



CONSOLIDATED ELECTRIC Co.

RIVERVIEW INDUSTRIAL PARK ◀ 141 SOUTH LAFAYETTE FREEWAY (HWY. 56)
ST. PAUL, MINNESOTA 55107

Automation and supervisory control systems for municipal and industrial water supply, waste treatment and process applications 612/224-9474

SUBMITTAL

DATE ENTERED 5-6-75

CUSTOMER ORDER NO. 75-JMC-9

CECO 15726

JACKSONVILLE, N.C. -8U

147-29-75

15726-03/EM-1

Quote #3397

JOB No 15726

Page 1

60 4078-3/12/76

Page 1

SOLD TO

The McMahan Co., Inc.
P.O. Box 88382
Dunwoody, GA. 30338

REQUESTED MARK

PPD COLLECT

SHIP TO

Peabody Southeast Co.
c/o Marine Air Station
(Helicopter) New River
Jacksonville, N.C. 28540

FOB ST. PAUL DEST.

TERMS NET 30 DAYS

REQUESTED DATE

After approval

VIA

McLean

ITEM	QUANTITY	BULLETIN	MODEL	VOLTS	PHASE	NEMA TYPE
		Serial #15726				
		Per Page 77 of Plans - MANS-26 Sewage lift Sta. Section 15J P. 334 of specs.				
A	1	Bulletin A700	Model 2ASX			Nema type 1 Powerpack Control Panel for operation on 208 volt, 3 phase, 4 wire, 60 cycle power supply. This panel is to provide control for two pumps in pump-down operation.
		Starters to control 7½ H.P., 1750 R.P.M. standard motors having nameplate full load current 24.0 amps. Provide 3 pole overload relays.				
		INCLUDE FOLLOWING OPTIONS:				
		a) 2 - Nema Size 1 MS/CE x-line combos with H-O-A switches, door interlock handles				
		b) Automatic alternation with manual over-ride switch				
		c) High and low alarm sensors, suction failure control				
		d) Independent start, common off operation for bubbler				
		e) Duplex receptacle, on left side of encl. weatherproof				
		f) 3½" Gauge, door mounted 0-160"				
		g) Air flow package				
		h) 2 - Reed type air compressors with timed alternation No storage				
		i) High temp. shut-down of pumps (Klixon circuits)				
		j) 4 Circuit lighting panel, Bolt-on type				
		1) Control 2) Duplex Recept. 3) Compressor 4) Spa				

SETS DATA SENT

DATE

TO

8/12/75

McMahan Co.
Ceco

Resubmit 3-16-76

HELD FROM PRODUCTION YES NO

FOR INFORMATION

APPROVAL RECEIVED

FOR APPROVAL

DATE





CONSOLIDATED ELECTRIC Co.

RIVERVIEW INDUSTRIAL PARK ◀ 141 SOUTH LAFAYETTE FREEWAY (HWY. 56)
ST. PAUL, MINNESOTA 55107

Automation and supervisory control systems for municipal and industrial water supply, waste treatment and process applications 612/224-9474

SUBMITTAL

DATE ENTERED 5-6-75 CUSTOMER ORDER NO. 75-JMC-9 CECO 15726 JACKSONVILLE, N.C.
T-7-29-75 15726-CS/EM-1 CO 4078 - 3/12/76

Page 2

JOB 15726
Page 2

SOLD TO The McMahan Co., Inc.
P.O. Box 88382
Dunwoody, GA. 30338

SHIP TO Peabody Southeast Co.
c/o Marine Air Station
(Helicopter) New River
Jacksonville, N.C. 28540

REQUESTED MARK

PPD COLLECT
X
FOB ST. PAUL DEST.
X Freight Allowed
TERMS NET 30 DAYS

QFC:el

REQUESTED DATE After approval VIA McLean

ITEM	QUANTITY	BULLETIN	MODEL	VOLTS	PHASE	NEMA TYPE
B	1	<p>Serial #15726-B</p> <p>Page 72 and Page 74 of Plans - Geiger Surge Basin, Effluent Station.</p> <p>Motor Control Center, Nema 12 enclosure, Type 1-A wiring. Service available is 240 volt, 3 phase, 4 wire. To include standard MCC construction and paint of enclosures</p> <ul style="list-style-type: none"> a) Main Circuit Breaker - 200 a b) 3 - Size 1 MS/Circuit breaker x-line for 5 H.P. aerators with start-stop pushbuttons and 2 aux. contacts on each starter. Fla. is 14.6, 2 pilot lites c) 2 - Size 2 MS/Circuit breaker x-line for 15 H.P. sewage pumps with H-O-A Fla. 48.4, 2 pilot lites d) Bulletin A700, Model 2ASHLX, Basic Control Panel for operation on 120 volt, single phase, 2 wire, 60 cycle power supply. This panel is to provide control for two pumps in pump-down operation. <p>Starters to control 15H.P., 850 R.P.M. standard motors having nameplate full load current 48.4 amps. Provide 3 pole overload relays. M.S. ect. in MCC.</p> <ul style="list-style-type: none"> e) Automatic alternation with manual over-ride switch f) High and low alarm sensors, suction failure control g) Independent start, common off operation for bubbler h) Duplex receptacle on left side on encl. weatherproof i) 3/4" Gauge, door mtd 0-160" 				

SETS DATA SENT DATE TO

See Page 1

HELD FROM PRODUCTION
YES NO

FOR INFORMATION

APPROVAL RECEIVED

FOR APPROVAL

DATE

1930



CONSOLIDATED ELECTRIC Co.

RIVERVIEW INDUSTRIAL PARK ◀ 141 SOUTH LAFAYETTE FREEWAY (HWY. 56)
ST. PAUL, MINNESOTA 55107

Automation and supervisory control systems for municipal and industrial water supply, waste treatment and process applications 612/224-9474

SUBMITTAL

DATE ENTERED 5-6-75 CUSTOMER ORDER NO. 75-JMC-9 CECO 15726 JACKSONVILLE, N.C.
T-7-29-75 15726-CS/EM-1 CO 4078 - 3/12/76

Page 3

JOB 15726
Page 3

SOLD TO The McMahan Co., Inc.
P.O. Box 88382
Dunwoody, GA. 30338

SHIP TO Peabody Southeast Co.
c/o Marine Air Station
(Helicopter) New River
Jacksonville, N.C. 28540

REQUESTED MARK

PPD COLLECT

X
FOB ST. PAUL DEST.

X Freight allowed
TERMS: NET 30 DAYS

QFC:el

REQUESTED DATE

After approval

VIA

McLean

ITEM	QUANTITY	BULLETIN	MODEL	VOLTS	PHASE	NEMA TYPE
	Continued	j)	Air Flow package			
		k)	2 - Reed type air compressors with timed alternat No storage			
		l)	Hi temperature shut-down of pumps, Klixon circuit			
		m)	4 Circuit lighting panel, Bolt-on type			
		n)	Condensation heater & thermo switch			
		Serial #15726-C				
		Per Page 45 of Plans - Curtis Road Raw Water Booster Station				
C	1	Motor Control Center, Nema 12 enclosure Type 1-A wiring service available is 480 volt, 3 phase, 4 wire, to include std MCC construction and painting.				
		a)	2 - Nema Size 2 YD/MS x-line combo with CPT's start-stop pushbuttons, aux. contacts, 2 pilot lites for 25 H.P. pumps Fla. 32.5			
		b)	Lightning arrester 3 pole			
		c)	Lighting transformer and fused disconnect switch.			
		d)	4 Circuit lighting panel, bolted conn. type			
		e)	Low suction pressure cut-off and restore of pumps, range 0-60 psig (see plan sheet 45)			
		f)	Receiving panel to interface with main panel (start stop pumps, ect.) with phone jacks and pushbutton			
		g)	Condensation heater and thermo switch			

SETS DATA SENT DATE TO

See page 1

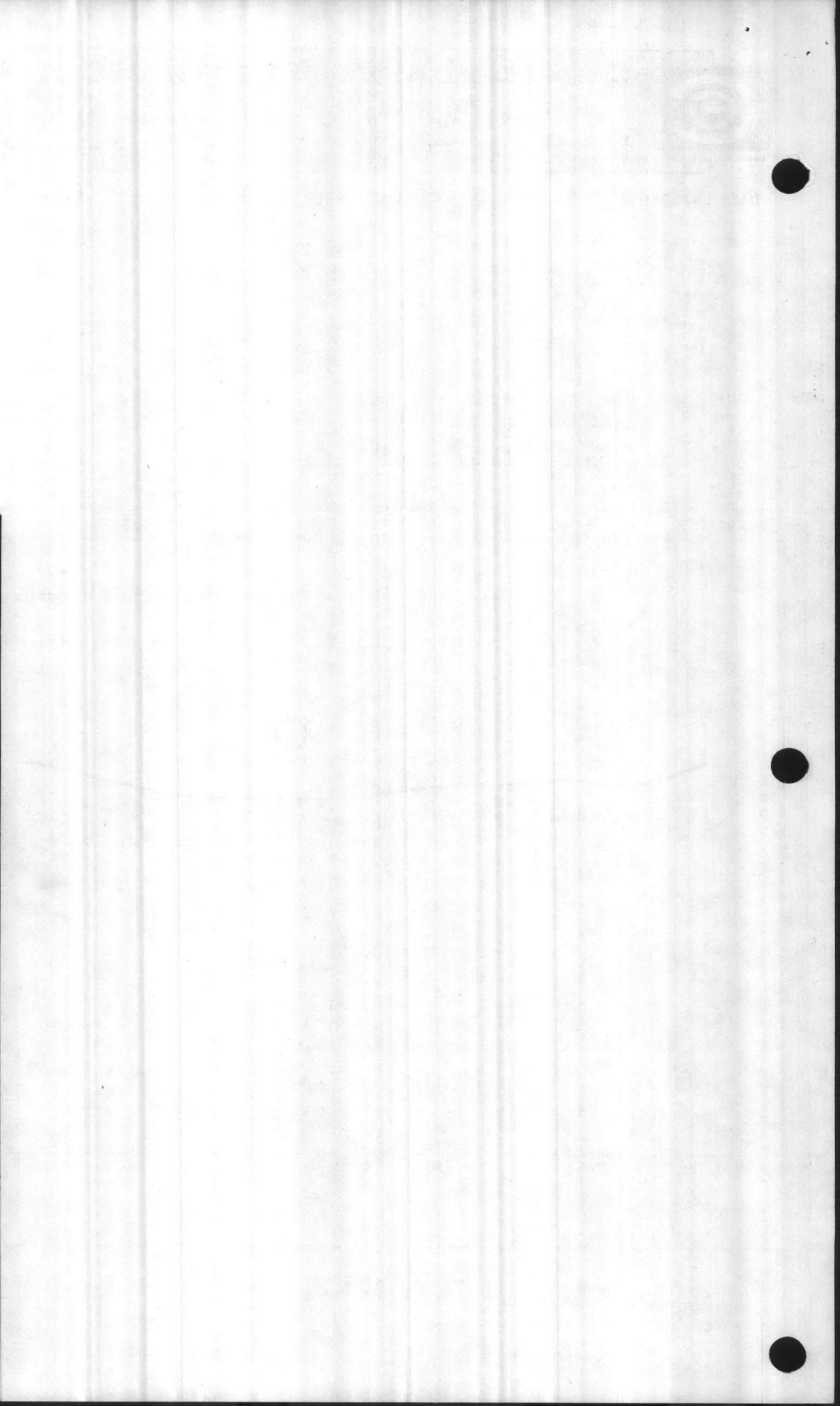
HELD FROM PRODUCTION
YES NO

FOR INFORMATION

APPROVAL RECEIVED

FOR APPROVAL

DATE





CONSOLIDATED ELECTRIC Co.

