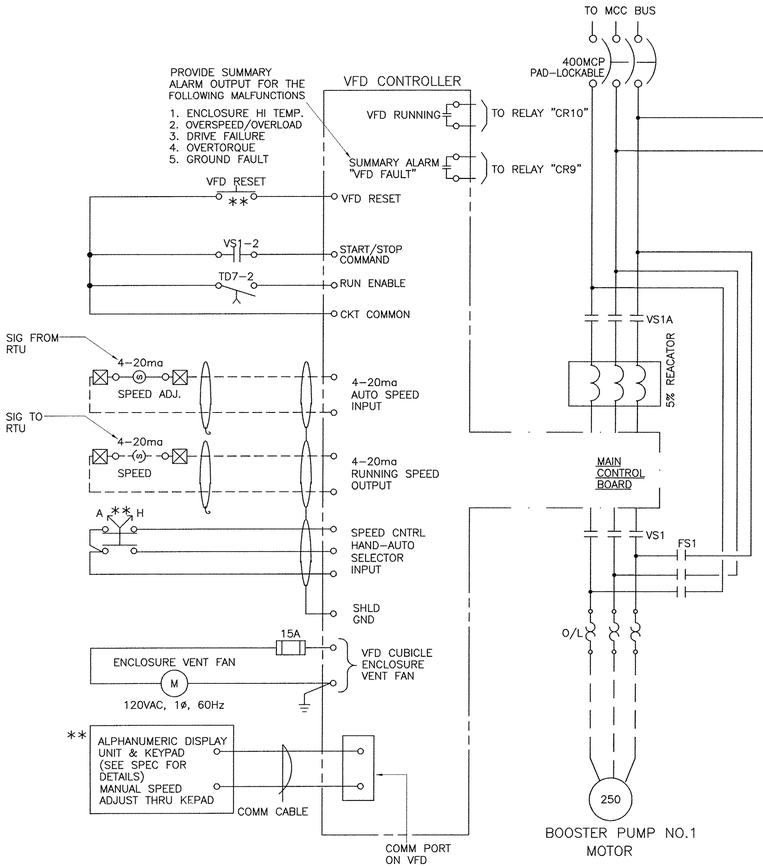
Battelle
The Business of Innovation

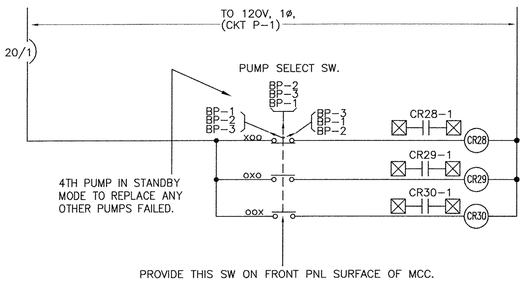
CITY OF PASADENA — INCORPORATED JUNE 1886

D.S.-209 & 210A

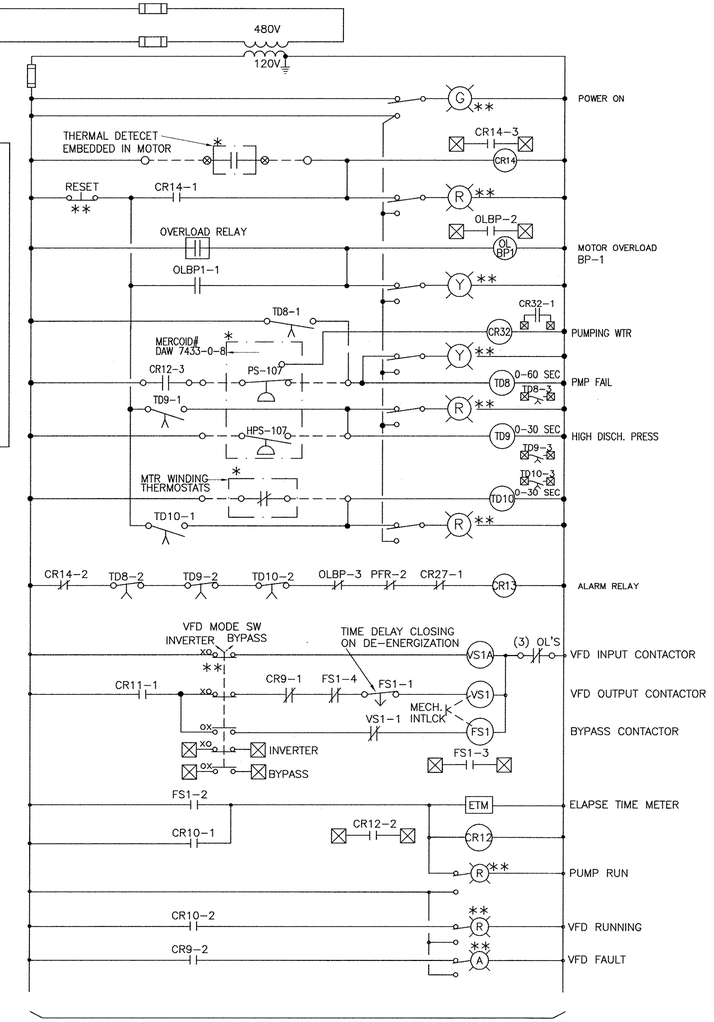
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FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED / REVISION

