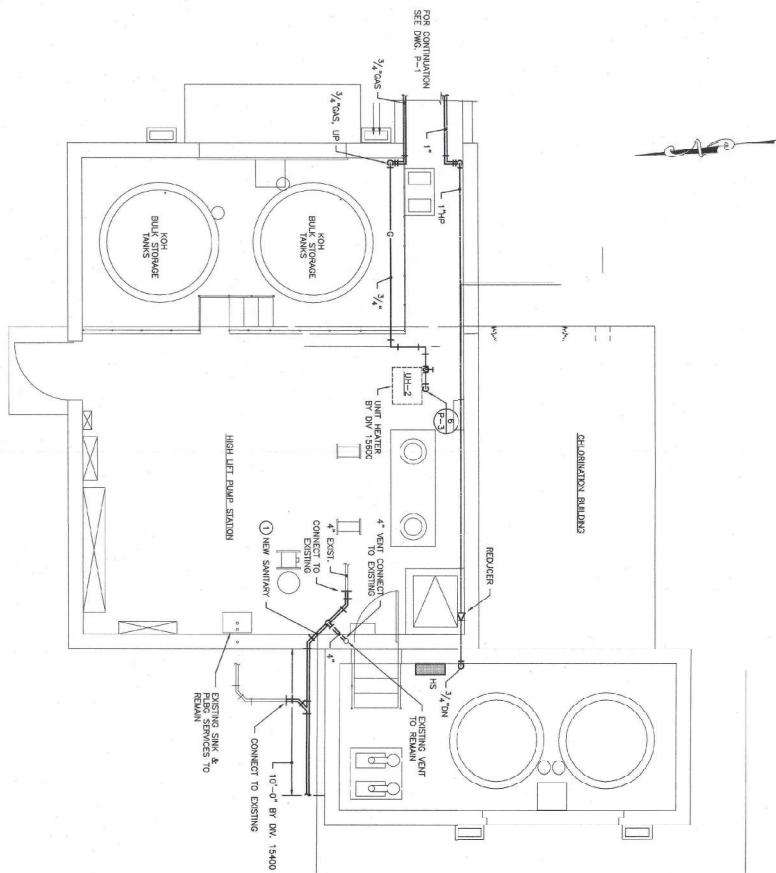


2138P2.002 1-1-02 30241 pt EST



EXISTING HIGH LIFT PUMP STATION & CHLORINATION ADDITION PLAN

SCALE 1/4" = 1'-0"

H2O Engineering
Consulting Associates, Inc.
Bedford, MA 01730

SFD ASSOCIATES CORP.
Consulting Engineers
1000 N. Main St.
Bedford, MA 01730
Tel: (617) 382-0382

NO.	DESCRIPTION	DATE	BY



DATE	1/4" = 1'-0"
DRAWN BY	JMA
DESIGNED BY	FTC
CHECKED BY	FTC

SUDBURY WATER DISTRICT
TOWN OF SUDBURY
199 RAYMOND ROAD
SUDBURY, MASSACHUSETTS

PROJECT	PROJECT NO.	DATE
WATER TREATMENT PLANT FOR WELLS NO. 2A, 6, 7 & 9	2000-25	1/09/02
TITLE	DRAWING NO.	SHEET
EXISTING HIGH LIFT PUMP STATION & CHLORINATION ADDITION PLAN	P-2	48 OF 60 SHEETS

BID SET

RECEIVED
FEB 19 2002
WMA 1000

NOT TO SCALE
SEE SHEET P-1
FOR DETAILS
OF ALL
EQUIPMENT
AND
MATERIALS
TO BE
USED
IN
THIS
PROJECT

ELECTRICAL SYMBOLS

- ⑤ DIPSW. W/OT RECEPTACLE
 - ⑥ SPRING EYE HOOKS, W/INTERLOCKS
 - ⑦ TIE-ROD, 1/2" DIA. W/OT CUFFLET
 - ⑧ TIE-ROD-CH-2000 W/OT CUFFLET
 - ⑨ TIE-ROD-CH-2000 W/OT CUFFLET
 - ⑩ TIE-ROD-CH-2000 W/OT CUFFLET
 - ⑪ TIE-ROD-CH-2000 W/OT CUFFLET
 - ⑫ TIE-ROD-CH-2000 W/OT CUFFLET
 - ⑬ TIE-ROD-CH-2000 W/OT CUFFLET
 - ⑭ TIE-ROD-CH-2000 W/OT CUFFLET
 - ⑮ TIE-ROD-CH-2000 W/OT CUFFLET
 - ⑯ TIE-ROD-CH-2000 W/OT CUFFLET
 - ⑰ TIE-ROD-CH-2000 W/OT CUFFLET
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 - ⑲ TIE-ROD-CH-2000 W/OT CUFFLET
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 - ㊾ TIE-ROD-CH-2000 W/OT CUFFLET
 - ㊿ TIE-ROD-CH-2000 W/OT CUFFLET

ELECTRICAL GENERAL NOTES

- [illegible]

ELECTRICAL ABBREVIATIONS LIST

- [illegible]

GENERAL ELECTRICAL DEMOLITION NOTES

- [illegible]

RECEIVED
FEB 19 2001
NMA INT

BID SET

H₂O Engineering
Consulting Associates, Inc.
SED ASSOCIATES CORP.
Consulting Engineers

**2 Alfred Circle
Bedford, MA 01730**

SED ASSOCIATES CORP.
Consulting Engineers
133 LINCOLN STREET
BOSTON, MA 02111
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FAX (617) 350-0332

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DESIGNED	DRAWN
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**INDUSTRIAL
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AND
ATTORNEYS**

T

NE

WATTE
MBOI

ABBREVIATIONS

2A, 6, 7

9
& NOT

[illegible]DATE _____
DRAWING NO. _____

	/08/02
E-1	

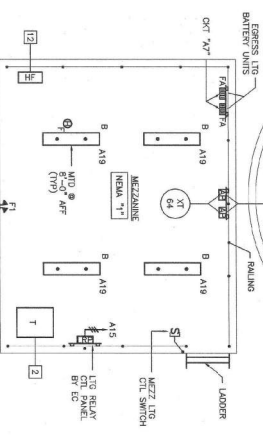


H2O Engineering
Consulting Associates, Inc.
2 Alfred Circle
Bedford, MA 01730

SFD ASSOCIATES CORP.
120 LINDA A STREET
BEDFORD, MA 01730
TEL: (617) 326-2335

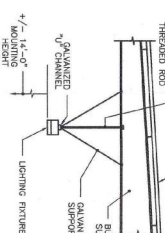
**MEZZANINE (ABOVE CONTROL ROOM)
PARTIAL LIGHTING PLAN**

SCALE: 1/4" = 1'-0"



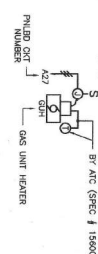
**PROCESS AREA LIGHTING FIXTURE
TYPICAL MOUNTING AND WIRING DETAIL**

NOT TO SCALE



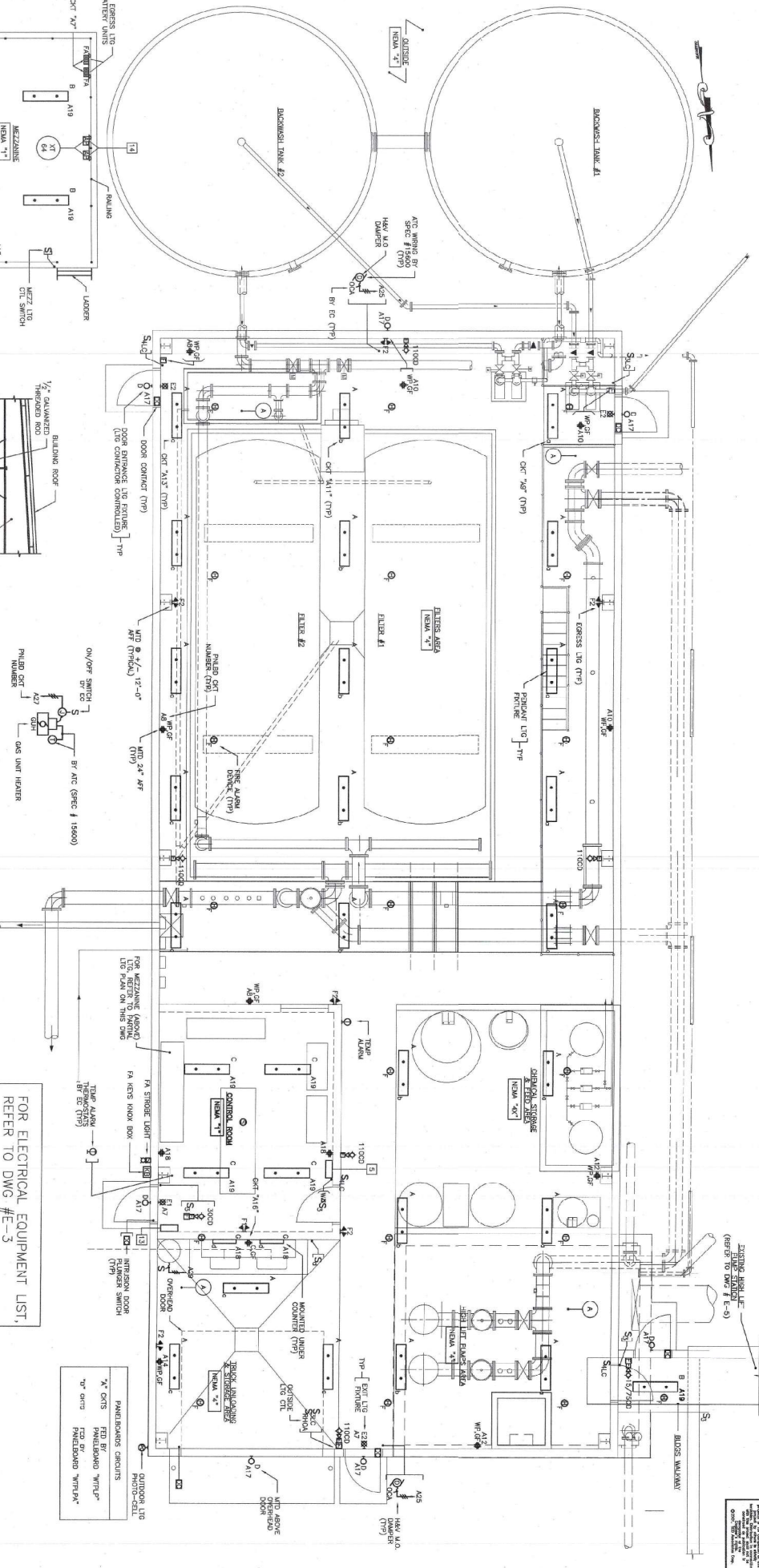
**PROPOSED GAS UNIT HEATER
WIRING DETAIL**

NOT TO SCALE



**PROPOSED
WATER TREATMENT BUILDING LIGHTING PLAN**

SCALE 1/4" = 1'-0"



**SUBBURY WATER DISTRICT
TOWN OF SUBBURY
199 RAYMOND ROAD
SUBBURY, MASSACHUSETTS**

BID SET

FOR ELECTRICAL EQUIPMENT LIST,
REFER TO DWG #E-3

FOR WTP LIGHTING PLAN NOTES,
REFER TO DWG #E-7

**WATER TREATMENT PLANT FOR
WELLS NO. 2A, 6, 7 & 9**

**WATER TREATMENT BUILDING
LIGHTING PLAN**

PROJECT NO. 2000-25
DATE 1/28/02
DRAWING NO. **E-4**
SHEET 50 OF 60 SHEETS

RECEIVED FEB 13 2002
FOR ELECTRICAL EQUIPMENT LIST, REFER TO DWG #E-3 AND E-4

- 1) FOR SYMBOLS, ABBREVIATIONS & TYPICAL NOTES, REFER TO DWG #E-1.
- 2) FOR ELECTRICAL, SITE PLAN, REFER TO DWG #E-2.
- 3) FOR BUILDING POWER/LIGHTING PLANS AND WIRING DETAILS, REFER TO DWG #E-3 THRU E-7.
- 4) FOR MECHANICAL, PLUMBING & HVAC DETAILS, REFER TO DWG #E-8 THRU E-10.
- 5) FOR CIVIL, REFER TO DWG #E-11 THRU E-13.
- 6) FOR ELECTRICAL, REFER TO DWG #E-14 THRU E-16.
- 7) FOR ELECTRICAL, REFER TO DWG #E-17 THRU E-19.
- 8) FOR ELECTRICAL, REFER TO DWG #E-20 THRU E-22.
- 9) FOR ELECTRICAL, REFER TO DWG #E-23 THRU E-25.
- 10) FOR ELECTRICAL, REFER TO DWG #E-26 THRU E-28.
- 11) FOR ELECTRICAL, REFER TO DWG #E-29 THRU E-31.
- 12) FOR ELECTRICAL, REFER TO DWG #E-32 THRU E-34.
- 13) FOR ELECTRICAL, REFER TO DWG #E-35 THRU E-37.
- 14) FOR ELECTRICAL, REFER TO DWG #E-38 THRU E-40.
- 15) FOR ELECTRICAL, REFER TO DWG #E-41 THRU E-43.
- 16) FOR ELECTRICAL, REFER TO DWG #E-44 THRU E-46.
- 17) FOR ELECTRICAL, REFER TO DWG #E-47 THRU E-49.
- 18) FOR ELECTRICAL, REFER TO DWG #E-50 THRU E-52.
- 19) FOR ELECTRICAL, REFER TO DWG #E-53 THRU E-55.
- 20) FOR ELECTRICAL, REFER TO DWG #E-56 THRU E-58.
- 21) FOR ELECTRICAL, REFER TO DWG #E-59 THRU E-61.
- 22) FOR ELECTRICAL, REFER TO DWG #E-62 THRU E-64.
- 23) FOR ELECTRICAL, REFER TO DWG #E-65 THRU E-67.
- 24) FOR ELECTRICAL, REFER TO DWG #E-68 THRU E-70.
- 25) FOR ELECTRICAL, REFER TO DWG #E-71 THRU E-73.
- 26) FOR ELECTRICAL, REFER TO DWG #E-74 THRU E-76.
- 27) FOR ELECTRICAL, REFER TO DWG #E-77 THRU E-79.
- 28) FOR ELECTRICAL, REFER TO DWG #E-80 THRU E-82.
- 29) FOR ELECTRICAL, REFER TO DWG #E-83 THRU E-85.
- 30) FOR ELECTRICAL, REFER TO DWG #E-86 THRU E-88.
- 31) FOR ELECTRICAL, REFER TO DWG #E-89 THRU E-91.
- 32) FOR ELECTRICAL, REFER TO DWG #E-92 THRU E-94.
- 33) FOR ELECTRICAL, REFER TO DWG #E-95 THRU E-97.
- 34) FOR ELECTRICAL, REFER TO DWG #E-98 THRU E-100.