RIVERVIEW INDUSTRIAL PARK ◀ 141 SOUTH LAFAYETTE FREEWAY (HWY. 56)
ST. PAUL, MINNESOTA 55107

Automation and supervisory control systems for municipal and industrial water supply, waste treatment and process applications 612/224-9474

SUBMITTAL

DATE ENTERED 5-6-75

CUSTOMER ORDER NO. 75-JMC-9

JACKSONVILLE, N.C.

T-7-29-75

15726-CS/EM-1

CO 4078-3/12/76

JOB 15726

Page 4

Page 4

SOLD TO

The McMahan Co., Inc.
P.O. Box 88382
Dunwoody, GA. 30338

PPD COLLECT

SHIP TO

Peabody Southeast Co.
c/o Marine Air Station
(Helicopter) New River
Jacksonville, N.C. 28540

REQUESTED MARK

FOB ST. PAUL DEST.

Freight Allowed
TERMS NET 30 DAYS

OFC:el

REQUESTED DATE

After approval

VIA

McLean

ITEM	QUANTITY	BULLETIN	MODEL	VOLTS	PHASE	NEMA TYPE
------	----------	----------	-------	-------	-------	-----------

D

1

Serial #15726-**D**

Per Plan Sheet 52-54-56 - Ref. sheet 73 New River Sewage Pump Station

Motor Control Center, Nema 12 enclosure, Nema type 1-A wiring, service available is 208 volt, 3 phase, 4 wire, to include;

- a) Main circuit breaker 200 amp trip
- b) Automatic transfer switch
- c) 3 - Size 2 MS/CB x-line combo with H-0-A, 2 aux. contacts, 2 pilot lights ea. starter, for 10 H.P. pumps, 28.0 Fla. CPT's
- d) Panel board "L" and circuit breaker for main
- e) Mount and wire 2 sonar units, customer supplied
- f) 3 Pole lightning arrestor
- g) Telemetering of wet pit alarm and pump status to sewage treatment plant annunciator via 1" conduit and cables. Wet pit alarms by Mod. 9G Float Switches
- h) Condensation heater and thermo switch
- i) 3 Load Relays for pump control from sonar level unit

SETS DATA SENT DATE TO

See Page 1

HELD FROM PRODUCTION
YES NO

FOR INFORMATION

APPROVAL RECEIVED

FOR APPROVAL

DATE





CONSOLIDATED ELECTRIC CO.

RIVERVIEW INDUSTRIAL PARK ◀ 141 SOUTH LAFAYETTE FREEWAY (HWY. 56)
ST. PAUL, MINNESOTA 55107

Automation and supervisory control systems for municipal and industrial water supply, waste treatment and process applications 612/224-9474

SUBMITTAL

DATE ENTERED 5-6-75
T-7-29-75

CUSTOMER ORDER NO. 75-JMC-9 CECO 15726
15726-CS/EM-1 CO 4078 - 3/12/76

JACKSONVILLE, N.C.

Page 5

JOB 15726

SOLD TO

The McMahan Co., Inc.
P.O. Box 88382
Dunwoody, GA. 30338

Page 5

SHIP TO

Peabody Southeast Co.
c/o Marine Air Station
(Helicopter) New River
Jacksonville, N.C. 28540

REQUESTED MARK

PPD COLLECT

X
FOB ST. PAUL DEST.

Freight allowed
TERMS NET 30 DAYS

OFC:el

REQUESTED DATE

After approval

VIA

McLean

ITEM	QUANTITY	BULLETIN	MODEL	VOLTS	PHASE	NEMA TYPE
------	----------	----------	-------	-------	-------	-----------

Serial #15726-E1 - 15726-E2
15726-E3 - 15726-E4 - 15726-E5

Per sheet 43 of plans, Wells N, O, P, Q, and R
See sheet 44 for drive interlock

Consolidated Powerpack Panel, Nema 1, service available is 208 volt, 3 phase, 4 wire to control 1 well pump, to include;

- a) 3 Pole lightning arrestor
- b) 1 - Size 2 ED/MS x-line combo with start-stop pushbutton
- c) Interlock engine and electric drives, double throw switch
- d) Relay panel with phone jack and call button
- e) 2 pole Disc. sw. With fuses for lights & Duplex outlet

SETS DATA SENT DATE TO

See Page 1

HELD FROM PRODUCTION
YES NO

FOR INFORMATION

APPROVAL RECEIVED

FOR APPROVAL

DATE





CONSOLIDATED ELECTRIC CO.

RIVERVIEW INDUSTRIAL PARK ◀ 141 SOUTH LAFAYETTE FREEWAY (HWY. 56)
ST. PAUL, MINNESOTA 55107

Automation and supervisory control systems for municipal and industrial water supply, waste treatment and process applications 612/224-9474

SUBMITTAL

DATE ENTERED 5-6-75
1-7-29-75

CUSTOMER ORDER NO. 75-JMC-9

CECO 15726

JACKSONVILLE, N.C.

15726-CS/EM-1

CO 4078 - 3/12/76

Page 6

JOB 15726

SOLD TO

The McMahan Co., Inc.
P.O. Box 88382
Dunwoody, GA. 30338

Page 6

SHIP TO

Peabody Southeast Co.
c/o Marine Air Station
(Helicopter) New River
Jacksonville, N.C. 28540

REQUESTED MARK

PPD COLLECT

X
FOB ST. PAUL DEST.

X Freight allowed
TERMS: NET 30 DAYS

OFC:el

REQUESTED DATE

After approval

VIA

McLean

ITEM	QUANTITY	BULLETIN	MODEL	VOLTS	PHASE	NEMA TYPE
F	1					
Serial #15726- <u>F</u>						
Per Pages 37 and 40 of plans, Clearwell Probe Control System						
Control panel for three clearwell pumps, basic control only, Nema 1 enclosure, service available is 120 volt, single phase, 2 wire, to include;						
a) Pumps are started-stopped by pushbuttons on pump starters, located elsewhere						
b) D100 Probe system						
1) Hi alarm						
2) Low alarm and pump cut-off (manual restore)						
3) Hi alarm drop-out						
4) Lo alarm drop-out						
5) Ground						
c) Relays as required						