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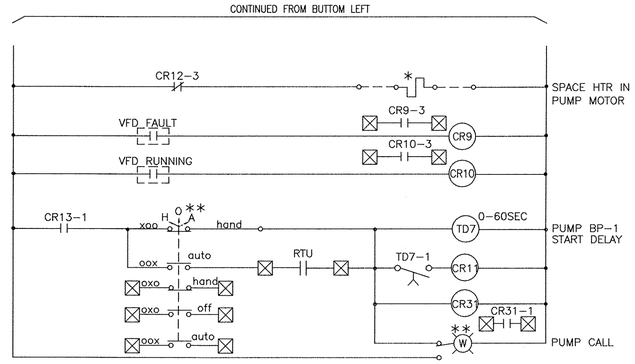
MISCELLANEOUS DIAGRAM

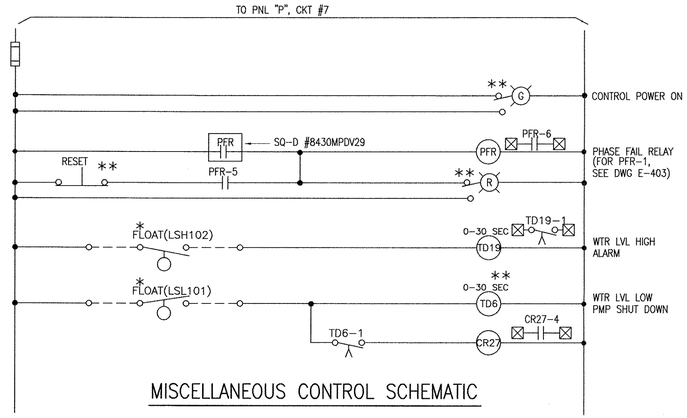


CONTINUE TO TOP RIGHT

VENTURA BOOSTER PUMP MOTOR NO.1

TYPICAL FOR BOOSTER PUMP MOTOR NO.2, NO.3, EXCEPT DEVICE NUMBERS VARY ACCORDINGLY.





MISCELLANEOUS CONTROL SCHEMATIC

SPECIAL NOTES

THIS DIAGRAM IS PREPARED FOR THE CONTROL REFERENCE ONLY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PREPARATION OF THE FINAL DIAGRAM AND SUBMITTING THE DIAGRAM AS A PART OF THE SHOP DRAWING SUBMITTAL BASED ON THE CITY AND THE PUMP SYSTEM MFR'S RQMTS AND THE DEVICES MFR'S INSTRUCTIONS, PRIOR TO ANY ACTIVITIES.

- * : DEVICE AT FIELD AND FIELD WIRING (BY THE EQUIPMENT INSTALLATION CONTRACTOR)
- **: DEVICE AT FRONT SURFACE OF MCC.
- ☒ : TERMINAL IN THE TELEMETRY SECTION FOR RTU INTERFACE. PROVIDE THE TERMINAL NUMBERS IN THE SHOP DWG FOR AN APPROVAL. CONTRACTOR SHALL CONSULT THE CITY FOR ADDITIONAL I/O OTHER THAN THE SHOWN ON THIS SCHEMATIC. PROVIDE SPARE TERMINALS (50EA) IN ADDITION TO THE TERMINALS SHOWN. TERMINALS SHALL BE ARRANGED ON ONE SIDE OF THE BACK PANEL IN THE TELEMETRY SECTION NOT TO INTERFERE WITH THE RTU EQUIPMENT INSTALLATION.