FOR ELECTRICAL EQUIPMENT LIST,
REFER TO DWG #E-3

FOR WTP LIGHTING PLAN NOTES,
REFER TO DWG #E-7

FOR MECHANICAL, PLUMBING & HVAC DETAILS,
REFER TO DWG #E-8 THRU E-10

FOR CIVIL, REFER TO DWG #E-11 THRU E-13

FOR ELECTRICAL, REFER TO DWG #E-14 THRU E-16

FOR ELECTRICAL, REFER TO DWG #E-17 THRU E-19

FOR ELECTRICAL, REFER TO DWG #E-20 THRU E-22

FOR ELECTRICAL, REFER TO DWG #E-23 THRU E-25

FOR ELECTRICAL, REFER TO DWG #E-26 THRU E-28

H2O Engineering
 CONSULTING ENGINEERS, INC.
 2 Alfred Circle
 Bedford, MA 01730

SEI ASSOCIATES CORP.
 CONSULTING ENGINEERS
 1000 Main Street
 Needham Heights, MA 01946
 TEL: (617) 552-2335
 FAX: (617) 552-2336

DATE: _____
 BY: _____
 CHECKED BY: _____
 SCALE: AS SHOWN

DESIGNED BY: CLB
 DRAWN BY: RIG
 CHECKED BY: WFE

PROJECT NO. 2000-25
 DATE 1/09/02
 SHEET NO. E-6
 SHEET 22 OF 26 SHEETS

WATER TREATMENT PLANT FOR
 WELLS NO. 2A, 6, 7 & 9

MISCELLANEOUS PARTIAL BUILDING
 POWER PLANS & DETAILS "T"

FOR ELECTRICAL EQUIPMENT LIST
 REFER TO DWG #E-3

RECEIVED
 FEB 13 2002
 WMA

FOR ELECTRICAL EQUIPMENT LIST
 REFER TO DWG #E-3

FOR ELECTRICAL EQUIPMENT LIST
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 REFER TO DWG #E-3

FOR ELECTRICAL EQUIPMENT LIST
 REFER TO DWG #E-3

FOR ELECTRICAL EQUIPMENT LIST
 REFER TO DWG #E-3

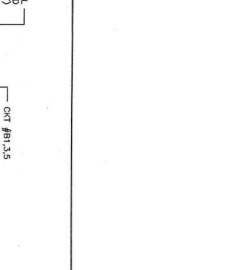
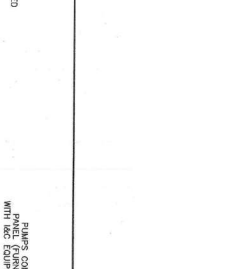
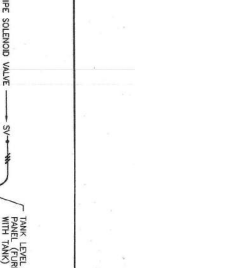
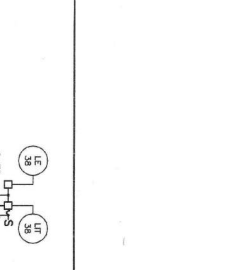
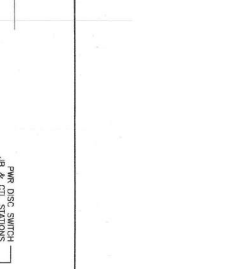
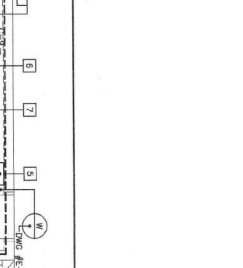
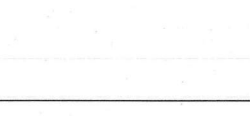
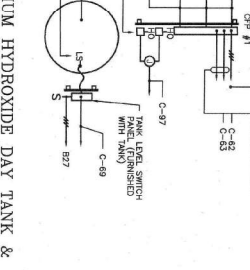
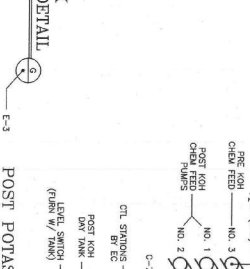
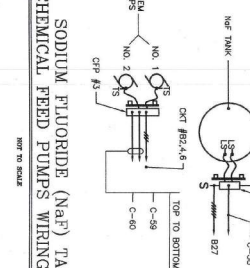
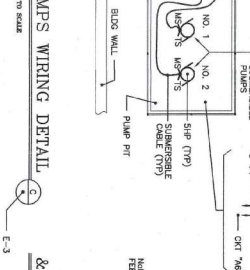
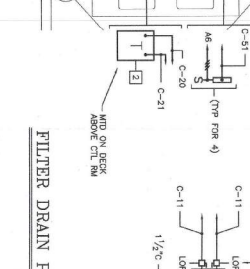
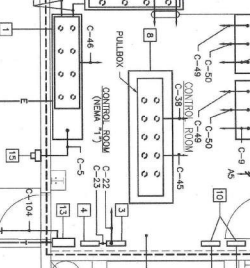
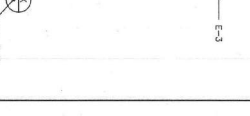
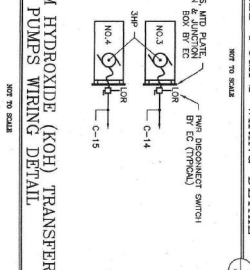
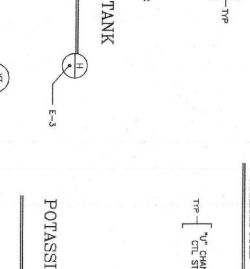
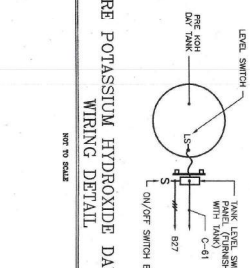
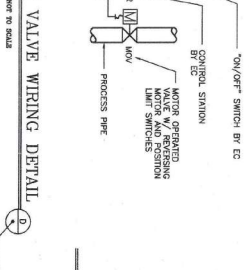
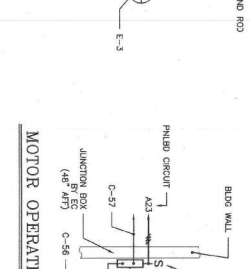
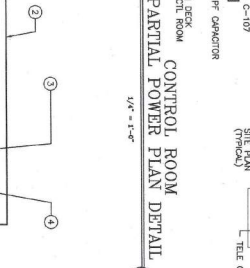
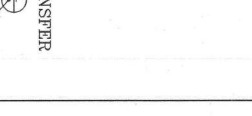
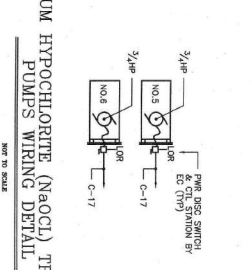
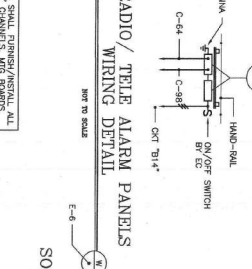
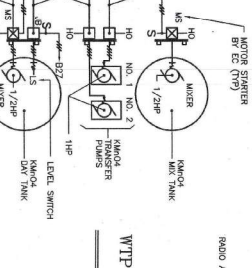
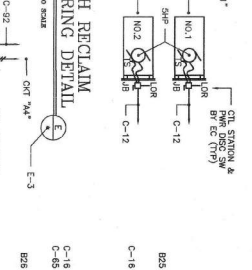
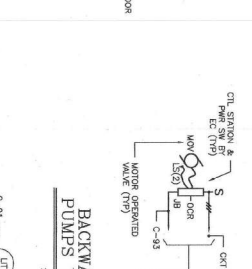
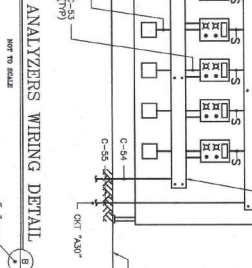
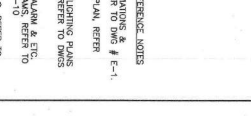
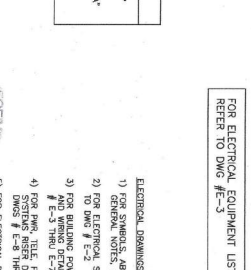
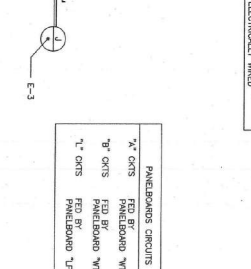
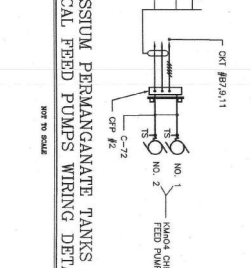
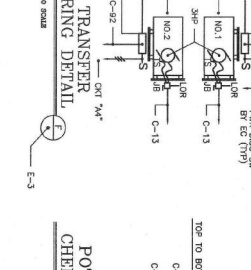
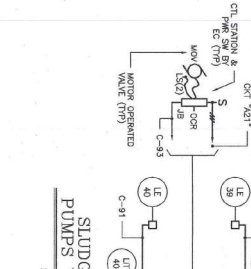
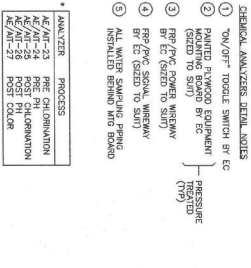
FOR ELECTRICAL EQUIPMENT LIST
 REFER TO DWG #E-3

FOR ELECTRICAL EQUIPMENT LIST
 REFER TO DWG #E-3

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 REFER TO DWG #E-3

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 REFER TO DWG #E-3

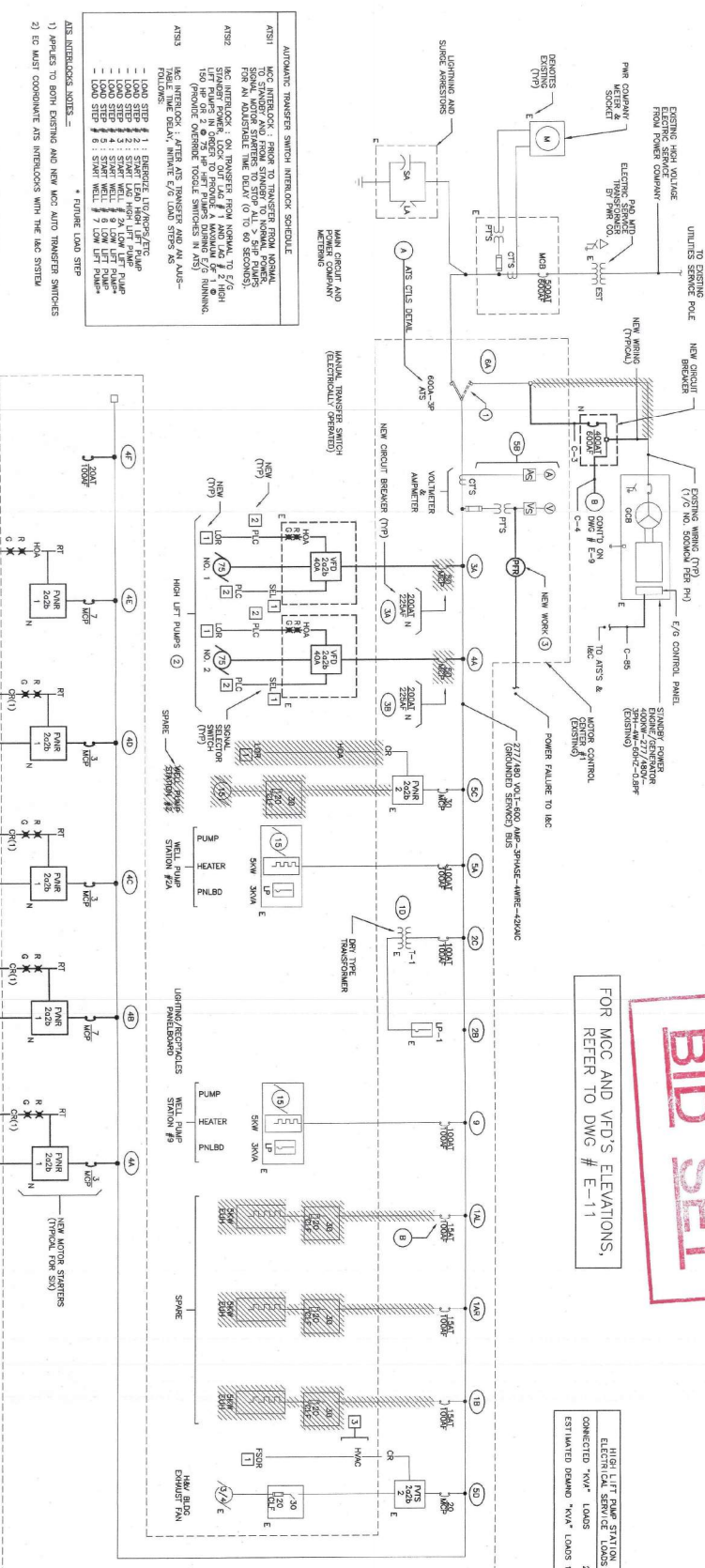
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 REFER TO DWG #E-3



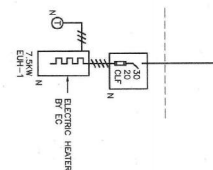
BID SET

FOR MCC AND VFD'S ELEVATIONS,
REFER TO DWG # E-11

HIGH LIFT PUMP STATION
ELECTRICAL SERVICE LOADS
CONNECTED "KVA" LOADS 207.8 KVA
ESTIMATED DEMAND "KVA" LOADS 102.4 KVA



CHLORINATION ADDITION
ELEC UNIT HEATER
DIAGRAM DETAIL



- CONTROL DEVICE AND LOCATION SCHEDULE**
1. LOCAL MAINTENANCE CONTROLS, LOCATED AT OR NEAR THE EQUIPMENT, LOCATED AT THE EQUIPMENT.
 2. REMOTE MAINTENANCE CONTROLS, LOCATED AT THE EQUIPMENT, LOCATED AT THE EQUIPMENT.
 3. REMOTE MAINTENANCE CONTROLS, LOCATED AT THE EQUIPMENT, LOCATED AT THE EQUIPMENT.
 4. REMOTE MAINTENANCE CONTROLS, LOCATED AT THE EQUIPMENT, LOCATED AT THE EQUIPMENT.

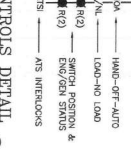
NO.	SIZE	WIRE
1	4/0	120/208
2	3	4

- ATS INTERLOCKS, NOTES:**
1. APPLIES TO BOTH EXISTING AND NEW MCC AND TRANSFER SWITCHES
 2. TO MAINTAIN EQUIPMENT INTERLOCKS WITH THE MCC SYSTEM

- LOCAL NOTES:**
1. TO SHUT DOWN ALL TO FULLY AUTOMATIC OPERATION INCLUDING ALL AUTOMATIC VFD'S
 2. TO SHUT DOWN ALL TO FULLY AUTOMATIC OPERATION INCLUDING ALL AUTOMATIC VFD'S
 3. TO SHUT DOWN ALL TO FULLY AUTOMATIC OPERATION INCLUDING ALL AUTOMATIC VFD'S

**EXISTING HIGH LIFT PUMP STATION
POWER DISTRIBUTION SYSTEM RISER DIAGRAM**

ATS CONTROLS DETAIL



**WATER TREATMENT PLANT FOR
WELLS NO. 2A, 6, 7 & 9**

H2O Engineering
Consulting Associates, Inc.
Bedford, MA 01730

SFD ASSOCIATES CORP.
Consulting Engineers
Bedford, MA 01730

SCALE
AS SHOWN

DESIGNED BY
CQB

CHECKED BY
RFG

DATE
1/10/02

PROJECT NO.
2000-25

SHEET 54 OF 60 SHEETS

H2O Engineering
Consulting Associates, Inc.
Bedford, MA 01730

SED ASSOCIATES, INC.
Consulting Engineers
1000 WASHINGTON ST.
BOSTON, MA 02111
TEL: (617) 552-2022
FAX: (617) 552-2023

SCALE	DATE	BY	DESCRIPTION
AS SHOWN			
DESIGNED BY			
CHECKED BY			
DATE			

SUBBURY WATER DISTRICT
TOWN OF SUBBURY
199 RAYMOND ROAD
SUBBURY, MASSACHUSETTS

WATER TREATMENT PLANT FOR
WELLS NO. 2A, 6, 7 & 9
RISER DIAGRAMS "T"