SETS DATA SENT DATE TO

See Page 1

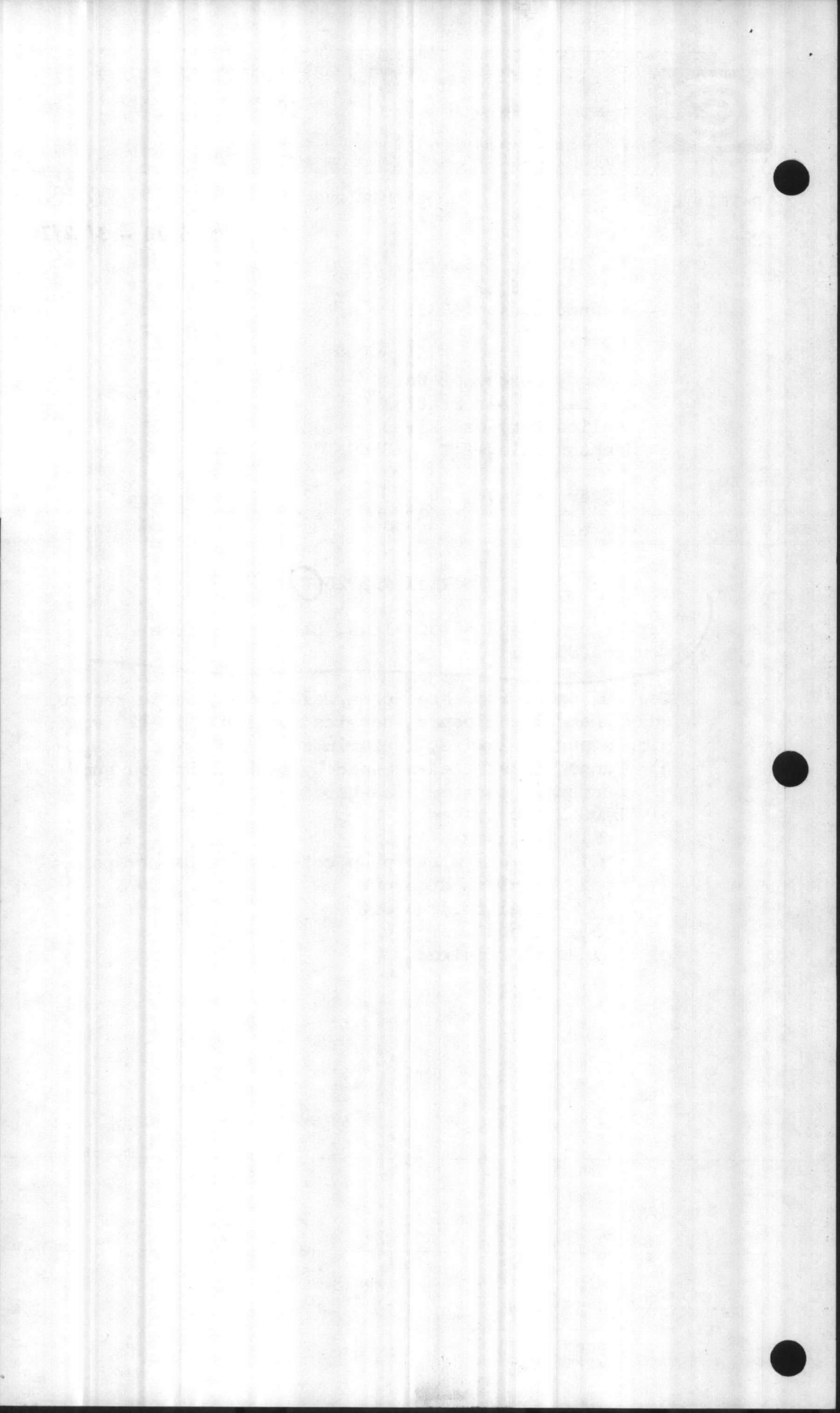
HELD FROM PRODUCTION
YES NO

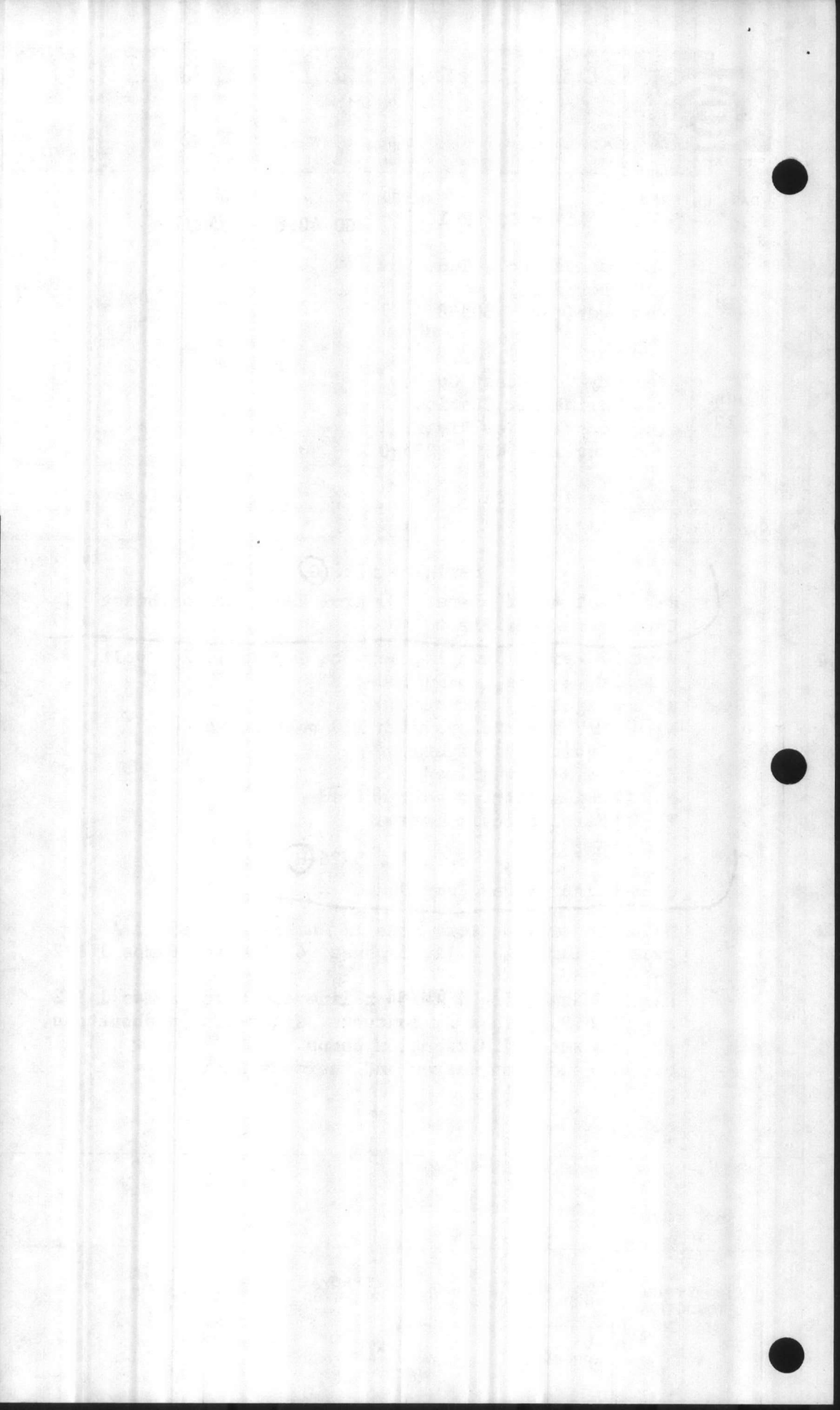
FOR INFORMATION

APPROVAL RECEIVED

FOR APPROVAL

DATE







CONSOLIDATED ELECTRIC CO.

RIVERVIEW INDUSTRIAL PARK ◀ 141 SOUTH LAFAYETTE FREEWAY (HWY. 56)
ST. PAUL, MINNESOTA 55107

Automation and supervisory control systems for municipal and industrial water supply, waste treatment and process applications 612/224-9474

SUBMITTAL

DATE ENTERED 5-6-75 CUSTOMER ORDER NO. 75-JMC-9 CECO 15726
T-7-29-75 15726-CS/EM-1 GO 4078 - 3/12/76
Page 8

JACKSONVILLE, N.C.

SOLD TO The McMahan Co., Inc.
P.O. Box 88382
Dunwoody, GA. 30338

JOB 15726
Page 8

SHIP TO Peabody Southeast Co.
c/o Marine Air Station
(Helicopter) New River
Jacksonville, N.C. 28540

REQUESTED MARK

PPD COLLECT

X
FOB ST. PAUL DEST.

X Freight allowed
TERMS NET 30 DAYS

OFC:el

REQUESTED DATE After approval VIA McLean

ITEM	QUANTITY	BULLETIN	MODEL	VOLTS	PHASE	NEMA TYPE
		Serial #15726-I				
		Per sheet 73 of plans Camp Geiger Sewage Treatment Plant				
I	1	Power and Control Center, Nema 1, 240 volt, 3 phase, 4 wire construction, Nema 1-A wiring. Condensation heater and thermo switch.				
		Serial #15726-J				
J	1	Annunciator Panel - to be located at Geiger Sewage Treatment Plant - Nema 1, 120 volt, single phase, 2 wire service. Includes lights, sound power, telephone jack and alarm stations				
		Serial #15726-K				
K	1	Sewage Filter Control Console, Nema 1, 120 volt, single phase, 2 wire, to include; a) Flow rate instruments, furnished by others, Ceco to mount and wire b) Logic and programming for automatic backwash of two sewage plant filters c) Filter headloss indicators, furnished by others, Ceco to mount and wire				

SETS DATA SENT DATE TO

See Page 1

HELD FROM PRODUCTION
YES NO

FOR INFORMATION

APPROVAL RECEIVED

FOR APPROVAL

DATE





CONSOLIDATED ELECTRIC Co.

RIVERVIEW INDUSTRIAL PARK ◀ 141 SOUTH LAFAYETTE FREEWAY (HWY. 56)
ST. PAUL, MINNESOTA 55107

Automation and supervisory control systems for municipal and industrial water supply, waste treatment and process applications 612/224-9474

SUBMITTAL

DATE ENTERED 5-6-75 CUSTOMER ORDER NO. 75-JMC-9 CECO 15726
T-7-29-75 15726-CS/EM-1 CO 4078 - 3/12/76

JACKSONVILLE, N.C.

Page 9
SOLD TO The McMahan Co., Inc.
P.O. Box 88382
Dunwoody, GA. 30338

JOB 15726
page 9

SHIP TO Peabody Southeast Co.
c/o Marine Air Station
(Helicopter) New River
Jacksonville, N.C. 28540

REQUESTED MARK

PPD COLLECT

X
FOB ST. PAUL DEST.

X Freight allowed
TERMS: NET 30 DAYS

QFC:el

REQUESTED DATE After approval VIA McLean

ITEM	QUANTITY	BULLETIN	MODEL	VOLTS	PHASE	NEMA TYPE
Continued		d)	L1LO and auto. restore of effluent pumps from A1000 system			
		e)	Control for electric motor valve operators (furnished by others)			
		f)	Filter effluent and B.W. influent valves will be modulated type with position meters			
		g)	AN-01 Controller for each filter, to operate from A1000 Transducer			
		h)	2-Setpoint controllers, furnished by CECO with Servo output, to control filter effluent valves from filter level			
		i)	2 - 96 Pin Timers for Sludge Valve control			
			Serial #15726-11 - 15726-L2 - 15726-			
			Per Page 38 of Plans New River Water Treatment Plant			
L	3		Filter Consoles, Nema 1, service required is 120 volt single phase, 2 wire.			
		a)	Manual control system			
		b)	Mount and wire flow instruments as required. Instruments furnished to Ceco			
		c)	Stop/Start pushbuttons for two (2) surface wash pumps			

SETS DATA SENT DATE TO

See Page 1

HELD FROM PRODUCTION
YES NO

FOR INFORMATION

APPROVAL RECEIVED

FOR APPROVAL

DATE





CONSOLIDATED ELECTRIC Co.

RIVERVIEW INDUSTRIAL PARK ◀ 141 SOUTH LAFAYETTE FREEWAY (HWY. 56)
ST. PAUL, MINNESOTA 55107

Automation and supervisory control systems for municipal and industrial water supply, waste treatment and process applications 612/224-9474

SUBMITTAL

JACKSONVILLE, N.C.

DATE ENTERED 5-6-75
T-7-29-75

15726-CS/Em-1 CUSTOMER ORDER NO.

75-JMC-9 CECO 15726
CO 4078 - 3/12/76

15726

Page 10

Page 10

SOLD TO The McMahan Co., Inc.
P.O. Box 88382
Dunwoody, GA. 30338

SHIP TO Peabody Southeast Co.
c/o Marine Air Station
(Helicopter) New River
Jacksonville, N.C. 28540

REQUESTED MARK

PPD COLLECT

FOB ST. PAUL DEST. Freight allowed

TERMS: NET 30 DAYS

REQUESTED DATE After approval VIA McLean

ITEM	QUANTITY	BULLETIN	MODEL	VOLTS	PHASE	NEMA TYPE
M	1	Serial #15726-M Per Sheet 39 New River Water Treatment Plant Main Control Panel as shown - rear entry type				
N	13	Serial #15726-N1 thru #15726-N13 Relay panels as required, for remote pumps in Nema 1 encl.				
O	1	Serial #15726-O Camp Geiger Elevated Tank Remote sensing transmitter, Nema 4, 120 volt, single phase, 2 wire, to include: a) Condensation heater and thermo switch				
P	1	Serial #15726-P Campbell St. Elev. Tank (New River) Remote sensing transmitter, Nema 4, 120 volt, single phase, 2 wire, to include: a) Condensation heater and thermo switch				

SETS DATA SENT DATE TO
See Page 1

HELD FROM PRODUCTION YES NO	FOR INFORMATION	APPROVAL RECEIVED
	FOR APPROVAL	DATE





CONSOLIDATED ELECTRIC CO.