E-404

REVISION		
NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER — CHAE YOUNG LEE — No E 12266 — EXP. 6-30-2010 — ELECTRICAL — STATE OF CALIFORNIA

APPROVED BY:
CHAE YOUNG LEE 12266 EE — DATE 3/10/09
APPROVED: — DATE
APPROVED: — DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

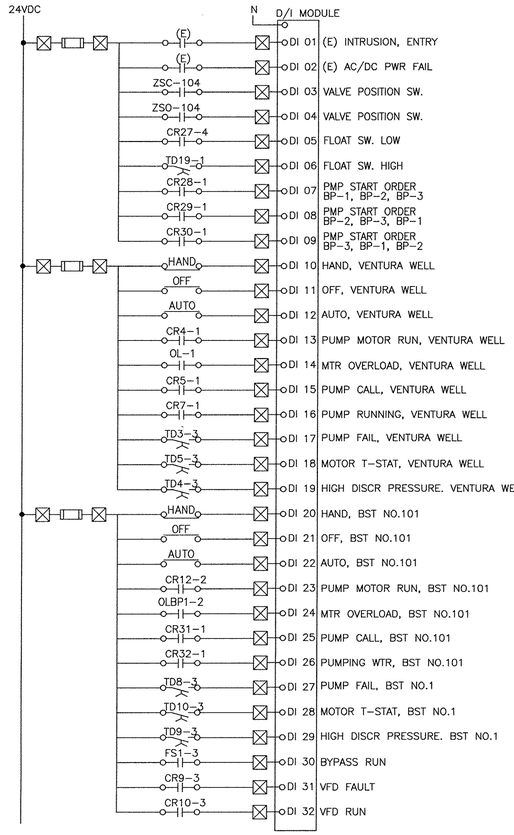
Battelle — The Business of Innovation

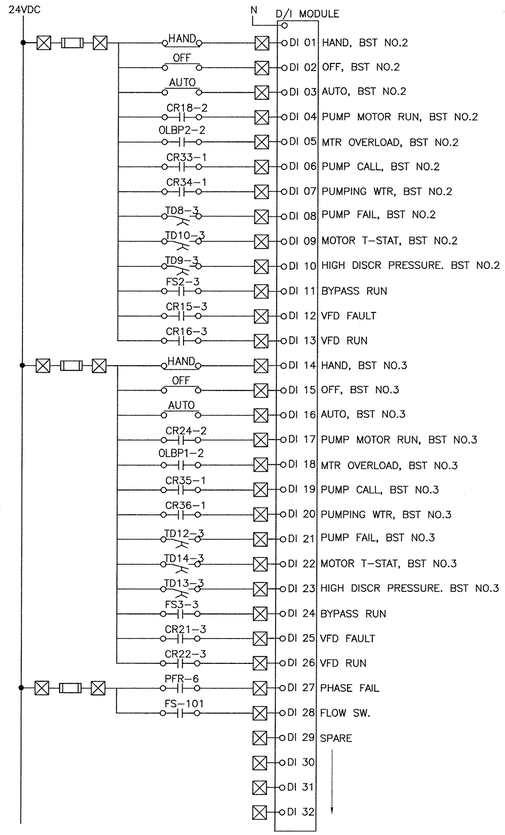
CITY OF PASADENA — INCORPORATED JUNE 1886