PROJECT NO. 2000-25
DATE 1/28/02
DRAWING NO. **E-9**
SHEET 55 OF 60 SHEETS

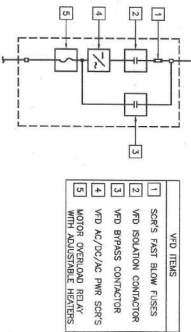
PROPOSED WATER TREATMENT PLANT
POWER DISTRIBUTION SYSTEM RISER DIAGRAM

NOT TO SCALE

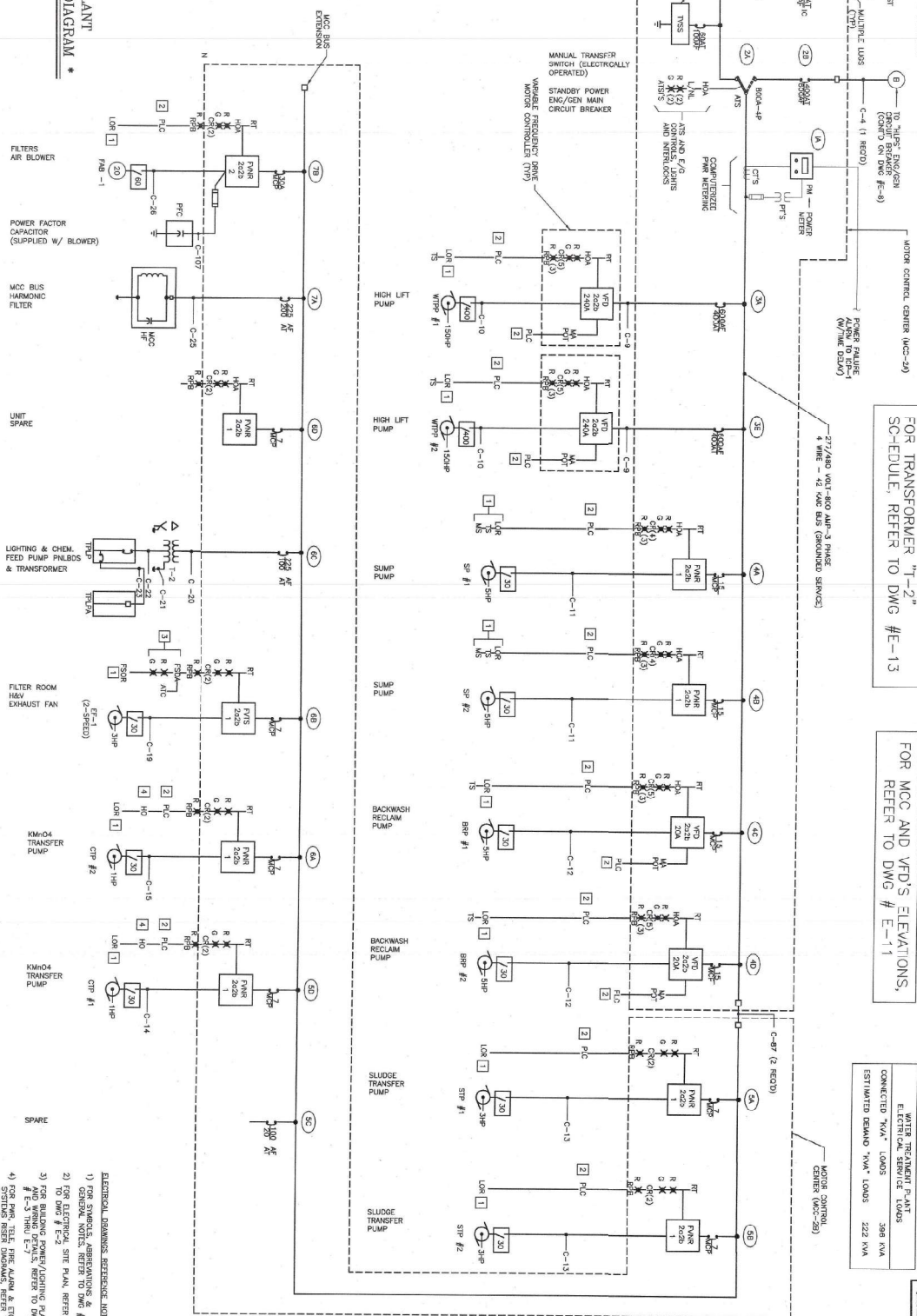
* FOR EXISTING HIGH LIFT PUMP STATION POWER
SINGLE LINE DIAGRAM, REFER TO DWG # E-8

TYPICAL PUMP VFD
PARTIAL RISER DIAGRAM

NOT TO SCALE



FOR AUTOMATIC TRANSFER
SWITCH INTERLOCKS, REFER
TO DWG # E-8



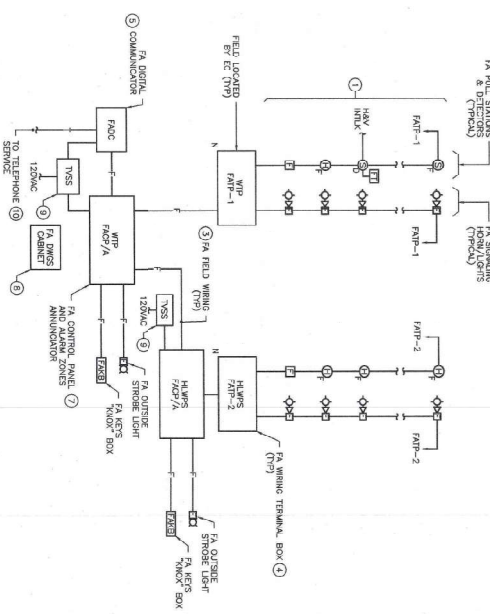
FOR TRANSFORMER "T"-2"
SC-EQUIPE, REFER TO DWG #E-13

FOR MCC AND VFD'S ELEVATIONS,
REFER TO DWG # E-11

WATER TREATMENT PLANT
ELECTRICAL SERVICE LOADS
360 KVA
ESTIMATED DEMAND "KVA" LOADS 222 KVA

REVISIONS
NO. DESCRIPTION
1. FOR ELECTRICAL SYMBOLS, REFER TO DWG # E-1.
2. FOR ELECTRICAL, SITE PLAN, REFER TO DWG # E-2.
3. FOR BUILDING POWER/LOADING PLANS AND WIRING DETAILS, REFER TO DWG # E-3 THRU E-7.
4. FOR PUMP, RISE, PUMP, AND ETC. DETAILS, REFER TO DWG # E-8 THRU E-10.
5. FOR ELECTRICAL DETAILS, REFER TO DWG # E-11 AND E-12.
6. DWG # E-13 AND E-14.

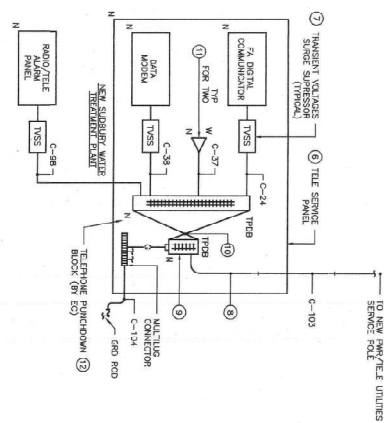
NOT TO SCALE



- 1) NEW LIFE AND CONTROL PANEL, AND NEW ANIMATIONS
- 2) NEW LIFE AND REFINING SOCIAL COMMUNICATION
- 3) NEW LIFE AND REFINING SOCIAL COMMUNICATION
- 4) NEW LIFE AND REFINING SOCIAL COMMUNICATION
- 5) NEW LIFE AND REFINING SOCIAL COMMUNICATION
- 6) NEW LIFE AND REFINING SOCIAL COMMUNICATION
- 7) NEW LIFE AND REFINING SOCIAL COMMUNICATION
- 8) NEW LIFE AND REFINING SOCIAL COMMUNICATION
- 9) NEW LIFE AND REFINING SOCIAL COMMUNICATION
- 10) NEW LIFE AND REFINING SOCIAL COMMUNICATION
- 11) NEW LIFE AND REFINING SOCIAL COMMUNICATION

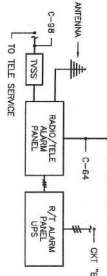
[illegible]

EXT 5	COMMUNICATOR - ALARMS	FA TELEPHONE MODEM
EXT 4	MODEN - I&C P.C.S COMMUNICATION	I&C TELEPHONE MODEM
EXT 3	COMMUNICATOR - FIRE ALARM (SECONDARY)	FA DIGITAL COMMUNICATOR
EXT 2	COMMUNICATOR - FIRE ALARM (PRIMARY)	FA DIGITAL COMMUNICATOR
EXT 1	COMMUNICATOR - FIRE ALARM (PRIMARY)	FA DIGITAL COMMUNICATOR



NOT TO SCALE

NOT TO SCALE



D'FORD, M.

HIGH LIFT PUMP STATION BUILDING FIRE ALARM SYSTEM ZONE SCHEDULE			
ZONE NO	LOCATION AND ALARM	INITIATING DEVICE	DESCRIPTION
1	PUMP ROOM	MANUAL PULL STATIONS & DETECTORS	
2	WATER TOWER ROOM	WATER TOWER DETECTORS	
3	FA CONTROL PANEL TROUBLE	FIRE ALARM CONTROL PANEL	
4	FA KNOX KEY BOX TAMPER	KNOX BOX TAMPER SWITCH	
5	SPACE		

WATER TREATMENT PLANT BUILDING FIRE ALARM SYSTEM ZONE SCHEDULE	
ZONE	LOCATION AND INFLUENCING DEVICE
1	PLANT ROOM
2	CONTROL ROOM
3	PLANT OPERATING STATION
4	FIRE CONTROL PANEL, TROUBLE
5	SPRINKLER CONTROL PANEL
6	SMOKE DETECTOR
7	SMOKE DETECTOR
8	SMOKE DETECTOR
9	SMOKE DETECTOR
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99	SMOKE DETECTOR
100	SMOKE DETECTOR

ROAD/TELE ALARMS PANEL		①
ZONE	DESCRIPTION	INITIATING DEVICE
NO		
1	CITIZEN PROCESS ALARMS	AC PANEL
2	BLINDING INTRUSION ALARMS	MC PANEL
3	SPRINKLER	MC PANEL
4	SPRINKLER	MC PANEL
5	SPRINKLER	MC PANEL
6	SPRINKLER	MC PANEL
7	SPRINKLER	MC PANEL
8	SPRINKLER	MC PANEL
9	SPRINKLER	MC PANEL
10	SPRINKLER	MC PANEL
11	SPRINKLER	MC PANEL
12	SPRINKLER	MC PANEL

① TOWN SHALL CARRY OUT A & NON-CRITICAL

BID SET

RECEIVED
FEB 19 2002

ENT PLANT FOR 2A.6.7 & 9

RAMS "III"

DRAWING NO.	E-10
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ELECTRICAL DRAWINGS, REFERENCE NOTES

- 1) FOR SYMBOLS, ABBREVIATIONS & GENERAL NOTES, REFER TO DWG # E-1
- 2) FOR ELECTRICAL SITE PLAN, REFER TO DWG # E-2
- 3) FOR BUILDING POWER/LIGHTING PLANS AND WIRING DETAILS, REFER TO DWGS # E-3 THRU E-7

BID SET

DATE	1/08/02
DRAWING NO.	E-12
SHEET 58 OF 60 SHEET	

E-1.

1. *Journal of the American Medical Association*, 1997; 277: 1001-1005.

2

1. *Journal of the American Medical Association*, 1997; 277: 1039-1043.

[illegible]

1. *Journal of the American Medical Association*, 2000; 284: 2689-2695.

judgment of
majority of
the jury.
The jury
found that
the defendant
was guilty of
murder in
the second
degree.

H₂O Engineering
 Consulting Engineers
 1000 State Street
 Bedford, MA 01730

SED ASSOCIATES CORP.
 Consulting Engineers
 1000 State Street
 Bedford, MA 01730

DATE: _____
 BY: _____
 CHECKED BY: _____

SCALE: NONE

DESIGNED BY: CJB
 DRAWN BY: RFG

CHECKED BY: WFE

PROJECT
 WATER TREATMENT PLANT FOR
 WELLS NO. 2A, 6, 7 & 9

TITLE
 SCHEDULES "VI"

PROJECT
 DATE: 1/09/02
 DRAWING NO: E-14
 SHEET NO. OF 60 SHEETS

PROJECT
 DATE: 1/09/02
 DRAWING NO: E-14
 SHEET NO. OF 60 SHEETS

PROJECT
 DATE: 1/09/02
 DRAWING NO: E-14
 SHEET NO. OF 60 SHEETS

PROJECT
 DATE: 1/09/02
 DRAWING NO: E-14
 SHEET NO. OF 60 SHEETS

PROJECT
 DATE: 1/09/02
 DRAWING NO: E-14
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PROJECT
 DATE: 1/09/02
 DRAWING NO: E-14
 SHEET NO. OF 60 SHEETS

PROJECT
 DATE: 1/09/02
 DRAWING NO: E-14
 SHEET NO. OF 60 SHEETS

PROJECT
 DATE: 1/09/02
 DRAWING NO: E-14
 SHEET NO. OF 60 SHEETS

PROJECT
 DATE: 1/09/02
 DRAWING NO: E-14
 SHEET NO. OF 60 SHEETS

PROJECT
 DATE: 1/09/02
 DRAWING NO: E-14
 SHEET NO. OF 60 SHEETS

CONDUIT NO	WIRE NO	FROM	TO	COMMENTS
C-1	4.0"	TELEPHONE UTILITY	TELEPHONE UTILITY	ALARM
C-2	4.0"	6000K	TELEPHONE UTILITY	ALARM
C-3	4.0"	6000K	TELEPHONE UTILITY	ALARM
C-4	4.0"	6000K	TELEPHONE UTILITY	ALARM
C-5	1.0"	12	TELEPHONE UTILITY	ALARM
C-6	1.0"	12	TELEPHONE UTILITY	ALARM
C-7	1.0"	4/3	TELEPHONE UTILITY	ALARM
C-8	1.0"	4/3	TELEPHONE UTILITY	ALARM
C-9	3.0"	3000K	TELEPHONE UTILITY	ALARM
C-10	3.0"	3000K	TELEPHONE UTILITY	ALARM
C-11	1.0"	12	TELEPHONE UTILITY	ALARM
C-12	1.0"	12	TELEPHONE UTILITY	ALARM
C-13	1.0"	12	TELEPHONE UTILITY	ALARM
C-14	1.0"	12	TELEPHONE UTILITY	ALARM
C-15	1.0"	12	TELEPHONE UTILITY	ALARM
C-16	1.0"	12	TELEPHONE UTILITY	ALARM
C-17	1.0"	12	TELEPHONE UTILITY	ALARM
C-18	1.0"	12	TELEPHONE UTILITY	ALARM
C-19	1.0"	12	TELEPHONE UTILITY	ALARM
C-20	1.0"	12	TELEPHONE UTILITY	ALARM
C-21	1.0"	12	TELEPHONE UTILITY	ALARM
C-22	2.0"	3/0	TELEPHONE UTILITY	ALARM
C-23	1.5"	3/0	TELEPHONE UTILITY	ALARM
C-24	0.75"	24 UP	TELEPHONE UTILITY	ALARM
C-25	1.5"	3/0	TELEPHONE UTILITY	ALARM
C-26	1.5"	3/0	TELEPHONE UTILITY	ALARM
C-27	1.0"	6	TELEPHONE UTILITY	ALARM
C-28	3.0"	8 1/2"	TELEPHONE UTILITY	ALARM
C-29	0.75"	8	TELEPHONE UTILITY	ALARM
C-30	1.0"	6	TELEPHONE UTILITY	ALARM
C-31	1.0"	6	TELEPHONE UTILITY	ALARM
C-32	1.0"	6	TELEPHONE UTILITY	ALARM
C-33	1.0"	6	TELEPHONE UTILITY	ALARM
C-34	3.0"	8 1/2"	TELEPHONE UTILITY	ALARM
C-35	0.75"	8	TELEPHONE UTILITY	ALARM