RIVERVIEW INDUSTRIAL PARK ◀ 141 SOUTH LAFAYETTE FREEWAY (HWY. 56)
ST. PAUL, MINNESOTA 55107

Automation and supervisory control systems for municipal and industrial water supply, waste treatment and process applications 612/224-9474

SUBMITTAL

DATE ENTERED 5-6-75 CUSTOMER ORDER NO. 75-JMC-9 CECO 15726
T-7-29-75 15726-CS/EM-1

JACKSONVILLE, N.C.

Page 11

CO 4078 - 3/12/76

JOB 15726

SOLD TO

The McFahan Co., Inc.
P.O. Box 88382
Dunwoody, GA. 30338

Page 11

SHIP TO

Peabody Southeast Co.
c/o Marine Air Station
(Helicopter) New River
Jacksonville, N.C. 28540

REQUESTED MARK

PPD COLLECT

X
FOB ST. PAUL DEST.

X Freight allowed
TERMS NET 30 DAYS

QFC:el

REQUESTED DATE

After approval

VIA

McLean

ITEM	QUANTITY	BULLETIN	MODEL	VOLTS	PHASE	NEMA TYPE
------	----------	----------	-------	-------	-------	-----------

Q	1	Serial #15726-Q	White St. Elev. Tank (New River)			
			Remote Sensing Transmitter, Nema 4, 120 volt, single phase, 2 wire, to include;			
			a) Condensation heater and thermo switch			

R	1	Serial #15726-R	New River Ground Reservoir			
			Remote sensing Transmitter, Nema 4, 120 volt, single phase, 2 wire, to include;			
			a) Condensation heater and thermo switch			

S	1	Serial #15726-S	Camp Geiger Ground Reservoir			
			Remote Sensing Transmitter, Nema 12, 120 volt, single phase, 2 wire, to include;			
			a) Condensation heater and thermo switch			

T	2	Serial #15726-T1 - 15726-T2	Bulletin A1000, Model 157GTMA, Submersible Level Transducer for sensing level in each filter at the Camp Geiger Sewage Treatment Plant.			
---	---	-----------------------------	---	--	--	--

SETS DATA SENT DATE TO

See Page 1

HELD FROM PRODUCTION
YES NO

FOR INFORMATION

APPROVAL RECEIVED

FOR APPROVAL

DATE



CONSOLIDATED ELECTRIC Co.

RIVERVIEW INDUSTRIAL PARK ◀ 141 SOUTH LAFAYETTE FREEWAY (HWY. 56)
ST. PAUL, MINNESOTA 55107

Automation and supervisory control systems for municipal and industrial water supply, waste treatment and process applications 612/224-9474

SUBMITTAL

DATE ENTERED 5-6-75 CUSTOMER ORDER NO. 75-JMC-9
T-7-29-75 15726-CS/RM-1
Page 12 CO 4078 - 3/12/76

JACKSONVILLE, N.C.

JOB 15726 - SU

Page 12

SOLD TO The McMahan Co., Inc.
P.O. Box 88382
Dunwoody, GA. 30338

PPD COLLECT

SHIP TO Peabody Southeast Co.
c/o Marine Air Station
(Helicopter) New River
Jacksonville, N.C. 28540

REQUESTED MARK

FOB ST. PAUL DEST.

X Freight Allowed
TERMS NET 30 DAYS

QTC:el

REQUESTED DATE After approval VIA McLean

ITEM	QUANTITY	BULLETIN	MODEL	VOLTS	PHASE	NEMA TYPE
U	5	Bull. B100 Model 9G NOG DAFS, 20' cable				
						(normally open)
V	1	Bull. B100 Model 9G NCG DAFS, 20' cable				
						(normally closed)
W	6	Bull. B100 Model 9G CLI Clamps				
X	1	Probe Head #3E5B, for New River Water Plant Clearwell				
Y	5	Probes, insulated 3R type - PVC insulated				
		7 foot 3R7B1				
		6½ foot 3R6½B1				
		7½ foot 3R7½B1				
		3 foot 3R3B1				
		2½ foot 3R2½B1				
Z	4	Telephones Sound Powered				
		Stromberg-Carlson #70219-675 with Alpha #690/4 coiled				
		cord and Newark #39F763 Phone Plug (Switchcraft #250)				
	3	Sets Drawings and Instructions				

Transp

cont. on page 13

SETS DATA SENT DATE TO

See Page 1

HELD FROM PRODUCTION
YES NO

FOR INFORMATION

APPROVAL RECEIVED

FOR APPROVAL

DATE





CONSOLIDATED ELECTRIC CO.

RIVERVIEW INDUSTRIAL PARK ◀ 141 SOUTH LAFAYETTE FREEWAY (HWY. 56)
ST. PAUL, MINNESOTA 55107

Automation and supervisory control systems for municipal and industrial water supply, waste treatment and process applications 612/224-9474

SUBMITTAL

DATE ENTERED

CUSTOMER ORDER NO.

Page 13

T-3/12/76 ADD to 15726

75-JMC-9/ CECO 15726
CO 4078 - 3/12/76

JACKSONVILLE, N.C.

JOB

15726 - Page 13

SOLD TO

The McMahan Co., Inc.
P.O. Box 88382
Dunwoody, Ga. 30338

REQUESTED MARK

PPD

COLLECT

SHIP TO

Peabody Southeast Co.
c/o Marine Air Station
(Helicopter) New River

FOB ST. PAUL DEST.

TERMS NET 30 DAYS
Freight Allowed

REQUESTED DATE

Jacksonville, N.C. 28540

VIA

TM:AAV:TB

After approval
BULLETIN MODEL

McLean
NEMA TYPE

ITEM QUANTITY

VOLTS PHASE

AT CAMP GEIGER SEWAGE PLANT DECANT BASIN

Serial # 15726-AA

POWERPACK , NEMA 12 Duplex Control Panel for operation on 230 Volt/ 3 Phase/ 4 Wire/ 60 hz. power.

To provide manual control with low level cutout for two 3 H.P. Decant Pumps.

INCLUDE THE FOLLOWING OPTIONS:

- a) High Temperature shutdown of pumps
- b) High Alarm from 9G
- c) 4 Circuit Lighting Panel, bolted type
- d) Condensation Heater & Thermo. Switch
- e) Sel. Sw. for two 3-way Discharge Valves
- f) "Surge Basin" & "Sludge Line" lights for two 3-way valves.
- g) 3 pole C.B. for Valve operators.