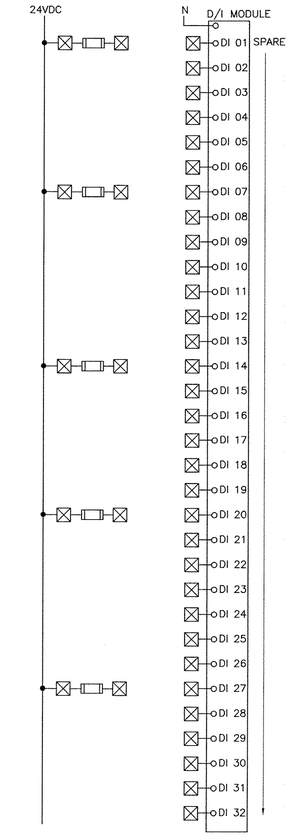
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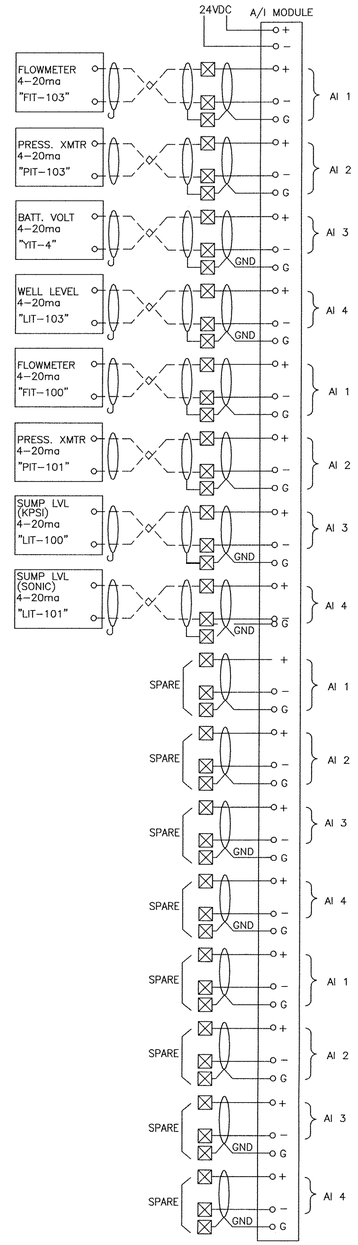
DATE: NOVEMBER 2008	SCALE: AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 77 OF 79 SHEETS
DRAWN BY: CALPOWER DESIGNED BY: CALPOWER CHECKED BY: CIVILTEC SUBMITTED BY: CIVILTEC		VENTURA BOOSTER PUMP CONTROL SCHEMATICS	WORK ORDER 02557 / FILE NUMBER E-1670
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED / REVISION

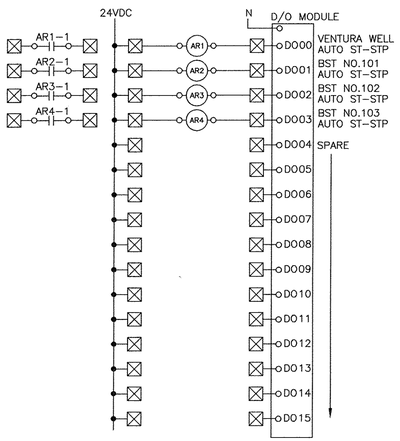
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VENTURA WELL

NOTES FOR RTU(PLC) SYSTEM

1. MODIFY EXIST RTU BY PROVIDING NECESSARY MODULES AND ACCESSORIES TO ACCOMMODATE I/O'S AS SHOWN.
2. RTU AND SCADA SYSTEM PROGRAMMING BY THE CITY.

SYMBOLS

(SEE DWG E-001 FOR OTHER SYMBOLS)

- ☒ TERMINAL FOR RTU(PLC) CONNECTION
- – – FIELD WIRING (BY CONTRACTOR OR RESPONSIBLE VENDOR)
- ▭ FUSE AT TERMINAL BLOCK

E-405

REVISION		
NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER — CHAE YOUNG LEE — No E 12266 — EXP. 06/30/2010 — ELECTRICAL — STATE OF CALIFORNIA