CONDUIT NO	WIRE NO	FROM	TO	COMMENTS
C-36	1.0"	6	TELEPHONE UTILITY	ALARM
C-37	0.75"	1 1/2"	TELEPHONE UTILITY	ALARM
C-38	0.75"	24 UP	TELEPHONE UTILITY	ALARM
C-39	1.0"	12	TELEPHONE UTILITY	ALARM
C-40	1.0"	12	TELEPHONE UTILITY	ALARM
C-41	1.0"	1 1/2"	TELEPHONE UTILITY	ALARM
C-42	1.0"	1 1/2"	TELEPHONE UTILITY	ALARM
C-43	1.0"	1 1/2"	TELEPHONE UTILITY	ALARM
C-44	0.75"	1 1/2"	TELEPHONE UTILITY	ALARM
C-45	1.0"	4	TELEPHONE UTILITY	ALARM
C-46	3.0"	3 1/2"	TELEPHONE UTILITY	ALARM
C-47	3.0"	3 1/2"	TELEPHONE UTILITY	ALARM
C-48	2.0"	6 2/3"	TELEPHONE UTILITY	ALARM
C-49	1.5"	8	TELEPHONE UTILITY	ALARM
C-50	1.5"	8	TELEPHONE UTILITY	ALARM
C-51	1.0"	2 1/2"	TELEPHONE UTILITY	ALARM
C-52	1.0"	2 1/2"	TELEPHONE UTILITY	ALARM
C-53	1.0"	1 1/2"	TELEPHONE UTILITY	ALARM
C-54	1.0"	1 1/2"	TELEPHONE UTILITY	ALARM
C-55	1.0"	1 1/2"	TELEPHONE UTILITY	ALARM
C-56	1.0"	1 1/2"	TELEPHONE UTILITY	ALARM
C-57	1.0"	1 1/2"	TELEPHONE UTILITY	ALARM
C-58	0.75"	4	TELEPHONE UTILITY	ALARM
C-59	1.5"	2 1/2"	TELEPHONE UTILITY	ALARM
C-60	1.5"	2 1/2"	TELEPHONE UTILITY	ALARM
C-61	0.75"	1 1/2"	TELEPHONE UTILITY	ALARM
C-62	1.5"	3 1/2"	TELEPHONE UTILITY	ALARM
C-63	1.5"	3 1/2"	TELEPHONE UTILITY	ALARM
C-64	2.0"	2 1/2"	TELEPHONE UTILITY	ALARM
C-65	0.75"	4	TELEPHONE UTILITY	ALARM
C-66	0.75"	4	TELEPHONE UTILITY	ALARM
C-67	1.5"	2 1/2"	TELEPHONE UTILITY	ALARM
C-68	1.5"	2 1/2"	TELEPHONE UTILITY	ALARM
C-69	0.75"	1 1/2"	TELEPHONE UTILITY	ALARM
C-70	1.0"	1 1/2"	TELEPHONE UTILITY	ALARM
C-71	0.75"	1 1/2"	TELEPHONE UTILITY	ALARM
C-72	1.0"	1 1/2"	TELEPHONE UTILITY	ALARM

CONDUIT NO	WIRE NO	FROM	TO	COMMENTS
C-73	1.0"	2 1/2"	TELEPHONE UTILITY	ALARM
C-74	1.0"	12	TELEPHONE UTILITY	ALARM
C-75	2.0"	3 1/2"	TELEPHONE UTILITY	ALARM
C-76	1.0"	12	TELEPHONE UTILITY	ALARM
C-77	1.0"	12	TELEPHONE UTILITY	ALARM
C-78	1.0"	12	TELEPHONE UTILITY	ALARM
C-79	1.0"	12	TELEPHONE UTILITY	ALARM
C-80	0.75"	1 1/2"	TELEPHONE UTILITY	ALARM
C-81	3.0"	12 1/2"	TELEPHONE UTILITY	ALARM
C-82	3.0"	12 1/2"	TELEPHONE UTILITY	ALARM
C-83	1.0"	4	TELEPHONE UTILITY	ALARM
C-84	1.0"	4	TELEPHONE UTILITY	ALARM
C-85	2.0"	4	TELEPHONE UTILITY	ALARM
C-86	0.75"	1 1/2"	TELEPHONE UTILITY	ALARM
C-87	4.0"	4	TELEPHONE UTILITY	ALARM
C-88	0.75"	1 1/2"	TELEPHONE UTILITY	ALARM
C-89	1.5"	3 1/2"	TELEPHONE UTILITY	ALARM
C-90	1.5"	3 1/2"	TELEPHONE UTILITY	ALARM
C-91	1.0"	1 1/2"	TELEPHONE UTILITY	ALARM
C-92	0.75"	1 1/2"	TELEPHONE UTILITY	ALARM
C-93	1.0"	12	TELEPHONE UTILITY	ALARM
C-94	1.0"	12	TELEPHONE UTILITY	ALARM
C-95	1.0"	12	TELEPHONE UTILITY	ALARM
C-96	0.75"	1 1/2"	TELEPHONE UTILITY	ALARM
C-97	0.75"	1 1/2"	TELEPHONE UTILITY	ALARM
C-98	1.0"	1 1/2"	TELEPHONE UTILITY	ALARM
C-99	1.0"	1 1/2"	TELEPHONE UTILITY	ALARM
C-100	0.75"	1 1/2"	TELEPHONE UTILITY	ALARM
C-101	0.75"	1 1/2"	TELEPHONE UTILITY	ALARM
C-102	1.0"	3	TELEPHONE UTILITY	ALARM
C-103	4.0"	4	TELEPHONE UTILITY	ALARM
C-104	1.0"	1	TELEPHONE UTILITY	ALARM
C-105	0.75"	1 1/2"	TELEPHONE UTILITY	ALARM
C-106	1.5"	2	TELEPHONE UTILITY	ALARM
C-107	1.0"	4	TELEPHONE UTILITY	ALARM

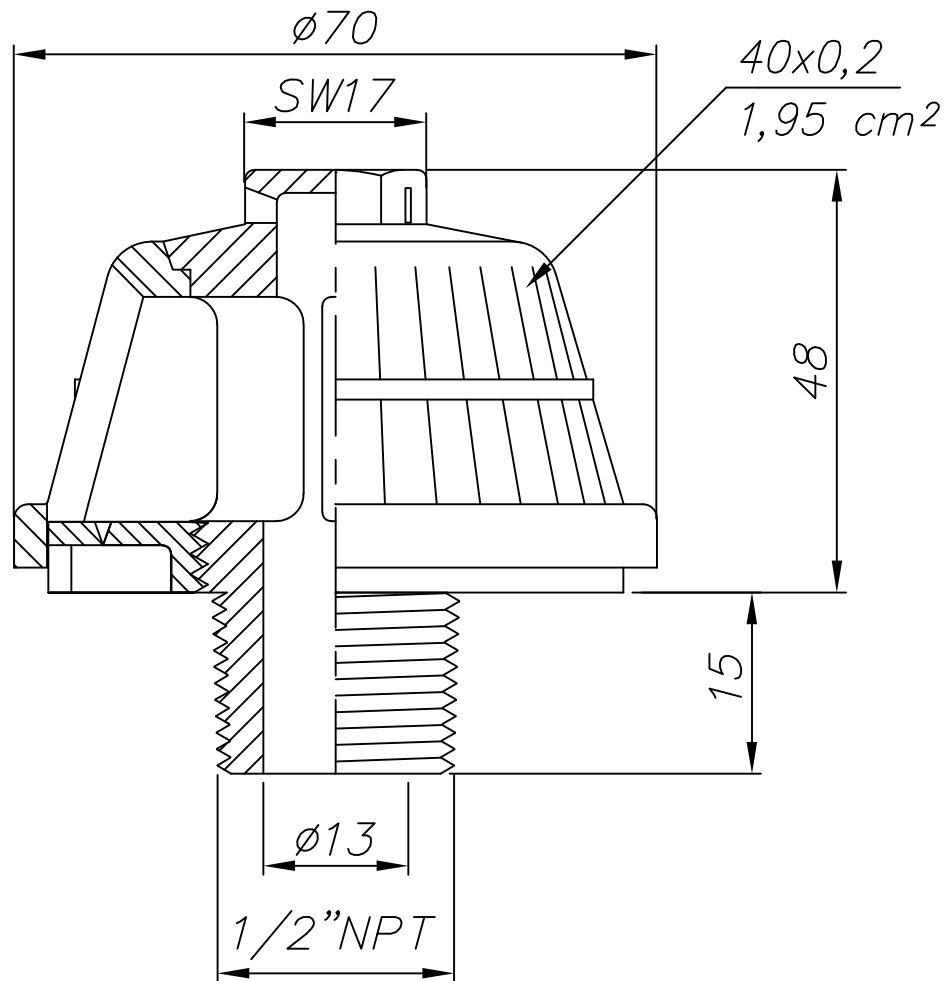
CONDUIT & WIRE SCHEDULE NOTES -

- ELECTRICIAN CONTRACTOR SHALL COORDINATE ALL EQUIPMENT WITH THE ELECTRICAL CONTRACTOR PRIOR TO ANY WORK.
- FOR ELECTRICAL CONTRACTOR, REFER TO DWG # E-1.
- FOR ELECTRICAL CONTRACTOR, REFER TO DWG # E-2.
- FOR ELECTRICAL CONTRACTOR, REFER TO DWG # E-3.
- FOR ELECTRICAL CONTRACTOR, REFER TO DWG # E-4.
- FOR ELECTRICAL CONTRACTOR, REFER TO DWG # E-5.
- FOR ELECTRICAL CONTRACTOR, REFER TO DWG # E-6.
- FOR ELECTRICAL CONTRACTOR, REFER TO DWG # E-7.
- FOR ELECTRICAL CONTRACTOR, REFER TO DWG # E-8.
- FOR ELECTRICAL CONTRACTOR, REFER TO DWG # E-9.
- FOR ELECTRICAL CONTRACTOR, REFER TO DWG # E-10.
- FOR ELECTRICAL CONTRACTOR, REFER TO DWG # E-11.
- FOR ELECTRICAL CONTRACTOR, REFER TO DWG # E-12.
- FOR ELECTRICAL CONTRACTOR, REFER TO DWG # E-13.
- FOR ELECTRICAL CONTRACTOR, REFER TO DWG # E-14.

BID SET

FEB 19 2002

Sample Tap Screen



NOTE: DIMENSIONS ARE IN MILLIMETERS

NOT TO SCALE

ORTHOS

DRAWN	ACP	11/05/18	DRAWING NUMBER	SHEET
C'KED.				1/1
APP'D.			KR1 - 0.2 - 1/2"NPT	
REV.	0		NOZZLE DETAIL DRAWING	

©2017

Attachment C

ATTACHMENT C

CHANGE ORDERS

Policy:

This section supplements Section 17: “Change Orders, Price Modifications, and Other Amendments,” in the Contract (Attachment A).

All executed change orders submitted to the District for review and processing must be prepared in accordance with the attached change order format (Appendix A below) with the appropriate number of copies, calculation sheet(s) (Appendix B below) and all other supporting documentation necessary for evaluation. Failure to comply with these instructions will result in delays in processing the change order.

In order to avoid possible delays with approval of change orders, at the beginning of the project and as circumstances warrant, the Respondent shall submit a list of construction equipment, identifying major pieces of equipment to be utilized on the project. The list shall include the Respondent's designation, if any, the manufacturer, model, year of manufacture, serial number, size and horsepower of equipment. The Respondent shall also provide for approval a proposed bluebook equipment rental rate development that separately lists for each piece of equipment the monthly rental rate, area adjustment factor, depreciation factor, estimated operating cost per hour and total hourly rate. In the event the Respondent fails or is unable to provide appropriate rate information the District may develop equipment rental rates for use on change orders.

Payment of Change Orders:

Payment of all change orders shall be in accordance with the relevant provisions of Massachusetts General Laws, Chapter 30, Section 39G for non-building construction and Section 39K for building construction as amended from time to time.

Payment of change orders shall be made in accordance with one of the following three methods:

- A. Existing unit prices as set forth in the contract; or
 - B. Agreed upon lump sum or unit prices; or
 - C. Time and materials
- A. Payment for work for which there is a unit price in the contract:

Where the contract contains a unit price for work and the District orders a change for work of the same kind as other work contained in the contract and is performed under similar physical conditions, the Respondent shall accept full and final payment at the contract unit

price(s) for the acceptable quantities. Under certain circumstances, the unit prices may be subject to revaluation and adjustment.

B. Payment for work or materials for which no price is contained in the contract:

If the District directs, the Respondent shall submit promptly in writing to the District an offer to do the required work on a lump sum or unit price basis, as specified by the District. The stated price, either lump sum or unit price, shall be divided so as to show that it is the sum of:

1. The estimated cost of Labor, plus
2. Direct Labor Cost, plus
3. Material and Freight Costs, plus
4. Equipment Costs, plus
5. An amount not to exceed 15% of the sum of items 1 through 4 for overhead and profit, plus (if applicable),
6. In the case of work done by a sub-contractor an amount not to exceed 5%, for the Respondent of the sum of the cost (not including sub-contractor's overhead and profit) of items 1 through 4 for his overhead and profit (less, if applicable),
7. Credits for work deleted from the contract, including actual costs of the deleted work plus the percentage of overhead, profit, bonds and insurance attributable to such credit amount.

C. Payment for work on a time and materials basis:

Unless an agreed lump sum and/or unit price is obtained as noted above and is so stated in the change price, the Respondent shall accept as full payment for which no agreement is contained in contract, an amount equal to:

1. The estimated cost of Labor, plus
2. The Direct Labor Costs, plus
3. Equipment Costs, plus
4. Material and Freight Costs, plus
5. An amount not to exceed 15% of the sum of items 1 through 4 for overhead and profit, plus, if applicable,
6. In the case of work done by a sub-contractor an amount not to exceed 5%, for the general Respondent of the sum of the cost (not including sub-contractor's overhead and profit) of items 1 through 4 for his overhead and profit (less, if applicable),
7. Credit for work deleted from the Contract, including actual costs of the deleted work plus the percentage of overhead, profit, bonds and insurance attributable to such credit amount.

Explanation of items 1 through 7 as outlined in "B" and "C" above:

1. Labor - Only those workers employed on the project who are doing the extra work, including the foreman in charge, are allowable. General foremen, superintendents, or other supervisory personnel are considered to be included in the overhead markup as provided

in items 5 and/or 6. Hourly labor rates in excess of those as listed in the contract wage rates require documentation. As a minimum, an explanation and the appropriate copy of the certified payroll are required.

2. Direct Labor Costs - These costs are limited to those which are required in the contract document. Coverage in excess of the contract provisions, secured by the Respondent/sub-contractor(s) at his option, are ineligible. The following list of typical direct labor charges is provided for your assistance and is in no way intended to be complete or all encompassing:

Workman's Compensation

Federal/State: Social Security Tax and Unemployment Tax;

Health, Welfare and Pension Benefits; (this cost is included in the wage rates appearing in the Massachusetts Wage Rates.

Liability insurance:	Bodily injury; excess umbrella; property damage; public liability
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Blasters insurance:	If applied to any required direct labor costs
---------------------	---

Builders risk insurance:	If applied to any required direct labor costs
--------------------------	---

Experience modification insurance:	If applied to any required direct labor costs
------------------------------------	---

Surcharges:	If applied to any required direct labor costs
-------------	---

Following award and prior to execution of a construction contract, the Respondent and filed sub-bidders (where applicable) shall submit for review by the District, documentation to establish the markup percentage(s).

The documented direct labor markup for this contract may be adjusted on an annual basis as measured from the date the contract is executed. The contract agreement will provide for the establishment of the Direct Labor Cost percentage.

3. Material and Freight - Only those materials required as a result of the change order and reasonable freight charges for delivery of same are allowable.
4. Equipment - Only the equipment required as a result of the change order is allowable. Equipment rental rates shall be governed by the current EquipmentWatch, division of

Intertec Publishing [Formerly Nielson/Dataquest] Rental Rate Bluebook for Construction Equipment (the "Bluebook"). In determining the rental rate, the following shall apply:

- a. For equipment already on the project - the monthly prorated rental rate by the hourly use shall be applicable;
- b. For equipment not on the project the daily rate, the weekly rate, or monthly rate will prevail, whichever will prove to be most cost effective. Small tools and manual equipment are examples of costs not allowable under this item. These costs are considered to be included in the overhead markup as provided in items 5 and/or 6.