C O

*RE-Submit as Per
Specs and J.F.T.
Letter of 4/6/76*

SETS DATA SENT

DATE

TO

See Page 1

HELD FROM PRODUCTION
YES NO

FOR INFORMATION

APPROVAL RECEIVED


FOR APPROVAL


DATE

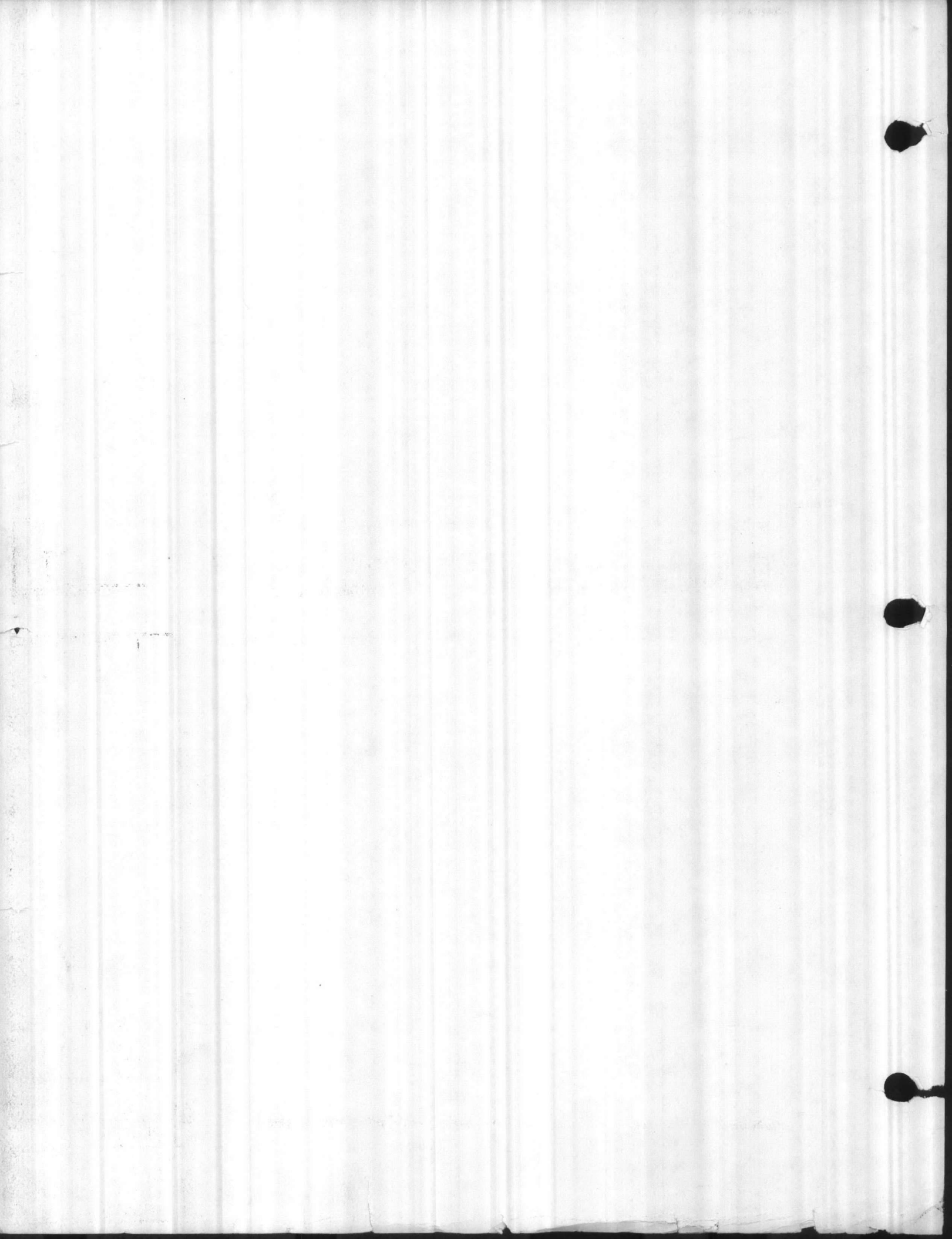
XX


XX




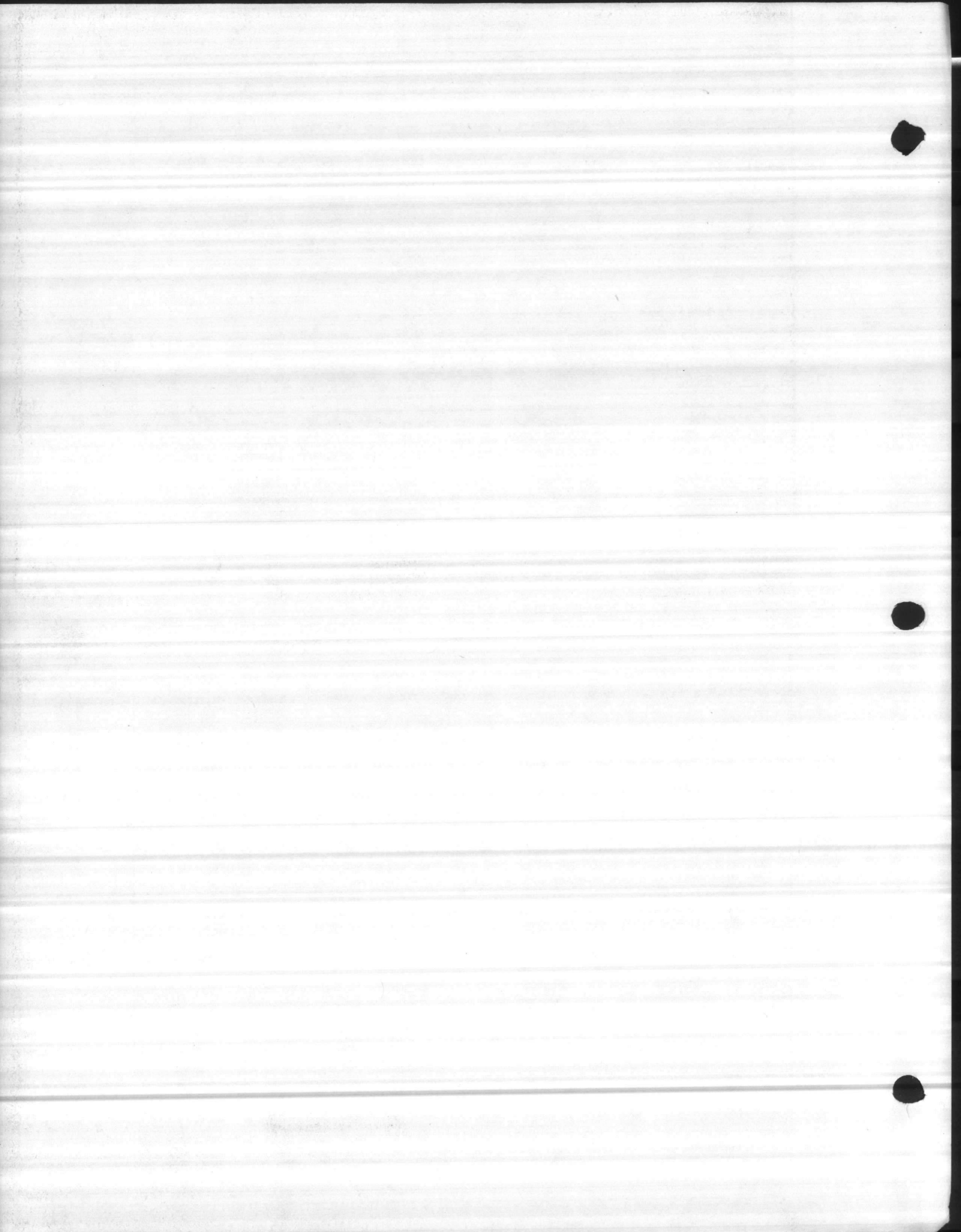
DOCUMENT LIST		DL01382			
Symbols Used	MB00015,16	1		1	
ITEM "A"-MABS 26 SEWAGE LIFT STN. PANEL					
Dimension and Arrangement	IM01109	1	1	1	
Wiring Diagram	902059-01	1	1	1	
Parts List	201889-01	1	1	1	
Description of Operation	IM01073	1	1	1	
Description - CMC09	IM01052	1		1	
Description - CMP02	IM00793	1		1	
ITEM "B"-GEIGER S.T.P. SURGE BASIN M.C.C.					
Dimension and Arrangement	IM01110	1	1	1	
Wiring Diagram	902060-01	1	1	1	
Parts List	201890-01	1	1	1	
Description of Operation	IM01074	1	1	1	
Description - CMC09	IM01052	REF		1	
Description - CMP02	IM00793	REF		1	
DRAWING DESCRIPTION		DRAWING NO.	APPR.	SHOP	SHIP
TITLE: NEW RIVER MARINE CORPS AIR STATION UTILITIES EXPANSION, WATER & SEWAGE		DRAWN HJG 6/27/75	DESIGNED TWM	S.O. 15726 JACKSONVILLE, N.C.	
 CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED <i>efm</i> 7-29-75	PAGE 1 OF 10	DRAWING NO. DL01382	REV C


		DL01382			
ITEM "C"-CURTIS RD. RAW WATER BOOSTER STN. M.C.C.					
Dimensions and Arrangement	IM01111	1	1	1	
Wiring Diagram	902061-01	1	1	1	
Parts List	201891-01	1	1	1	
Description of Operation	IM01075	1	1	1	
ITEM "D"-NEW RIVER SEWAGE PUMP STN. M.C.C.					
Dimensions and Arrangement	IM01112	1	1	1	
Wiring Diagram	902062-01	1	1	1	
Parts List	201892-01	1	1	1	
Description of Operation	IM01076	1	1	1	
ITEM "E"-WELL PANELS, WELLS N,O,P,Q & R					
Dimensions and Arrangement	IM01113	1	1	1	
* Wiring Diagram	902063-01	1	1	1	
Parts List	201893-01	1	1	1	
Description of Operation	IM01077	1	1	1	
* CUSTOMER INFO REQUIRED					
DRAWING DESCRIPTION		DRAWING NO.	APPR.	SHOP	SHIP
TITLE: NEW RIVER MARINE CORPS AIR STATION UTILITIES EXPANSION, WATER & SEWAGE		DRAWN HJG 6/27/75	DESIGNED TWM	S.O. 15726 JACKSONVILLE, N.C.	
 CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED <i>efm</i> 7-29-75	PAGE 2 OF 10	DRAWING NO. DL01382	REV C




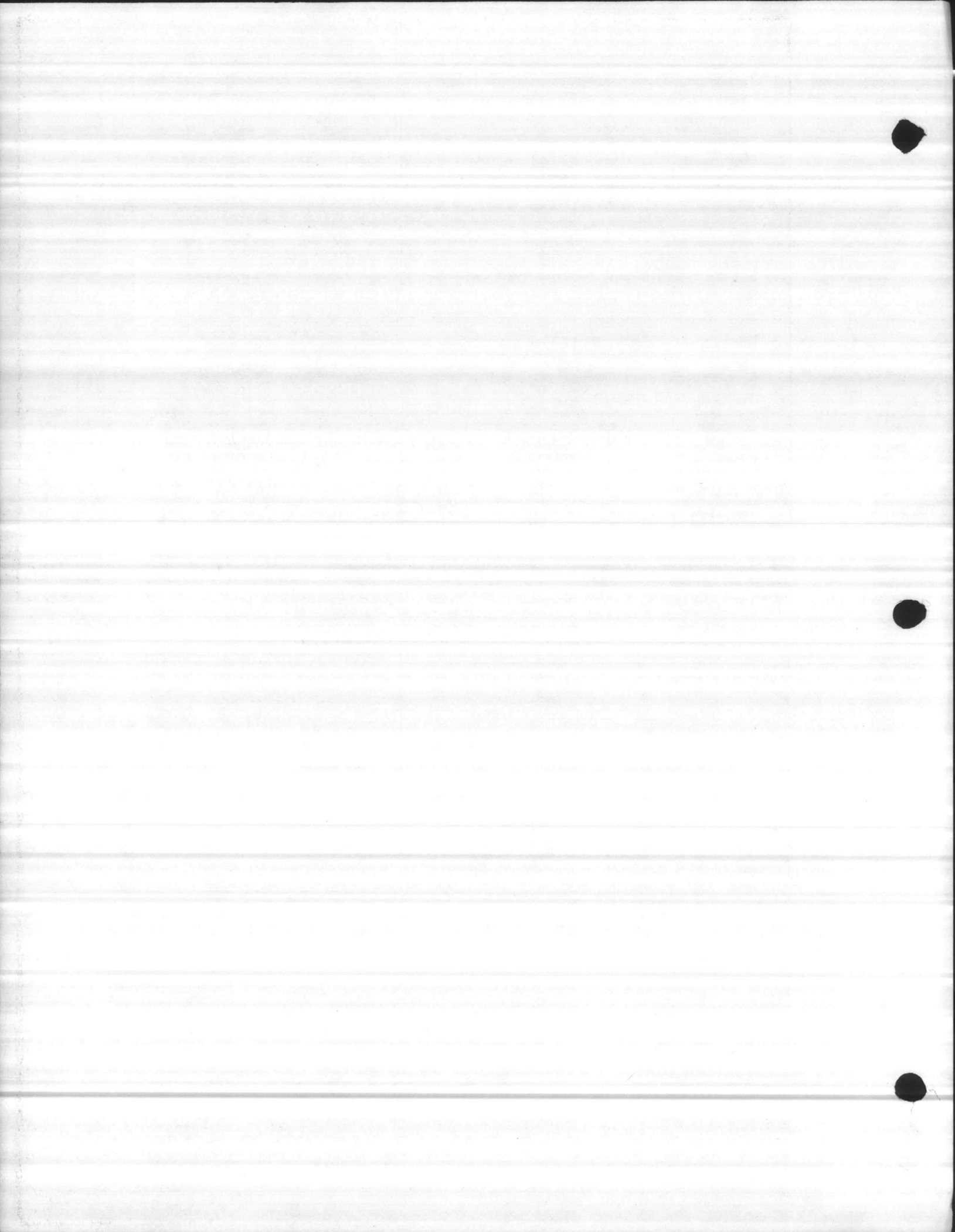
		DL01382			
ITEM "F"-WATER PLT. CLEARWELL PROBE PANEL					
Dimensions and Arrangement	IM01114	1	1	1	
Wiring Diagram	902064-01	1	1	1	
Parts List	201894-01	1	1	1	
Description of Operation	IM01078	1	1	1	
ITEM "G"-N.W. CORNER WELL PANEL					
Dimensions and Arrangement	IM01115	1	1	1	
Wiring Diagram	902065-01	1	1	1	
Parts List	201895-01	1	1	1	
Description of Operation	IM01079	1	1	1	
ITEM "H"-GEIGER WATER DIST'BN. PUMPS M.C.C.					
Dimensions and Arrangement	IM01116	1	1	1	
Wiring Diagram	902066-01	1	1	1	
Parts List	201896-01	1	1	1	
ITEM "I"-GEIGER S.T.P. PWR & CONTROL CTR.					
Dimensions and Arrangement	IM01117	1	1	1	
Wiring Diagram	902067-01	1	1	1	
DRAWING DESCRIPTION		DRAWING NO.	APPR.	SHOP	SHIP
TITLE: NEW RIVER MARINE CORPS AIR STATION UTILITIES EXPANSION, WATER & SEWAGE		DRAWN HJG 6/27/75	DESIGNED TWM	S.O. 15726 JACKSONVILLE, N.C.	
 CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED <i>dem</i> 7-29-75	PAGE 3 OF 10	DRAWING NO. DL01382	
				REV C	