APPROVED BY:
CHAE YOUNG LEE 12266 EE — DATE 3/2/09
APPROVED: — DATE
APPROVED: — DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
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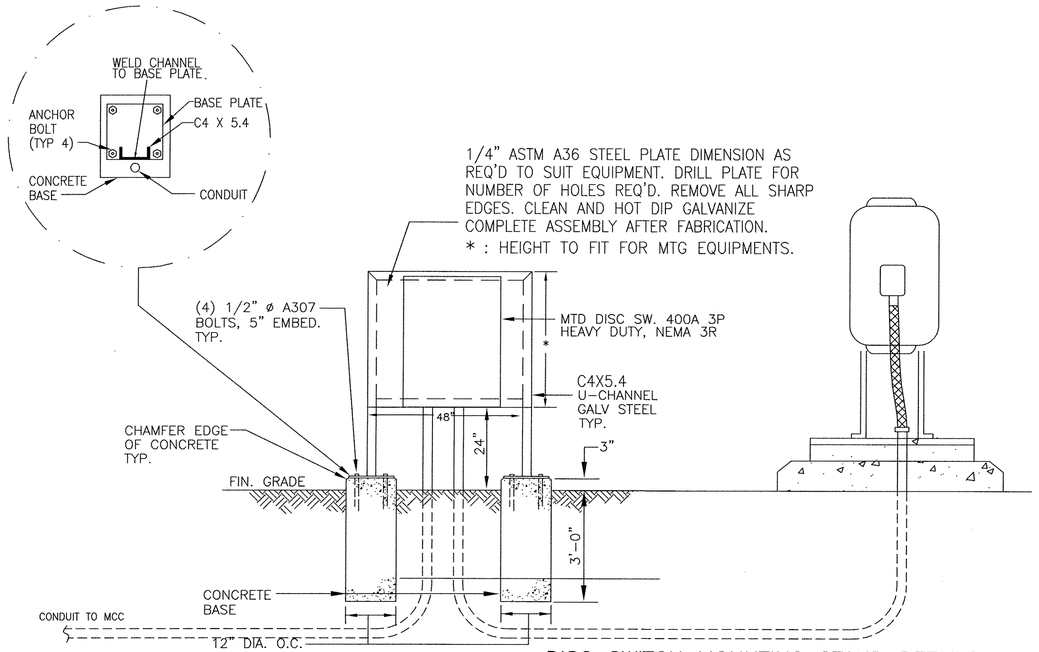
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CITY OF PASADENA INCORPORATED JUNE 1886

D.S.-209 & 210A

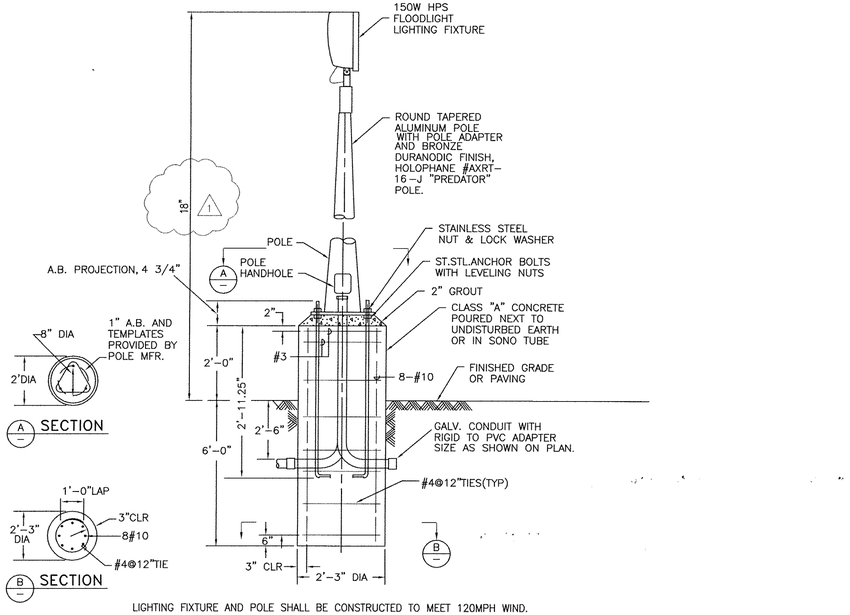
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FIELD BOOKS	CALC BOOKS	APPROVED / APPROVED	REVISION

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DISC SWITCH MOUNTING STAND DETAILS

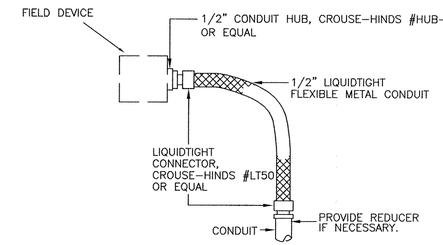
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LIGHTING FIXTURE AND POLE SHALL BE CONSTRUCTED TO MEET 120MPH WIND.