(1 Month (Normal Use) = 176 hours)

- 5.& 6. Overhead and Profit - All other costs not previously mentioned are considered to be included in this item, be it for the general Respondent or sub-contractor(s).
7. Credits - Work deleted, material and equipment removed from the contract, stored and/or returned shall be credited to the cost of the change order, less documented costs.

This change order will be prepared in such manner as to clearly separate Eligible and Ineligible Costs (as applicable to state-funded projects).

The Respondent shall furnish itemized statements of the cost of the work ordered and shall give the District access to all accounts, bills and vouchers relating thereto; and unless the Respondent shall furnish such itemized statements, and access to all accounts, bills and vouchers, he shall not be entitled to payment for any items of extra work for which such information is sought by the District.

APPENDIX A

Change Order
(Enter Project Name)
(Enter Location)

Sheet ___ of ___

Date _____

Project No. _____

Contract No. _____

Change Order No. _____

Contract Amount (As Bid) \$ _____

Amount of Previous Change Orders \$ _____

Net Change in Contract Price (this Change Order) \$ _____

Total Adjusted Contract Price (including this Change Order) \$ _____

This Change Order extends the time to complete the work by ____ calendar days.

The extended completion date is _____
_____.

This Change Order checked by: _____
Resident Representative Date

This Change Order is requested by: _____

This Change Order is recommended by:

Consultant to District (if applicable) P.E. # Date

The undersigned agree to the terms of the Change Order.

Respondent Date

District Date

Certification of Appropriation under M.G.L. c.44, s.31C: Adequate funding in an amount sufficient to cover the total cost of this change order is available.

By: _____
Certification Officer (Auditor, Accountant, Treasurer) Date

Do not write below this space: this space reserved for District

CHANGE ORDER (continued)
(Enter Project Name)
(Enter Location)

Sheet ___ of ___

Date _____

Project No. _____

Contract No. _____

Change Order No. _____

Owner's Name: _____

Owner's Address: _____

Respondent's Name: _____

Respondent's Address: _____

Item 1:

Description of Change: _____

Reason for Change: _____

Backup Information: _____

Cost: \$ _____

Item 2

Description of Change: _____

Reason for Change: _____

Backup Information: _____

Cost: \$ _____

Appendix B
Example Calculation Sheet

1. Labor

Foreman	10 hours @	\$10.00/hour	\$100.00
District	10 hours @	8.80/hour	85.00
Operator	10 hours @	9.50/hour	95.00
Laborers	24 hours @	7.00/hour	<u>168.00</u>
			\$448.00

2. Direct Labor Cost (use the agreed upon Direct Labor Cost)

*(30)% of \$448.

*(used for example purposes only) \$ 134.00

3. Materials & Freight

150 l.f. of 12" pipe @ \$2.00/l.f.	\$ 300.00
15 v.f. precast SMH	1,700.00
Freight (slip# ___ enclosed)	<u>25.00</u>
	\$2,025.00

4. Equipment

1 Backhoe	10 hours @	\$ 80.00/hour	\$ 800.00
1 Truck-crane	10 hours @	100.00/hour	<u>1000.00</u>
			\$1800.00

TOTAL (items 1 through 4): \$4,407.00

5. (20%) markup for Overhead, Profit

(20%) of \$4,407 \$ 881.00

6. (7½ %) markup on subRespondent's cost for general Respondent (if subRespondent is involved)

(7½ %) of \$4,407 \$ 331.00

7. Credits (deductibles) -\$323.00

TOTAL COST: \$5,296.00

Reminder: Provide support documentation as necessary i.e. vouchers, correspondence, calculation, photographs, reports.

END OF SECTION

Attachment D



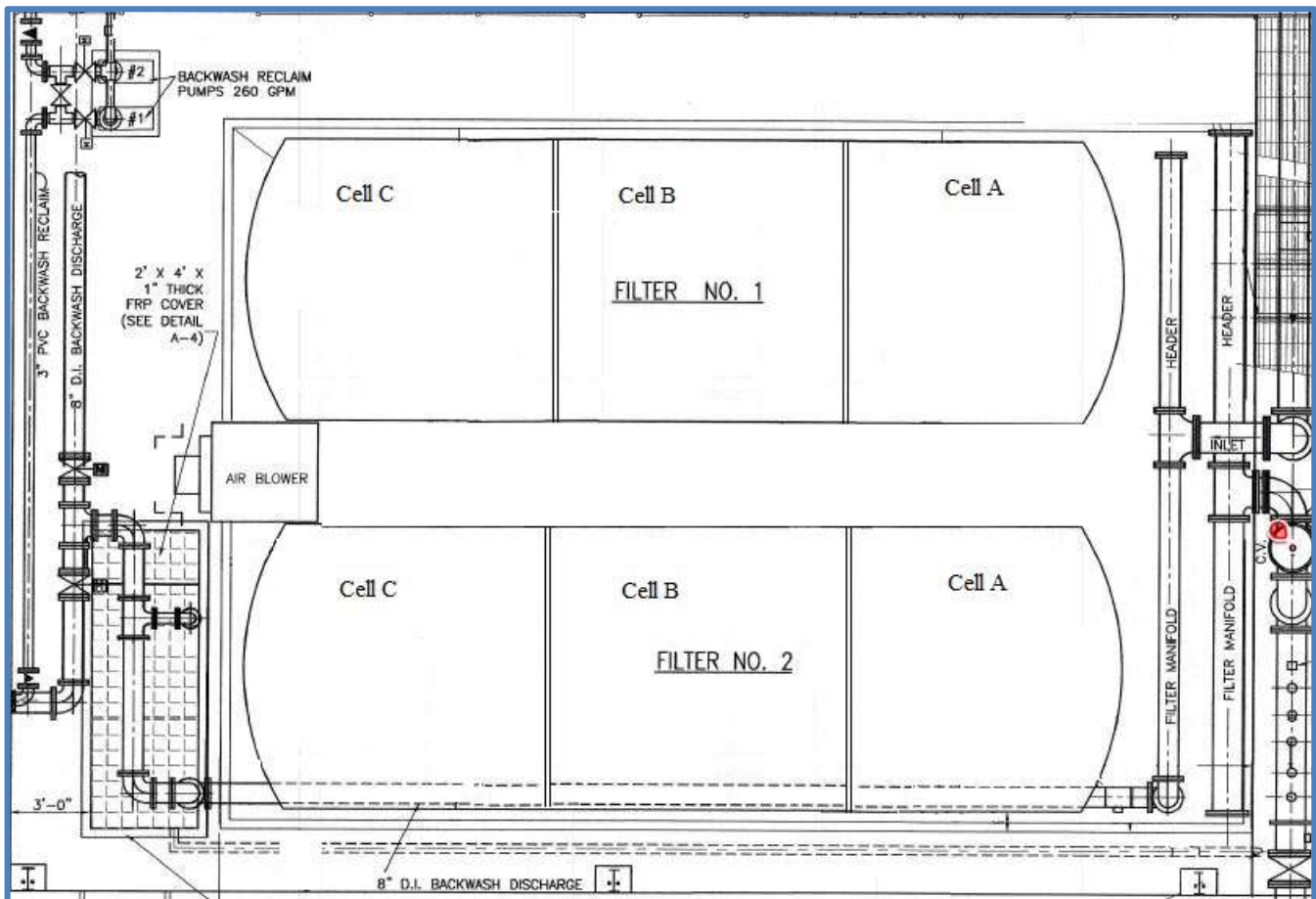
TECH MEMO

To:	Sudbury Water District	Ref:	Raymond Road WTP
			Sudbury, MA
Attn:	Vincent Roy		
cc:	Andrew Reid, PE	Subject:	Filter Evaluation
Written by:	Andrew Taylor	Memo Date:	12/23/2025

SUMMARY

On Tuesday, December 16th, Water Service Professionals of PA (WSP-US), Inc completed the evaluation of two (2) 10' x 30' multi-cell horizontal pressure filters at the Town of Sudbury's Raymond Road Water Treatment Plant. Prior to our arrival, the three (3) 14" x 18" manway covers on each filter cell had been opened and the units were in the process of draining.

In addition to the three filter cells, WSP-US technicians also opened the single 14" x 18" manway cover on Filter #1 to access the filter underdrain plenum.





TECH MEMO

GENERAL OBSERVATIONS

Once the units were fully drained, WSP-US technician entered Cell A of Filter 1. The inlet distributor and filter media surface were evaluated. Filter freeboard was measured, and a local excavation was performed to collect anthracite and Greensand Plus samples. Media samples were submitted to an independent laboratory for sieve analysis.

Inlet Distributor – The inlet distributor in Cell A of Filter 1 is nearly fouled with tuberculation. Fabrication drawings from the original manufacture indicate that the inlet distributors were originally comprised of eight (8) 3" diameter, Sch 40 steel pipes with an internal diameter of 3.068" each. Tuberculation has reduced the inlet orifices to less than 1 ½" in many locations.

Filter Media Surface – It was immediately apparent upon entering Cell A that the filter media was heavily fouled. Even manual excavation of the media was difficult.



Figure 1: 1 of 8, 3" inlet distributors in Filter 1, Cell A

Large mudballs, some exceeding 12" in length, were abundant in both the anthracite and Greensand Plus layers. Additionally, the coating on the media made it nearly impossible to differentiate the two media types.



Figure 2/3: "Mudballs" from Filter 1, Cell A. Extremely large and comprised primarily of filter media bound together with manganese and iron "sludge".



TECH MEMO

Media Test Results – Samples of the Greensand Plus and Anthracite were collected from Cell A of Filter #1 and were submitted for laboratory analysis. Both samples were tested for effective size and uniformity coefficient. As illustrated in the following table, both the samples were drastically out of the approved specification range. The anthracite was heavily coated and tested larger than specified with an Effective Size of 1.01 mm. The Greensand Plus is badly “fried” and has broken down to small particles averaging around 0.07 mm.

Description	GreenSand Plus	Anthracite
Design	E.S.-0.30 – 0.35mm UC ≤ 1.5	E.S.-0.60 – 0.80mm UC ≤ 1.5
Filter 1 / Cell A	E.S. = 0.07 UC = 7.4	E.S. = 1.01 UC = 1.43

Due to the condition of Cell A, the remaining five (5) filter cells were not entered. Each cell was visually inspected from the manway and similar conditions were noted. Filter freeboard was collected from all six (6) filter cells. Project drawing 31879-A04 indicates that the design freeboard is approximately 26 ½”. The freeboard measured were as follows:

Filter Cell	Freeboard
Design	26.5’
Filter 1	
Cell A	24”
Cell B	24”
Cell C	24”
Filter 2	
Cell A	24”
Cell B	24.5”
Cell C	25”

Air Scour – After completing the inspections, the underdrain manway of Filter 1 was reinstalled, and the entire vessel was refilled from below with finished water. Once the water level completely submerged the filter media, a test of the air scour system was performed in each cell. The blower was initiated from the control panel and sequentially, each filter cell’s air supply valve was opened.

During the air scour of Cells A and B, the blower air relief valve cycled open continuously and very little air was entering the filter cell. Cell C functioned slightly better, with only intermittent cycling of the air relief valve, but the air scour pattern was still poor. Blower discharge pressure for pressure filters is typically in the 1-3 psi range with the blower being designed with a discharge pressure of 6 psi. Visual inspection confirmed that the existing blower air relief valve is set for 7.5 psi.



TECH MEMO

Either the individual air scour laterals are fouled, or the condition of the filter media has deteriorated to a point that the pressure produced by the blower can no longer overcome the compacted media. Because these air scour laterals are located below a gravel retaining screen, the latter condition is the more likely scenario.



TECH MEMO

Underdrain Plenum – While Filter 1 was drained, the 14' x 18" underdrain manway was opened. Entry into the plenum was not attempted, but the condition of the plenum was observed from the manway opening. Significant tuberculation is present in the underdrain plenum. The tuberculation is typical for filters of this age and design. The technicians were not able to identify any missing or damaged underdrain nozzles, no obvious structural damage was apparent, and no filter media could be seen within the plenum.



Figure 4/5: Underdrain plenum looking to the left and right from the manway opening of Filter 1



TECH MEMO

RECOMMENDATIONS

1. The existing filter media is heavily fouled, and it is highly unlikely that the media beds could be rejuvenated through any mechanical or chemical processes. The age and condition of the filter media warrant a complete replacement. While the filter media is removed, the existing gravel retaining screen and air scour system should each be removed, cleaned, and inspected. Additionally, new support gravel should be furnished and installed. Replacement of the filter media and support gravel would also allow for a complete evaluation and cleaning of the existing underdrain nozzles.
2. The inlet distributors are heavily fouled and must be cleaned or replaced. Cleaning the distributors can prove difficult and, depending on the nature and extent of the tuberculation, can result in a damaged or structurally comprised influent distributor. Replacement in-kind with new sch. 40 steel pipe is recommended.
3. Each filter cell has three (3) sample taps. A majority of these sample taps are fouled. Taps should be cleaned and/or replaced during the filter media replacement project.
4. Prior to reinstalling the filter media or filter air scour system components, flush the entire system with air from the blower to assure no blockages are in the air scour line.
5. Operators report issues with the existing level control devices in each filter (2 per filter / 4 total). WSP recommends that the plant evaluate these instruments and repair/replace as necessary.

**MATERIAL ANALYSIS**

PROJECT: RAYMOND ROAD WATER TREATMENT PLANT – SUDBURY, MA
CLIENT: WATER SERVICE PROFESSIONALS OF PA, INC.
10 PETTITS BRIDGE ROAD
JAMISON, PA 18929

PROJECT NO.: 3891
DATE: 1/2/26

On December 29, 2025, two filter media samples were delivered to our laboratory for sieve analyses. All testing was performed in accordance with AWWA Specification B100-16. Following are the test results:

ANTHRACITE (1C)		
Sieve Size (ASTM C136)	Particle Size (mm)	% Passing
#6	3.366	100.0
#8	2.482	99.8
#10	2.041	96.4
#12	1.730	84.9
#14	1.422	57.6
#16	1.199	32.1
#18	1.014	10.0
#20	0.878	3.1

Test	Result
Effective Size (mm)	1.01
Uniformity Coefficient	1.43

GREENSAND PLUS (1C)		
Sieve Size (ASTM C136)	Particle Size (mm)	% Passing
#18	1.014	100.0
#20	0.878	99.9
#25	0.690	96.6
#30	0.587	89.3
#35	0.489	68.2
#40	0.401	33.2
#45	0.344	20.7
#50	0.289	18.1
#60	0.245	16.9
#70	0.212	15.7
#80	0.180	14.7
#100	0.150	13.8
#200	0.075	10.7
#270	0.053	9.0