		DL01382			
ITEM "I" (CONTINUED)					
Parts List	201897-01	1	1	1	
ITEM "J"-GEIGER S.T.P. ANNUNCIATOR PANEL					
Dimensions and Arrangement	IM01118	1	1	1	
Wiring Diagram	902068-01	1	1	1	
Parts List	201898-01	1	1	1	
Description of Operation	IM01082	1	1	1	
Description - CMX01	IM00778	1		1	
ITEM "K"-SEWAGE FILTER CONSOLE					
Dimensions and Arrangement	IM01119	1	1	1	
Wiring Diagram	902069-01	1	1	1	
Parts List	201899-01	1	1	1	
Description of Operation	IM01083	1	1	1	
ITEM "L"-WATER PLANT FILTER CONSOLES					
Dimensions and Arrangement	IM01120	1	1	1	
Wiring Diagram	902070-01	1	1	1	
Parts List	201900-01	1	1	1	
Description of Operation	IM01084	1	1	1	
DRAWING DESCRIPTION		DRAWING NO.	APPR.	SHOP	SHIP
TITLE: NEW RIVER MARINE CORPS AIR STATION UTILITIES EXPANSION, WATER & SEWAGE		DRAWN HJG 6/27/75	DESIGNED TWM	S.O. 15726 JACKSONVILLE, N.C.	
 CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED <i>dem</i> 7-29-75	PAGE 4 OF 10	DRAWING NO. DL01382	
				REV C	




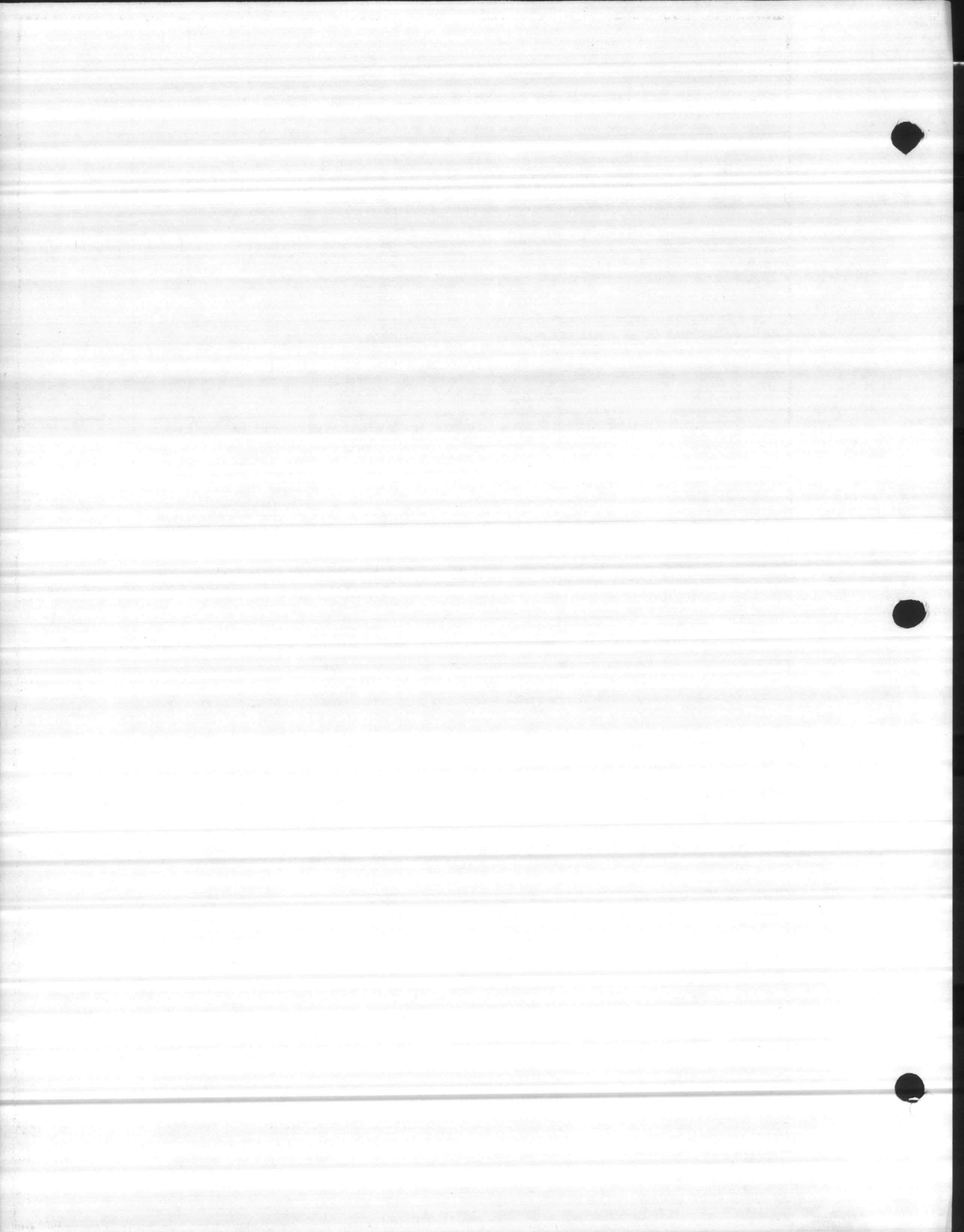
		DL01382			
ITEM "M"-WATER PLT. MAIN CONTROL PANEL					
Dimensions and Arrangement	IM01121	1	1	1	
Wiring Diagram	902071-01	1	1	1	
Parts List	201901-01	1	1	1	
Description of Operation	IM01085	1	1	1	
W/D, Pulse Width Receiver	902104-01	1	1	1	
P/L & Assy., Pulse Width Receiver	201999-01	1	1	1	
Testing Telephone Circuits	1A7108426	1		1	
ITEM "N"-RELAY PANELS FOR REMOTE PUMPS					
Dimensions and Arrangement	IM01122	1	1	1	
Wiring Diagram	902072-01	1	1	1	
Parts List	201902-01	1	1	1	
Description of Operation	IM01086	1	1	1	
ITEM "O"-GEIGER ELEV. TANK TRANSMITTER					
Dimensions and Arrangement, 20x20x6	IM00432	1		1	
Wiring Diagram	902105-01	1	1	1	
Parts List	202000-01	1	1	1	
Description of Operation	IM00402	1	1	1	
Calibration & Installation Data	ES50129	1	1	1	
W/D, Pulse Width Transmitter	901241-01	1	1	1	
P/L & Assy., Pulse Width Transmitter	600463-01	1	1	1	
DRAWING DESCRIPTION		DRAWING NO.	APPR.	SHOP	SHIP
TITLE: NEW RIVER MARINE CORPS AIR STATION UTILITIES EXPANSION, WATER & SEWAGE		DRAWN: HJG 6/27/75	DESIGNED TWM	S.O. 15726 JACKSONVILLE, N.C.	
 CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED <i>[Signature]</i> 7-29-75	PAGE 5 OF 10	DRAWING NO. DL01382	REV. C


		DL01382			
ITEM "P"-CAMPBELL ST. EL. TANK TRANSMITTER					
Dimensions and Arrangement, 20x20x6	IM00432	REF	1	1	
Wiring Diagram	902105-01	REF	1	1	
Parts List	202000-01	REF	1	1	
Description of Operation	IM00402	REF	1	1	
Calibration & Installation Data	ES50130	1	1	1	
W/D, Pulse Width Transmitter	901241-01	REF		1	
P/L & Assy., Pulse Width Transmitter	600463-01	REF		1	
ITEM "Q"-WHITE ST. EL. TANK TRANSMITTER					
Dimensions and Arrangement, 20x20x6	IM00432	REF	1	1	
Wiring Diagram	902105-01	REF	1	1	
Parts List	202000-01	REF	1	1	
Description of Operation	IM00402	REF	1	1	
Calibration & Installation Data	ES50131	1	1	1	
W/D, Pulse Width Transmitter	901241-01	REF		1	
P/L & Assy., Pulse Width Transmitter	600463-01	REF		1	
ITEM "R"-NEW RIVER RESERVOIR TRANSMITTER					
Dimensions and Arrangement, 20x20x6	IM00432	REF	1	1	
Wiring Diagram	902105-01	REF	1	1	
Parts List	202000-01	REF	1	1	
Description of Operation	IM00402	REF	1	1	
DRAWING DESCRIPTION		DRAWING NO.	APPR.	SHOP	SHIP
TITLE: NEW RIVER MARINE CORPS AIR STATION UTILITIES EXPANSION, WATER & SEWAGE		DRAWN: HJG 6/27/75	DESIGNED TWM	S.O. 15726 JACKSONVILLE, N.C.	
 CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED <i>[Signature]</i> 7-29-75	PAGE 6 OF 10	DRAWING NO. DL01382	REV. C