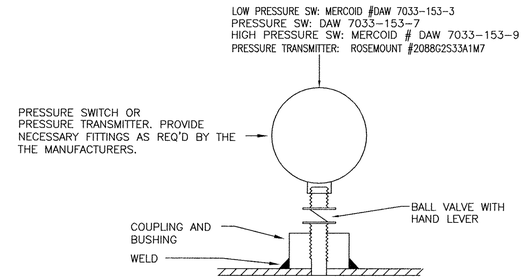
FLOODLIGHT LIGHTING FIXTURE(S) AND POLE

NOT TO SCALE



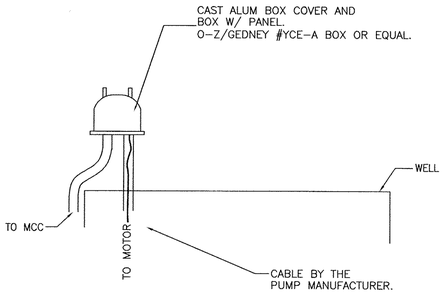
FIELD DEVICE CONNECTION DETAILS

NOT TO SCALE



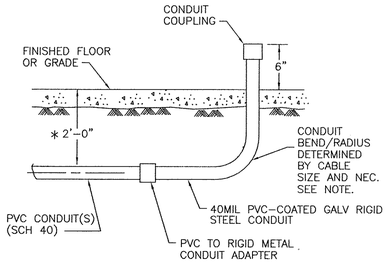
PRESSURE SWITCH OR TRANSMITTER MOUNTING DETAIL

NOT TO SCALE



WELLHEAD BOX DETAIL

NOT TO SCALE



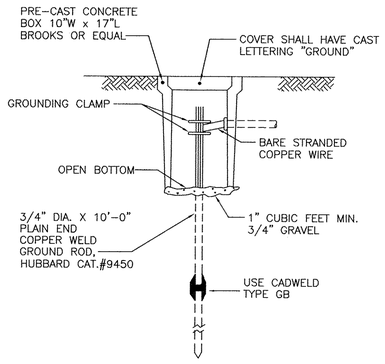
* : PROVIDE 36" CONVERING SERVICE CONDUIT FROM SWBD TO (E) UTILITY XFMR.

NOTES

PROVIDE SERVICE CONDUIT, FROM SWBD TO (E) UTILITY XFMR, PER THE CITY OF INDUSTRY'S RQMTS.

UNDERGROUND CONDUIT AND CONDUIT STUB-UP

NOT TO SCALE



GROUND DETAIL

NOT TO SCALE

E-501

REVISION		
NO.	DESCRIPTION	DATE
1	BUILDING DEPARTMENT PLAN CHECK COMMENTS	01/05/09

REGISTERED PROFESSIONAL ENGINEER CHAE YOUNG LEE No E 12266 EXP. 09/30/2010 ELECTRICAL STATE OF CALIFORNIA

APPROVED BY:
CHAE YOUNG LEE 12266 EE — 3/2/09 DATE
APPROVED: — DATE
APPROVED: — DATE

PLANS PREPARED BY:
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
118 West Lime Avenue
Monrovia, Ca. 91016
Phone: (626) 357-0588
Fax: (626) 303-7957

Battelle
The Business of Innovation

CITY OF PASADENA INCORPORATED JUNE 1886

D.S.-209 & 210A

DATE	SCALE		
NOVEMBER 2008	AS SHOWN	PASADENA WATER & POWER CITY OF PASADENA	SHEET NO 79 OF 79 SHEETS
DRAWN BY CALPOWER		WINDSOR WELL MISCELLANEOUS DETAILS	WORK ORDER 02557 / FILE NUMBER E-1670
DESIGNED BY CALPOWER			
CHECKED BY CIVILTEC			
SUBMITTED BY CIVILTEC			
FIELD BOOKS	CALC BOOKS	APPROVED	APPROVED / REVISION

X:\2007\27140-JP\ MONWHEL TREATMENT PLANT\DWG\SUBMITTALS\FINAL SUBMITTALS\E-501.DWG (03-02-09 9:10:12AM)