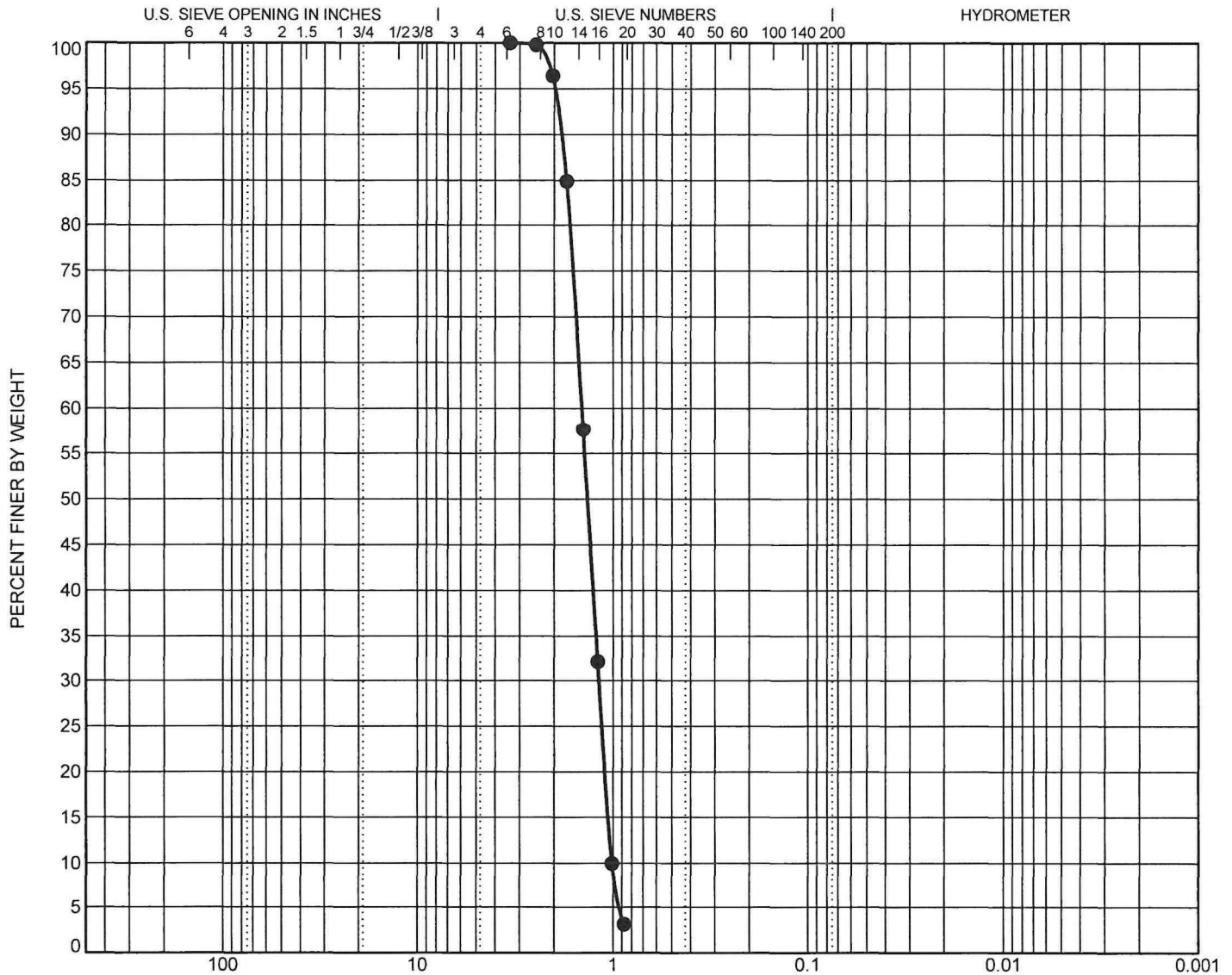
Test	Result
Effective Size (mm)	0.07
Uniformity Coefficient	7.20

If you have any questions, please do not hesitate to contact our office.

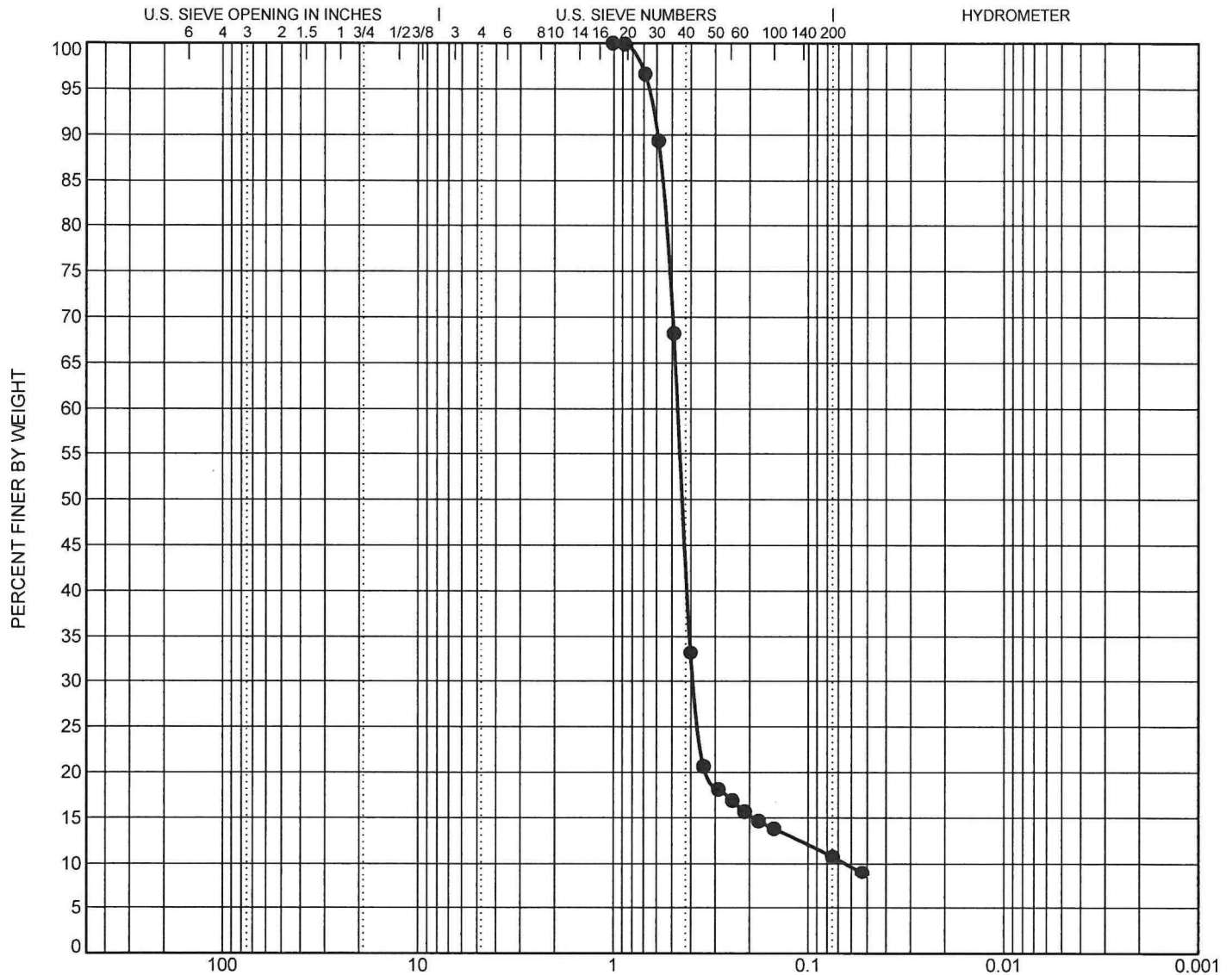
TECHNICIAN: DONALD HOLLENBAUGH

Attachments (2 pages)

GRAIN SIZE DISTRIBUTION TEST REPORT



GRAIN SIZE DISTRIBUTION TEST REPORT



Attachment E

High or Low Level Switch Package

SPECIFICATIONS

Relay Controller

Supply voltage: 120 VAC (240 VAC),
50-60 Hz.

Consumption: .25 amps

Relay type: (1) SPDT

Relay rating: 250 VAC, 10A, 1/2 hp

Relay mode: Selectable NO or NC

Time delay: 0-60 seconds

Temperature range: F: -40° to 158°
C: -40° to 70°

Enclosure rating: NEMA 4X (IP65)

Enclosure material: Polypropylene, U.L. 94VO

Enclosure rotation: 300° Swivel base

Conduit connection: 1/2" NPT

CSA certificate: LR 79326-3

CE compliance: EN 50082-2 immunity
EN 55011 emission
EN 61010-1 safety

Sensor Technology

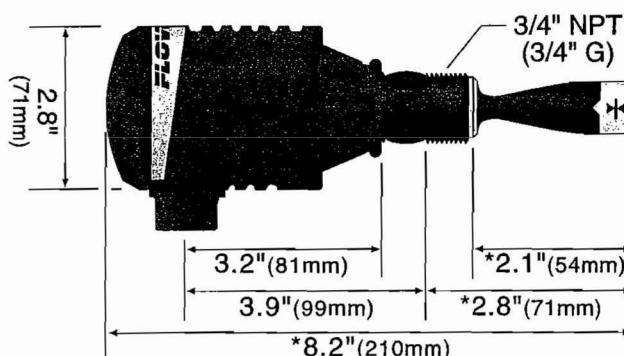
Z10 Tuning fork: Pages 46-47

U10 Ultrasonic: Pages 48-49

LP15 Capacitance: Pages 50-51

LH10 Buoyancy: Pages 62-63

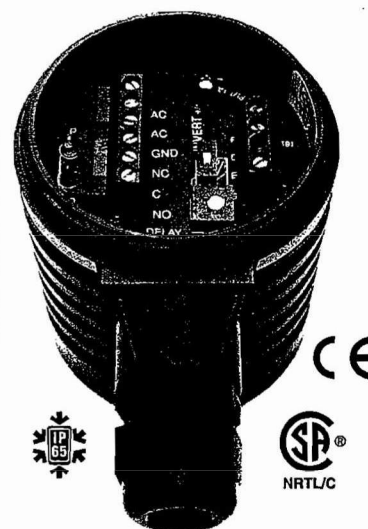
DIMENSIONS



* SuperGuard and buoyancy switch packages are slightly longer. Please refer to the sensor technology pages for additional dimensional data.

TECH TIP

The fail-safe relay controller features a 10 amp relay with an adjustable time delay, LED indicators and invert switch for simple NO or NC operation. The rugged NEMA 4X enclosure is made of fire retardant polypropylene with a 300° rotational base.



ORDERING INFORMATION

Switch Pro System

AZ13 - 1120

Sensor Technology (1) (2) (3)

→ Z - Tuning Fork (add \$185)

U - Ultrasonic (add \$165)

S - Capacitance (add \$145)

H - Buoyancy

Sensor Material (4)

PP ←

PFA (add \$100)

Mounting Thread (5)

0 - 3/4" NPT

4 - 3/4" G (add \$5)

STARTS FROM

\$ 235

Add \$ _____

Add \$ _____

Add \$ _____

Total \$ _____

Notes

(1) **Sensor Technology:** Select the best sensor technology based upon the application.

(2) **CE Approval:** To order the CE configuration, place CE at the end of the part number (example: AZ13-1120-CE) and add \$30.

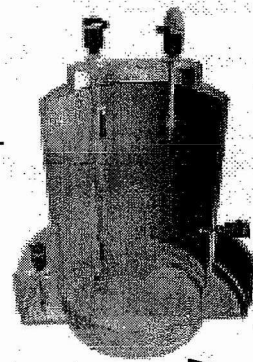
(3) **Supply Voltage:** To have the supply voltage factory configured to 240 VAC, place an E at the end of the part number (example: AZ13-1120-E).

(4) **Available Sensor Materials:**

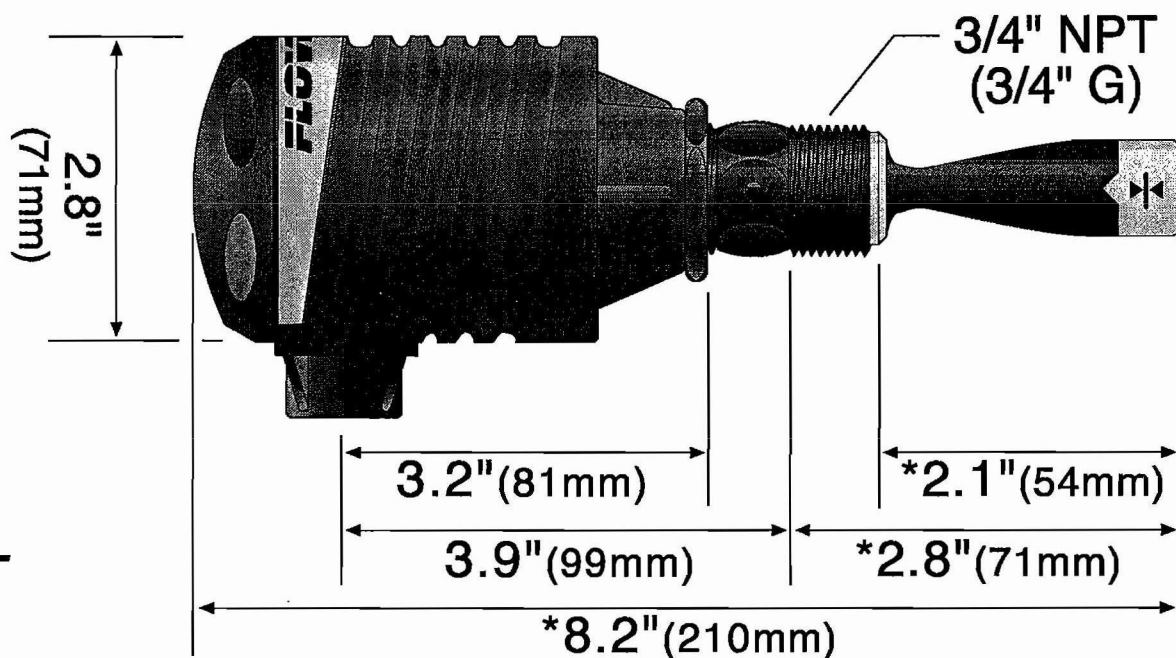
Tuning fork:	PP only
Ultrasonic:	PP or PFA
Capacitance:	PP only
Buoyancy:	PP only

(5) **Mounting Gasket:** The G thread Switch Pro comes with a 3/4" Viton mounting gasket.

FLOWLINE



Switch Pro™ with Compact Relay Controller



FLOWLINE

10500 Humbolt Street
Los Alamitos, CA 90720
Tel 562-598-3015
Fax 562-431-8507
www.flowline.com

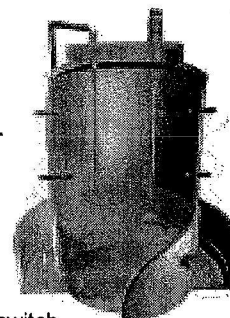
This document is provided for reference and is believed to be accurate at the time of publication. However, Flowline reserves the right to change product specifications at any time without notice. Additional information may be obtained on the Internet at <http://www.flowline.com> or by contacting Flowline.

Including Models:

**AZ13-1120, AZ13-1124,
AU13-1120, AU13-1124,
AU13-2120, AU13-2124,
AS13-1120, AS13-1124,
AH13-1120 & AH13-1124**

LEVEL SUPERSTORE

FLOWLINE



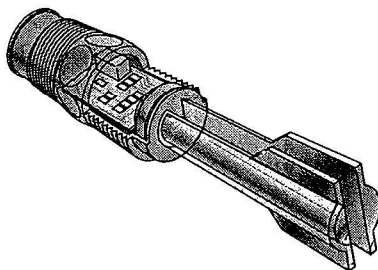
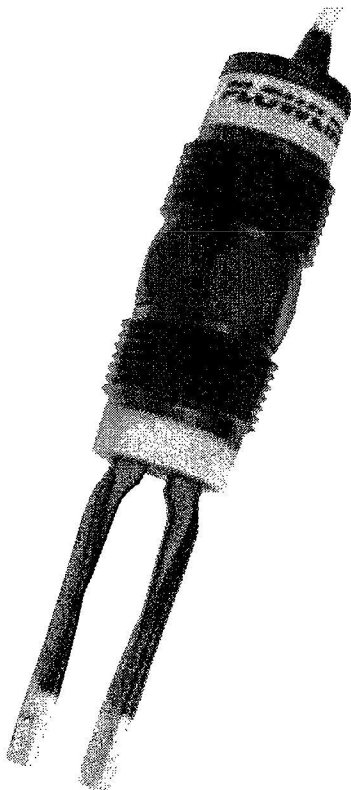
TUNING FORK LEVEL SWITCH

- The switch solution for more challenging coating, scaling or slurry type liquids
- All plastic construction with PP/Ryton® material for corrosive environments
- Application with non-hazardous, light weight solids including grains and pellets
- Sensor and cable rated IP68 for submersible operation in tanks or sumps
- Relay or FET switch output for interface with PLC, SCADA or alarms
- Selectable normally open or normally closed output states

APPLICATION

The tuning fork level switch is an excellent choice for more challenging application liquids including those with light to medium coating or scaling type characteristics. The relay or FET output provides a reliable switch interface with remote devices such as a PLC, SCADA or alarm. The general purpose sensor features a PP submersible probe and cable, and is designed for installation through the wall or inside the tank.