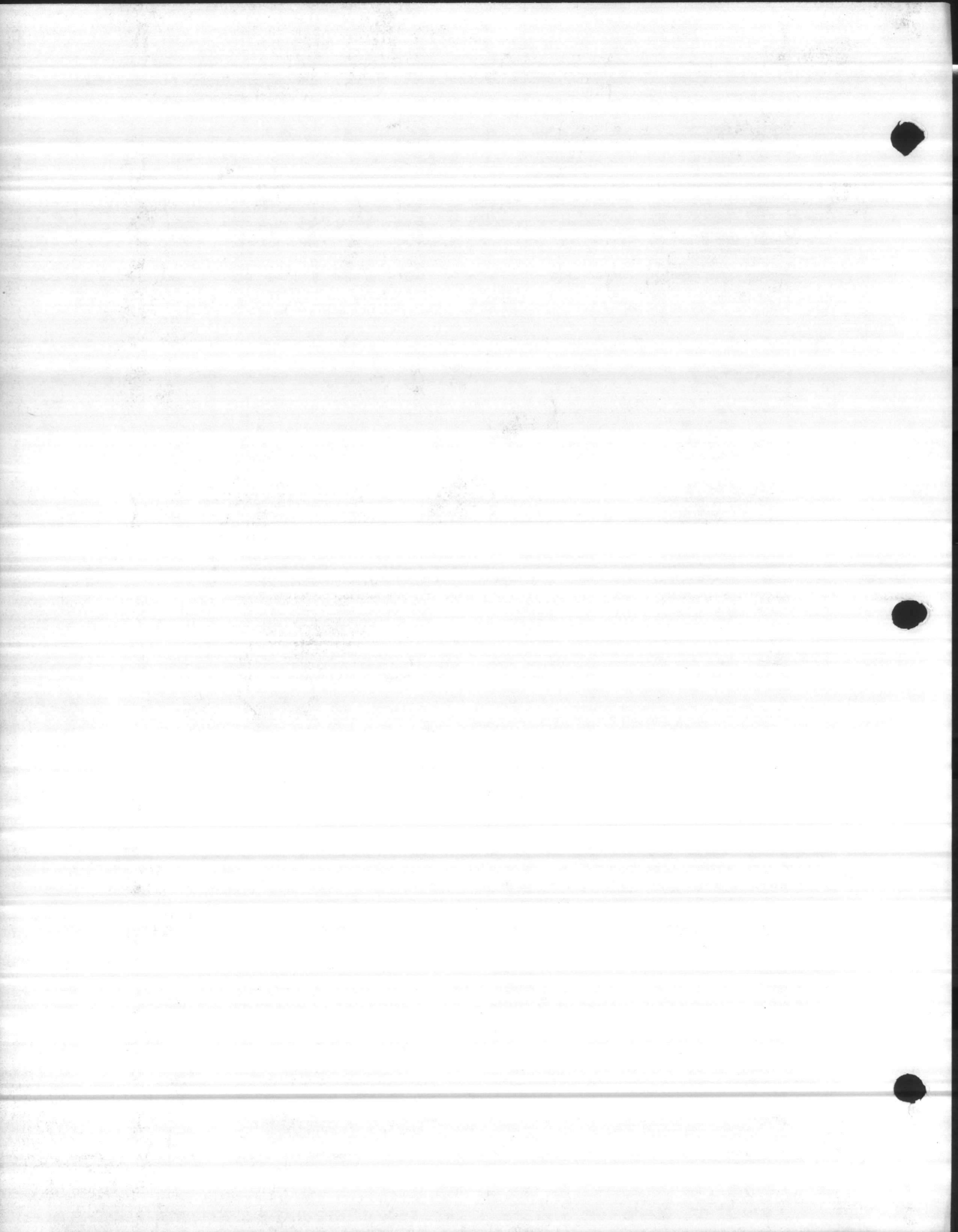
		DL01382			
ITEM "R" (CONTINUED)					
Calibration & Installation Data	ES50132	1	1	1	
W/D, Pulse Width Transmitter	901241-01	REF		1	
P/L & Assy., Pulse Width Transmitter	600463-01	REF		1	
ITEM "S"-CAMP GEIGER RESERVOIR TRANSMITTER					
Dimensions and Arrangement, 20x20x7	IM00305	1	1	1	
Wiring Diagram	902105-01	REF	1	1	
Parts List	202001-01	1	1	1	
Description of Operation	IM00402	REF	1	1	
Calibration & Installation Data	ES50133	1	1	1	
W/D, Pulse Width Transmitter	901241-01	REF		1	
P/L & Assy., Pulse Width Transmitter	600463-01	REF		1	
ITEM "T"-SEWAGE FILTER LEVEL TRANSDUCERS					
Submersible Transducer	Bull. A1000-B	1		1	
Parts List	202002-01	1	1	1	
Calibration & Installation Data	ES50134	1	1	1	
Instructions	IM00844	1		1	
DRAWING DESCRIPTION		DRAWING NO.	APPR.	SHOP	SHIP
TITLE: NEW RIVER MARINE CORPS AIR STATION UTILITIES EXPANSION, WATER & SEWAGE		DRAWN/HJG 6/27/75	DESIGNED TWM	S.O. 15726 JACKSONVILLE, N.C.	
 CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED <i>Chen</i> 7-29-75	PAGE 7 OF 10	DRAWING NO. DL01382	REV. C

		DL01382			
COMPONENT INFORMATION					
Model 9G Float Switch	Bull. B100-9G	1		1	
Cecotronic Transducers	IM00291	1		1	
Cecotronic PWM System	IM00290	1		1	
Voltage Amplifier, SEA-04	ES50063	1		1	
Simulator/Queller, SES-XX	ES50070	1		1	
Relay Module, QRM-01	ES50067	1		1	
Voltage Comparator, QEC-01	ES50065	1		1	
D.C. Receiver, DTC-02	ES50061	1		1	
West. Type W Motor Control Centers	12-150	1			
G.E. Circuit Breaker	CC002,3	1			
3Ø Lightning Arrestor	CC001	1			
Single Phase Lightning Arrestor	CC040	1			
West. HQCL Circuit Breaker	CC033	1			
G.E. Motor Starter	CC015	1			
O.L. Heater Table, G.E., Std. Trip	ES50040	1		1	
Gauges, 3½"	CC005,7	1			
Light, Dialco, Oiltight.	CC039	1			
Pilot Lamp De-Rating		1			
Air Compressor, Thomas	907AA18	1			
Cycle Timer, Eagle TM	CC029	1			
Selector Switch, Salinger	CC023	1			
Toggle Switch	CC036	1			
DRAWING DESCRIPTION		DRAWING NO.	APPR.	SHOP	SHIP
TITLE: NEW RIVER MARINE CORPS AIR STATION UTILITIES EXPANSION, WATER & SEWAGE		DRAWN/HJG 6/27/75	DESIGNED TWM	S.O. 15726 JACKSONVILLE, N.C.	
 CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED <i>Chen</i> 7-29-75	PAGE 8 OF 10	DRAWING NO. DL01382	REV. C

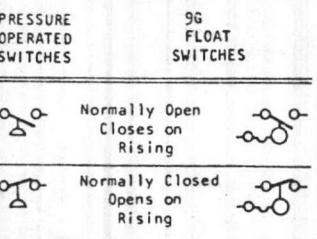
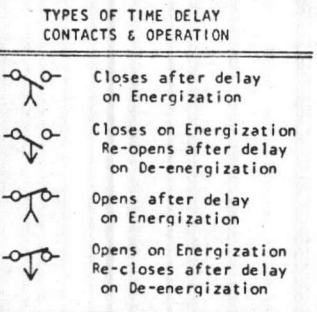
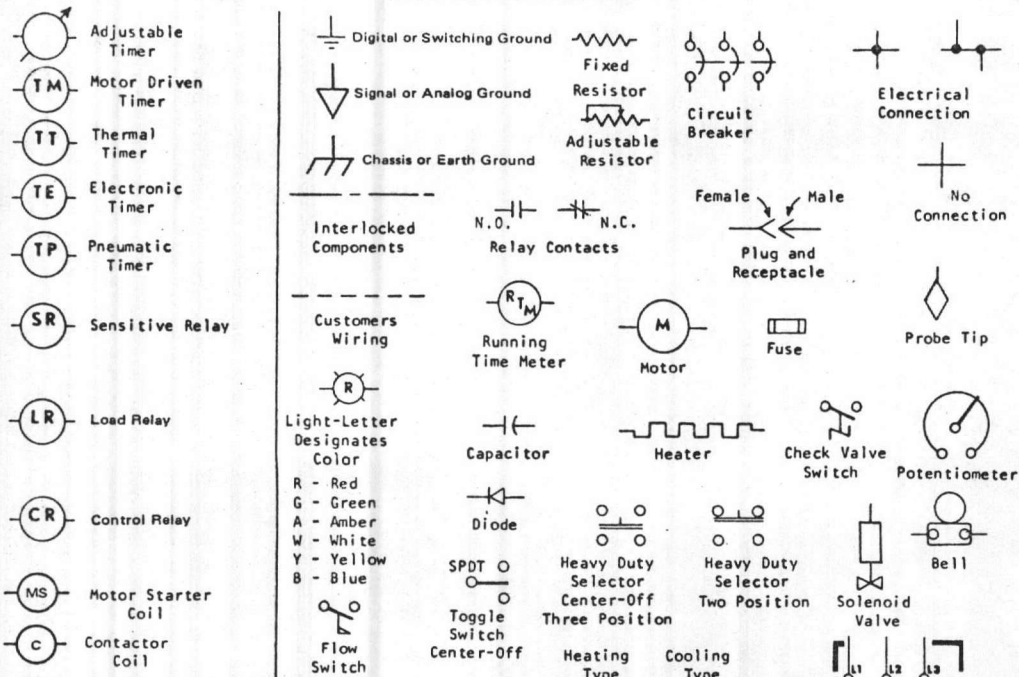