General Purpose	Yes	Non-metallic tank	Yes
Foam	Yes	PP sensor	Yes
Bubbles	Yes	Long sensor	Yes
Conductive	Yes	Relay	Option
Non-conductive	Yes	FET	Option
Clean	Yes	Intrinsically safe	No
Dirty	Yes	PFA sensor	No
Non-coating	Yes	Short sensor	No
Light coating	Yes	Reed	No
Medium coating	Yes	Heavy coating	No
Metallic tank	Yes		



The tuning fork switch vibrates at a nominal frequency of 400 Hz. As the switch becomes immersed in a liquid or slurry, a corresponding frequency shift occurs. When the measured frequency shift reaches the set point value, the switch changes state indicating the presence of a liquid or slurry medium.

SPECIFICATIONS

Accuracy:	± 1 mm in water
Repeatability:	± .5 mm in water
Frequency:	400 Hz. (nominal)
Supply voltage:	12-36 VDC
Consumption:	Relay: 25 mA FET: 8 mA (dry) 19 mA (wet)
Relay rating:	60 VDC/VAC @ 1A
FET rating:	36 VDC @ 100 mA
Switch output:	Selectable NO or NC states
Temp. rating:	F: -40° to 194° C: -40° to 90°
Pressure rating:	150 psi (10 bar) @ 25 °C., derated @ 1.667 psi (.113 bar) per °C. above 25 °C.
Sensor material:	PP / Ryton® (40% glass)
Sensor rating:	NEMA 6 / IP68
Mounting threads:	3/4" NPT (3/4" G)
Mounting gasket:	3/4" Viton (metric only)
Cable type:	8 ft. (2.5 m), 4-wire (relay) or 3-wire (FET), 22 gauge with ground, shield & PP jacket
CE compliance:	EN 50082-2 immunity EN 55011 emission

FLOWLINE

10500 Humbolt Street
Los Alamitos, CA 90720
Tel 562-598-3015
Fax 562-431-8507
www.flowline.com

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Tuning Fork Level Switch		STARTS FROM
LZ10 - 14 ☐ 3		\$ 270
→ Mounting Thread (1)	0 - 3/4" NPT	Add \$ _____
	2 - 3/4" G (add \$5)	
→ Switch Output (2)	2 - FET, N-channel	Add \$ _____
	3 - FET, P-channel	
	5 - Relay, SPDT (add \$20)	Total \$ _____

To special order a 25' of 50' sensor cable, place the cable length at the end of the part number (example: LZ10-1402-25') and add the following: 25' add \$15.00; 50' add \$30.00.

The G thread switch comes with a 3/4" Viton mounting gasket.

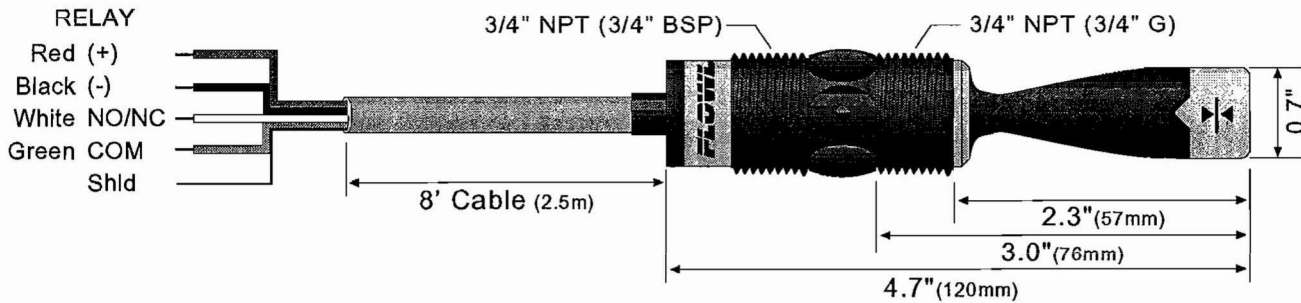
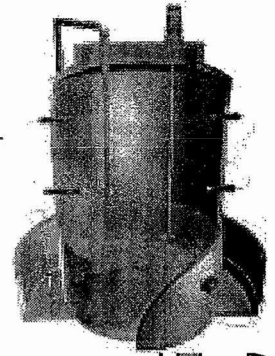
LEVEL EQUIPMENT TAG No.

LE-11 LE-12
LE-21 LE-22

LEVEL SUPERSTORE

FLOWLINE

Tuning Fork Level Switch



FLOWLINE

10500 Humbolt Street
Los Alamitos, CA 90720

Tel 562-598-3015

Fax 562-431-8507

www.flowline.com

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Including Models:

LZ10-1402, LZ10-1403, LZ10-1405,
LZ10-1422, LZ10-1423 & LZ10-1425

LEVEL SUPERSTORE

Warranty, Service & Repair

To register your product with the manufacturer, fill out the enclosed warranty card and return it immediately to:

Flowline Inc.
10500 Humbolt Street
Los Alamitos, CA 90720.

If for some reason your product must be returned for factory service, contact Flowline Inc. to receive a Material Return Authorization number (MRA) first, providing the following information:

1. Part Number, Serial Number
2. Name and telephone number of someone who can answer technical questions related to the product and its application.
3. Return Shipping Address
4. Brief Description of the Symptom
5. Brief Description of the Application

Once you have received a Material Return Authorization number, ship the product prepaid in its original packing to:

Flowline Factory Service
MRA _____
10500 Humbolt Street
Los Alamitos, CA 90720

To avoid delays in processing your repair, write the MRA on the shipping label. Please include the information about the malfunction with your product. This information enables our service technicians to process your repair order as quickly as possible.

FLOWLINE®

Tuning Fork LZ10/LZ11 Series Owner's Manual



Version 2.0
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All rights reserved.
Manual # LZ900001

5/99

WARRANTY

Flowline warrants to the original purchaser of its products that such products will be free from defects in material and workmanship under normal use and service for a period which is equal to the shorter of one year from the date of purchase of such products or two years from the date of manufacture of such products.

This warranty covers only those components of the products which are non-moving and not subject to normal wear. Moreover, products which are modified or altered, and electrical cables which are cut to length during installation are not covered by this warranty.

Flowline's obligation under this warranty is solely and exclusively limited to the repair or replacement, at Flowline's option, of the products (or components thereof) which Flowline's examination proves to its satisfaction to be defective. FLOWLINE SHALL HAVE NO OBLIGATION FOR CONSEQUENTIAL DAMAGES TO PERSONAL OR REAL PROPERTY, OR FOR INJURY TO ANY PERSON.

This warranty does not apply to products which have been subject to electrical or chemical damage due to improper use, accident, negligence, abuse or misuse. Abuse shall be assumed when indicated by electrical damage to relays, reed switches or other components. The warranty does not apply to products which are damaged during shipment back to Flowline's factory or designated service center or are returned without the original casing on the products. Moreover, this warranty becomes immediately null and void if anyone other than service personnel authorized by Flowline attempts to repair the defective products.

Products which are thought to be defective must be shipped prepaid and insured to Flowline's factory or a designated service center (the identity and address of which will be provided upon request) within 30 days of the discovery of the defect. Such defective products must be accompanied by proof of the date of purchase.

Flowline further reserves the right to unilaterally waive this warranty and to dispose of any product returned to Flowline where:

- a. There is evidence of a potentially hazardous material present with product.
- b. The product has remained unclaimed at Flowline for longer than 30 days after dutifully requesting disposition of the product.

THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE OF THIS WARRANTY. This warranty and the obligations and liabilities of Flowline under it are exclusive and instead of, and the original purchaser hereby waives, all other remedies, warranties, guarantees or liabilities, express or implied. EXCLUDED FROM THIS WARRANTY IS THE IMPLIED WARRANTY OF FITNESS OF THE PRODUCTS FOR A PARTICULAR PURPOSE OR USE AND THE IMPLIED WARRANTY OF MERCHANT ABILITY OF THE PRODUCTS.

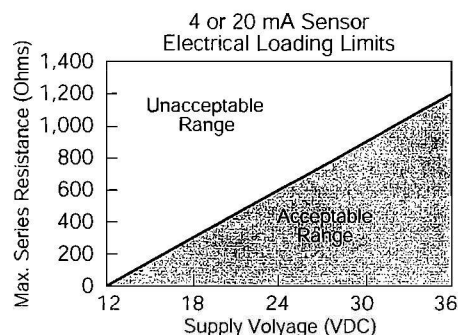
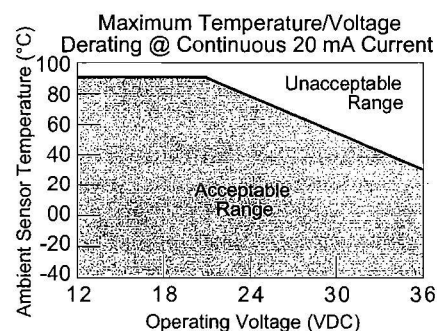
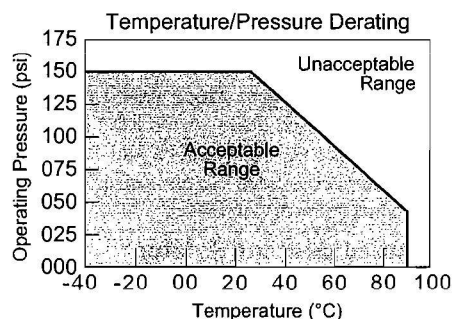
This warranty may not be extended, altered or varied except by a written instrument signed by a duly-authorized officer of Flowline, Inc.

SPECIFICATIONS

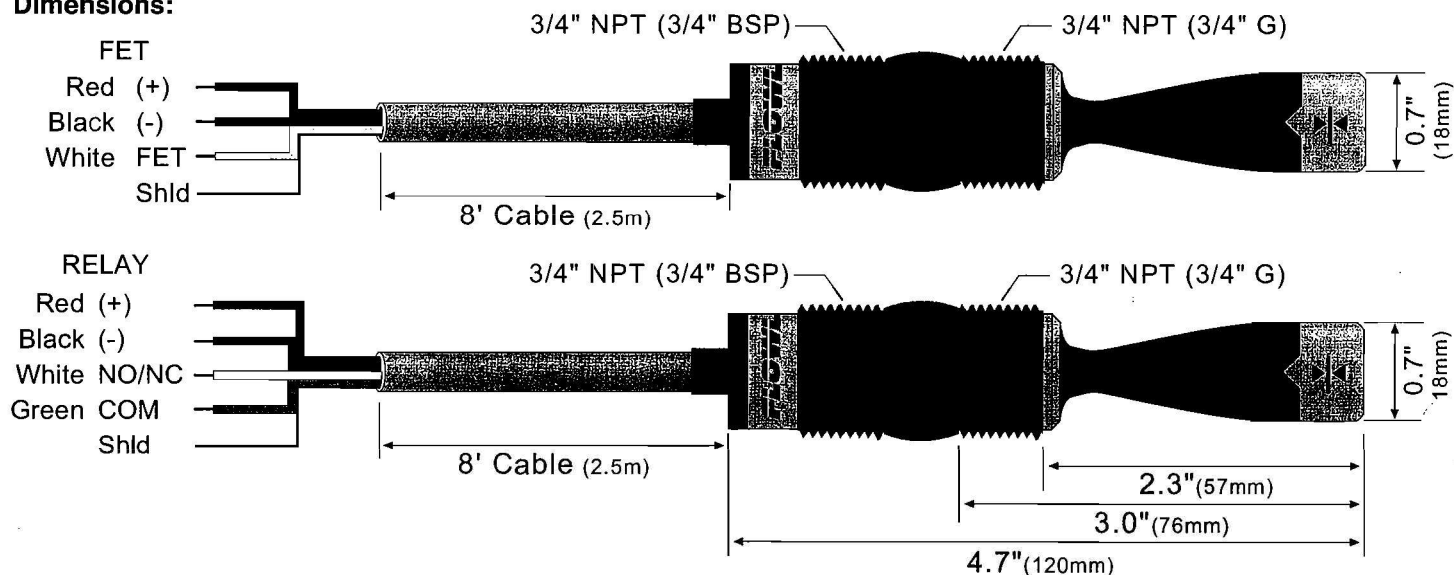
Step One

Accuracy:	± 1 mm in water
Repeatability:	± .5 mm in water
Frequency:	400 Hz (dry)
Supply voltage:	12-36 VDC
Consumption:	Relay: 25 mA
	FET: 8 mA (dry)
	19 mA (wet)
Relay rating:	60 VDC/VAC @ 1A
FET rating:	36 VDC @ 100 mA
Switch output:	Selectable NO or NC states
Temperature range:	F: -40° to 194 °
	C: -40° to 90°
Pressure range:	150 psi (10 bar) @ 25°C., derated @ 1.667
	psi (.113 bar) per °C. above 25° C.
Sensor material:	PP/Ryton® (40% glass)
Sensor rating:	NEMA 6 / IP68
Mounting threads:	3/4" NPT (3/4" G)
Mounting gasket:	Viton (3/4") metric only
Cable type:	8 ft. (2.5 m), 4-wire (relay) or 3-wire (FET),
	22 gauge with ground, shield & PP jacket
CE compliance:	EN 50082-2 immunity
	EN 55011 emission

Tuning Fork Switch	
	LZ1 - 14
Sensor	
0 - General	
1 - Sludge	
Mounting Thread	
0 - 3/4" NPT	
2 - 3/4" G	
Switch Output	
2 - FET, N-Channel	
3 - FET, P-Channel	
5 - Relay	



Dimensions:



SAFETY PRECAUTIONS

Step Two

About this Manual:

PLEASE READ THE ENTIRE MANUAL PRIOR TO INSTALLING OR USING THIS PRODUCT. This manual includes information on two different models of Tuning Fork sensors from FLOWLINE, all in the LZ10 and LZ11 series. Please refer to the part number located on the sensor label to verify the exact model which you have purchased.

⚠ User's Responsibility for Safety:

FLOWLINE manufactures a wide range of liquid level sensors and technologies. While each of these sensors is designed to operate in a wide variety of applications, it is the user's responsibility to select a sensor model that is appropriate for the application, install it properly, perform tests of the installed system, and maintain all components. The failure to do so could result in property damage or serious injury.

⚠ Proper Installation and Handling:

Because this is an electrically operated device, only properly-trained staff should install and/or repair this product. Use a proper sealant with all installations. Note: *Always install the 3/4" Viton gasket with the LZ1_-142_. The G threaded version of the Tuning Fork will not seal unless the gasket is installed properly.* Never overtighten the transmitter within the fitting. Always check for leaks prior to system start-up.

⚠ Material Compatibility:

The LZ10/LZ11 series sensor is available in one wetted material version. The bodies of the LZ1_-14__ are made of PP (Polypropylene) with the forks made of Ryton (40% glass filled). Make sure that the model which you have selected is compatible with the application liquids. To determine the chemical compatibility between the sensor and its application liquids, refer to the Compass Corrosion Guide, available from Compass Publications (858-589-9636).

⚠ Temperature and Pressure:

The LZ10/LZ11 series sensor is designed for use in application temperatures up to 90 °C, and for use at pressures up to 150 psi @ 25 °C., derated @ 1.667 psi per °C. above 25 °C.

⚠ Wiring and Electrical:

The supply voltage used to power the LZ10/LZ11 series sensor should never exceed a maximum of 36 volts DC. Electrical wiring of the sensor should be performed in accordance with all applicable national, state, and local codes.

⚠ Flammable, Explosive and Hazardous Applications:

The LZ10/LZ11 series sensor should not be used within flammable or explosive applications. In hazardous applications, use redundant measurement and control points, each having a different sensing technology.

⚠ WARNING ⚠

Do not squeeze the forks together. Doing so could damage or break the sensor and void the warranty.

Always install the 3/4" Viton gasket with the LZ1_-142_. The G threaded version of the Tuning Fork will not seal unless the gasket is installed properly.

INTRODUCTION

Step Three

Technology:

The Tuning Fork switch vibrates at a nominal frequency of 400 Hz. As the switch becomes immersed in a liquid or slurry, a corresponding frequency shift occurs. When the measured frequency shift reaches the set point value, the switch changes state indicating the presence of a liquid or slurry medium.

The LZ10-14__ is designed for detecting the change between air and liquid mediums. The LZ11-14__ is designed for detecting the change between a liquid medium and a suspension.

Initialization Sequence:

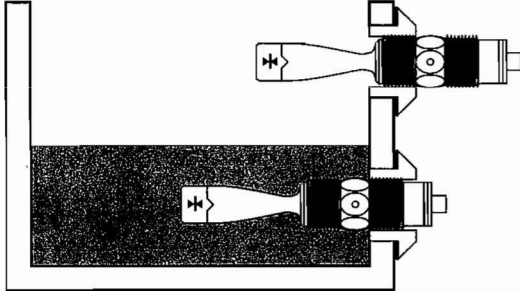
When powering up the LZ10/LZ11, the start-up procedure requires the switch to cycle through a wet condition for 1/2 second in order to determine an initial resonance.

INSTALLATION

Step Four

Through Wall Installation:

FLOWLINE's LZ10/LZ11 series sensors may be installed through the top, side or bottom of a tank wall. The sensor has male 3/4" NPT threads on either side of a 15/16" wrench flat. This enables the user to select the sensor's mounting orientation, installed outside of the tank in, or inside of the tank out.

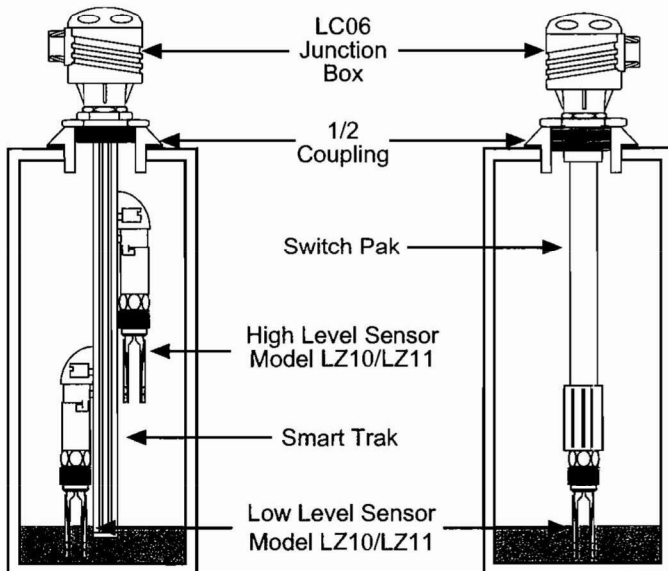


Smart Trak™ Installation:

FLOWLINE's Smart Trak LM10 series mounting system is an in-tank fitting which enables users to install up to four FLOWLINE sensors of any technology, to any depth, along the entire length of a track. Smart Trak may be installed through the top wall of any tank using a standard 2" NPT tank adapter. If no tank top is available, FLOWLINE's side mount bracket, LM50-1001 enables Smart Trak to be installed directly to the side wall of a tank.

Switch Pak™ Installation:

FLOWLINE's Switch Pak LM45 series mounting system is an in-tank fitting which enables users to install one FLOWLINE sensor, of any technology to a specified depth. The FLOWLINE sensor may be installed onto the 3/4" NPT adapter at the end of the Switch Pak. Switch Pak may be installed through the top wall of any tank using a standard 2" NPT tank adapter.



WARNING

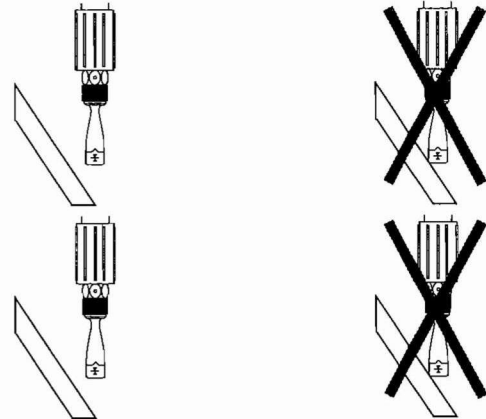
Do not squeeze the forks together. Doing so could damage or break the sensor and void the warranty.

Always install the 3/4" NPT tank adapter with the LZ10/LZ11 sensor. The correct orientation of the tank adapter will correct the sensor's orientation and protect the property.

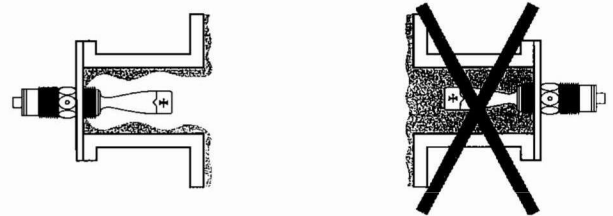
ORIENTATION

Step Five

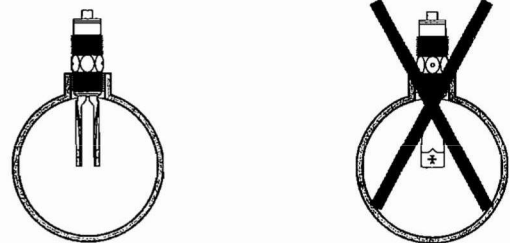
When installing the LZ10/LZ11, make sure that the forks do not touch the walls of the tank. Consider possible build up along the inner tank wall.



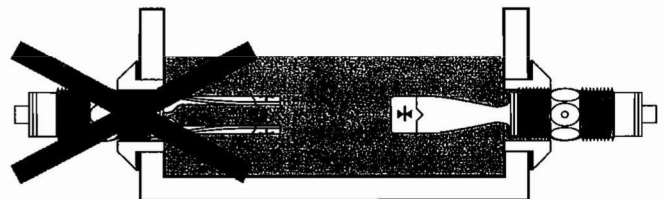
Higher viscosity liquids may build up inside of a flange and cause the LZ10/LZ11 to fail wet.



If installing the tuning fork within a pipe, make sure the forks allow the liquid to flow between them and not around them.



When installing the LZ10/LZ11 horizontally, make sure that the forks orientation is vertical and not horizontal.



ELECTRICAL

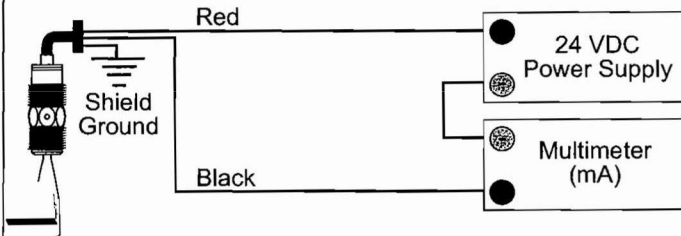
Step Six

Supply Voltage: The supply voltage to the LZ10/LZ11 series sensors should never exceed a maximum of 36 VDC. FLOWLINE controllers have a built-in 13.5 VDC power supply which provides power to all of FLOWLINE's electrically powered sensors. Alternative controllers and power supplies, with a minimum output of 12 VDC up to a maximum output of 36 VDC, may also be used with the LZ10/LZ11 series sensor.

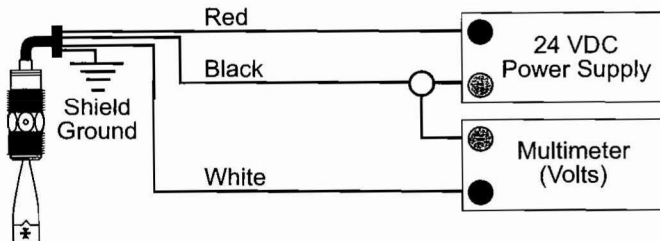
Cable Length: Determine the length of cable required between the LZ10/LZ11 series sensor and its point of termination. Allow enough slack to ensure the easy installation, removal and/or maintenance of the sensor. The cable length may be extended up to a maximum of 1000 feet, using a well-insulated, 20 gauge shielded wire.

Wire Stripping: Using a 10 gauge wire stripper, carefully remove the outer layer of insulation from the last 1-1/4" of the sensor's cable. Unwrap and discard the exposed foil shield from around the signal wires, leaving the drain wire attached if desired. With a 20 gauge wire stripper, remove the last 1/4" of the colored insulation from the signal wires.

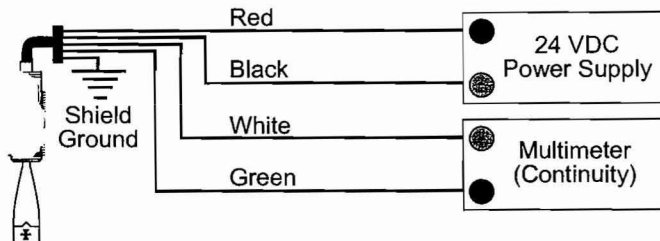
Signal Outputs (Current sensing): The standard method used by FLOWLINE controllers; this method uses only two wires (Red and Black). The sensor draws 8 mA when it is dry, and 19 mA when wet. NC/NO status must be set by the controller. The White wire is not used.



Signal Outputs (FET switching): Allows the sensor to switch a small DC load on or off directly, using all three wires. Model LZ1_-14_2 is an NPN type switch, which toggles the negative side of the load; model LZ1_-14_3 is a PNP type switch for applications where the switch must be on the positive side of the load. In both FET models, the NO/NC status is set by the polarity of the voltage feeding the Red and Black wires, and the White wire connects to the load.



Signal Output (Relay switching): Allows the sensor to switch a small load on or off directly, using an internal 1A relay (60 VAC/60 VDC). Only models LZ1_-14_5 uses the relay and features 4 wires (red, black, white and green) and a shield wire. The NO/NC status is set by the polarity of the voltage feeding the red and black wires. The green wire is the common for the relay and the white wire is the NO or NC, depending on the polarity of red and black.

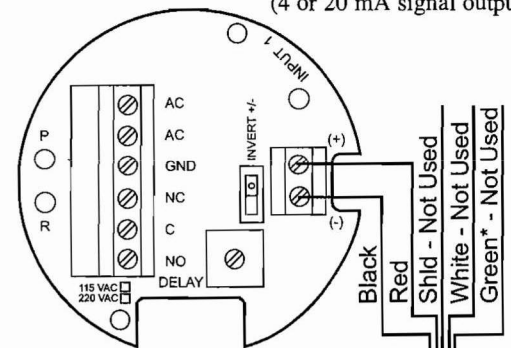


WIRING

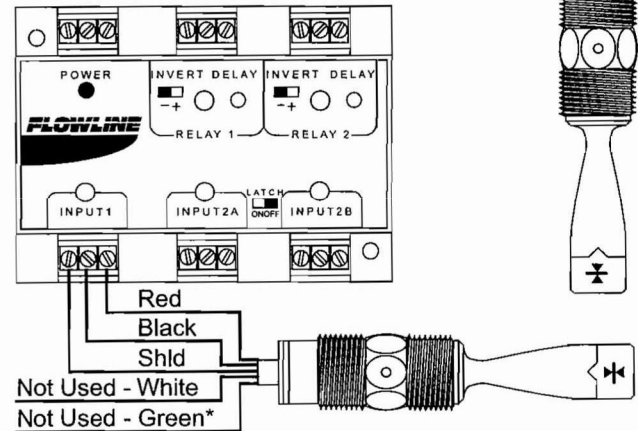
Step Seven

Models LZ1_-140_2, LZ1_-14_3 & LZ1_-14_5 Only Wiring to a FLOWLINE Controller

LC10 Series Controller
(4 or 20 mA signal output)



LC40 Series Controller
(4 or 20 mA signal output)



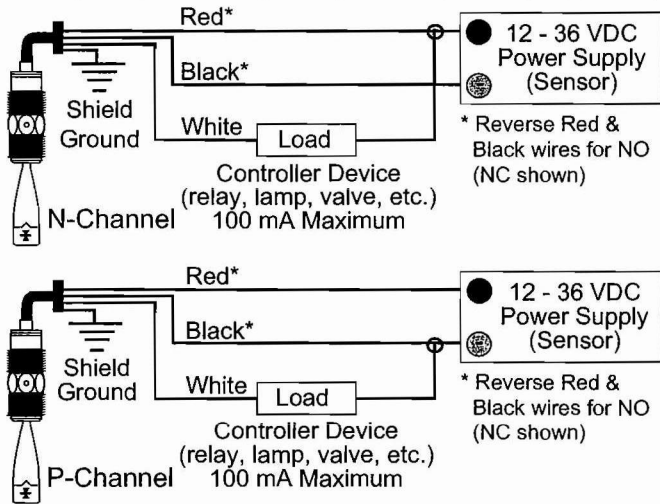
* The Green wire is for model LZ1_-1405 only

WIRING

Step Eight

Models LZ1_-14_2 & LZ1_-14_3 Only

Wiring direct to a load, NC operation (FET signal output)

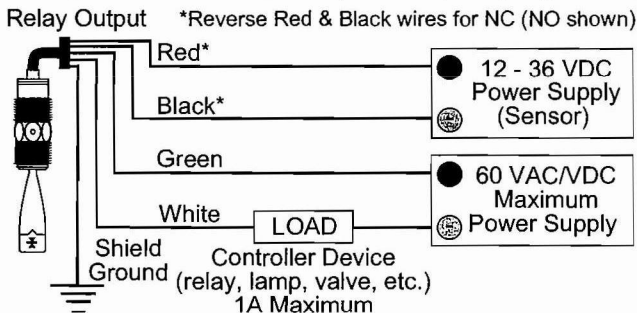


Wiring direct to load, Normally Open operation: LZ1_-14_2 and LZ1_-14_3 (FET outputs only):

This is the same as the wiring for Normally Closed operation, except the polarity of the Red and Black connections to the sensor is reversed. The other connections remain the same; the sensor and device power supplies remain tied in the same polarity as before. This method will turn the load on when the sensor is wet.

Models LZ1_-14_5 Only

Wiring direct to a load, NO operation (Relay signal output)



Wiring direct to load, Normally Closed operation: LZ1_-14_5 (Relay outputs only):

This is the same as the wiring for Normally Open operation, except the polarity of the Red and Black connections to the sensor is reversed. The other connections remain the same; the sensor and device power supplies remain tied in the same polarity as before. This method will turn the load on when the sensor is dry.

MAINTENANCE

Step Nine

General:

The LZ10/LZ11 series sensor itself requires no periodic maintenance except cleaning as required. It is the responsibility of the user to determine the appropriate maintenance schedule, based on the specific characteristics of the application liquids.

Cleaning Procedure:

- Power:** Make Sure that all power to the sensor, controller and/or power supply is completely disconnected.
- Sensor Removal:** In all through-wall installations, make sure that the tank is drained well below the sensor prior to removal. Carefully, remove the sensor from the installation.
- Cleaning the Sensor:** Use a soft bristle brush and mild detergent, carefully wash the LZ10/LZ11 series sensor. Do not use harsh abrasives such as steel wool or sandpaper, which might damage the surface sensor. Do not use incompatible solvents which may damage the sensor's Polypropylene plastic body.
- Sensor Installation:** Follow the appropriate steps of installation as outlined in the installation section of this manual.

Testing the installation:

- Power:** Turn on power to the controller and/or power supply.
- Immersing the switch:** Immerse the sensing tip in its application liquid, by filling the tank up to the switches point of actuation. An alternate method of immersing the switch during preliminary testing is to hold a cup filled with application liquid up to the switch's tip.
- Test:** With the switch being fluctuated between wet and dry states, the switch indicator light in the controller should turn on and off. If the controller doesn't have an input indicator, use a voltmeter or ammeter to ensure that the switch produces the correct signal.
- Point of actuation:** Observe the point at which the rising or falling fluid level causes the switch to change state, and adjust the installation of the switch if necessary.

Attachment F