COMPONENT INFORMATION (CONTINUED)				DL01382		
Push Button Switch, Salinger		CC063	1			
Jack & Plug, Switchcraft 111 & 250		pp. 1 & 5	1			
Sound Powered Telephone, 702019-675 S-C		D464/1266	1			
Retractable Cord, Alpha		690/4	1			
Valve Position Indicator, G.E. Cat. 30M		Pg. 18	1			
Water Tank Level Indicator, G.E. Cat. 20M		Pp. 24,25	1			
Pressure Switch, Low Differential		ES50095	1			
Low Suction Cutout Switch, A.B. Cat 102		Pg. 185	1			
D.C. Relay, P & B KHP Type		Pg. 10	1			
Relay, 10 Amp., P&B KUP Type		ES50077	1			
ITE Fusible Disconnect Switch		Bull. 6.8-1B	1			
Proportional Controller	Action Pak	UIS2100-02	1	1		
Position Controller	Action Pak	UIS3200-00	1	1		
Indicating Recorder	Bristol	B220-13d,-20d	1	1		
Power Supply	Bristol	B220-16-1a	1	1		
Power Supply	Bristol	B220-16-2a	1	1		
Indicator	Bristol	B220-15e-1	1	1		
Differential Pressure Xmitter	Bristol	B220-23b	1	1		
CEM Card Case	Bristol	M1776-21	1	1		
Sq. Root Extractor Card	Bristol	M1776-17	1	1		
Subtractor Card	Bristol	M1776-4a	1	1		
Flow Tube	Penn	Bull. 405	1	1		
DRAWING DESCRIPTION		DRAWING NO.		APPR.	SHOP	SHIP
TITLE: NEW RIVER MARINE CORPS AIR STATION UTILITIES EXPANSION, WATER & SEWAGE		DRAWN HJG 6/27/75	DESIGNED TWM	S.O. 15726 JACKSONVILLE, N.C.		
 CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED <i>Cyfer</i> 7-27-75	PAGE 9 OF 10	DRAWING NO. DL01382		REV. C

COMPONENT INFORMATION (CONTINUED)				DL01382		
Flow Transmitter, Pulse Width	Bristol	M1705-1b	1	1		
Power Supply, 9J1	Bristol	922081-10-1	1	1		
Indicator, 24 inch	Leopold	501-51421	1	1		
Indicator, 24", Wiring	Leopold	501-53403	1	1		
Orifice Plate	Daniel	Model 520	1	1		
DRAWING DESCRIPTION		DRAWING NO.		APPR.	SHOP	SHIP
TITLE: NEW RIVER MARINE CORPS AIR STATION UTILITIES EXPANSION, WATER & SEWAGE		DRAWN HJG 6/27/75	DESIGNED TWM	S.O. 15726 JACKSONVILLE, N.C.		
 CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED	PAGE 10 OF 10	DRAWING NO. DL01382		REV. C



ELECTRICAL SYMBOLS

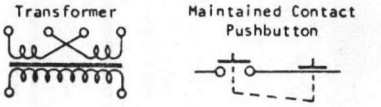


WIRE COLOR ABBREVIATION

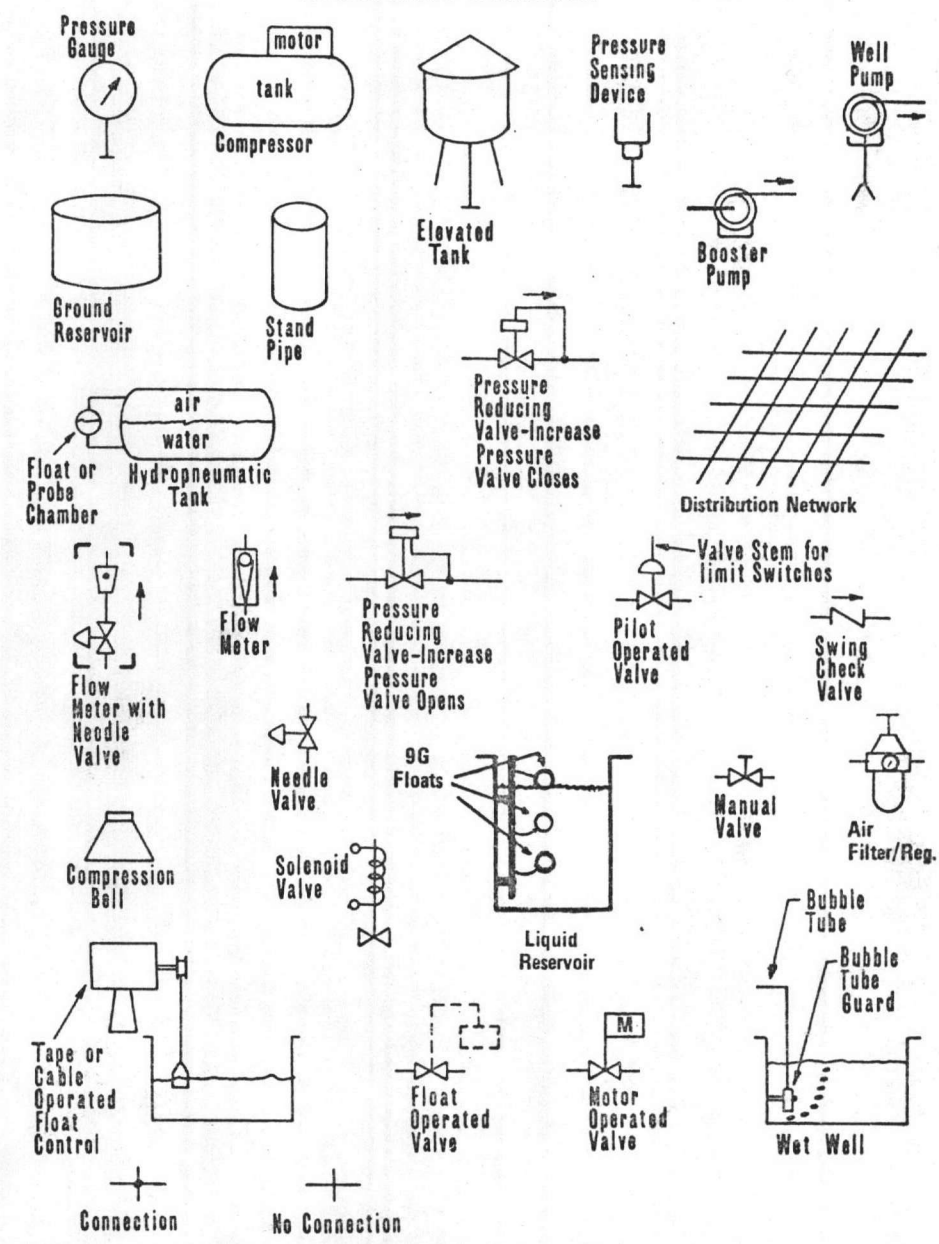
BK - Black - Line 1, 2, 3
 W - White - Neutral
 OR - Orange - Pilot Circuits
 Y - Yellow - Unpowered
 R - Red - Control Circuits
 GN - Green - Ground
 BR - Brown
 BU - Blue

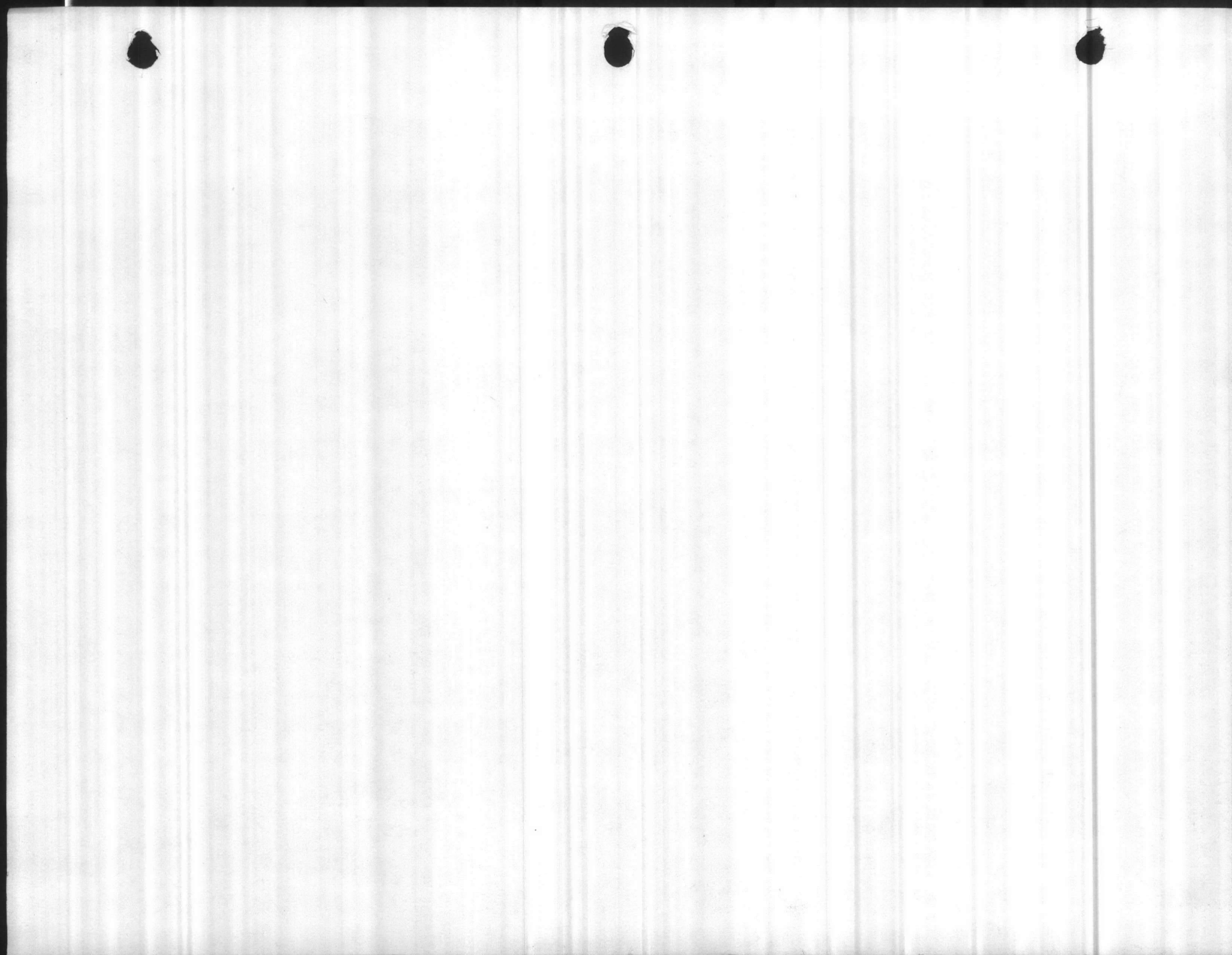
ABBREVIATIONS

H-O-A - Hand-Off-Auto.
 C-O-A - Closed-Open-Auto.
 MS - Motor Starter
 N.C. - Normally Closed
 N.O. - Normally Open
 O.L. - Motor Starter Overload



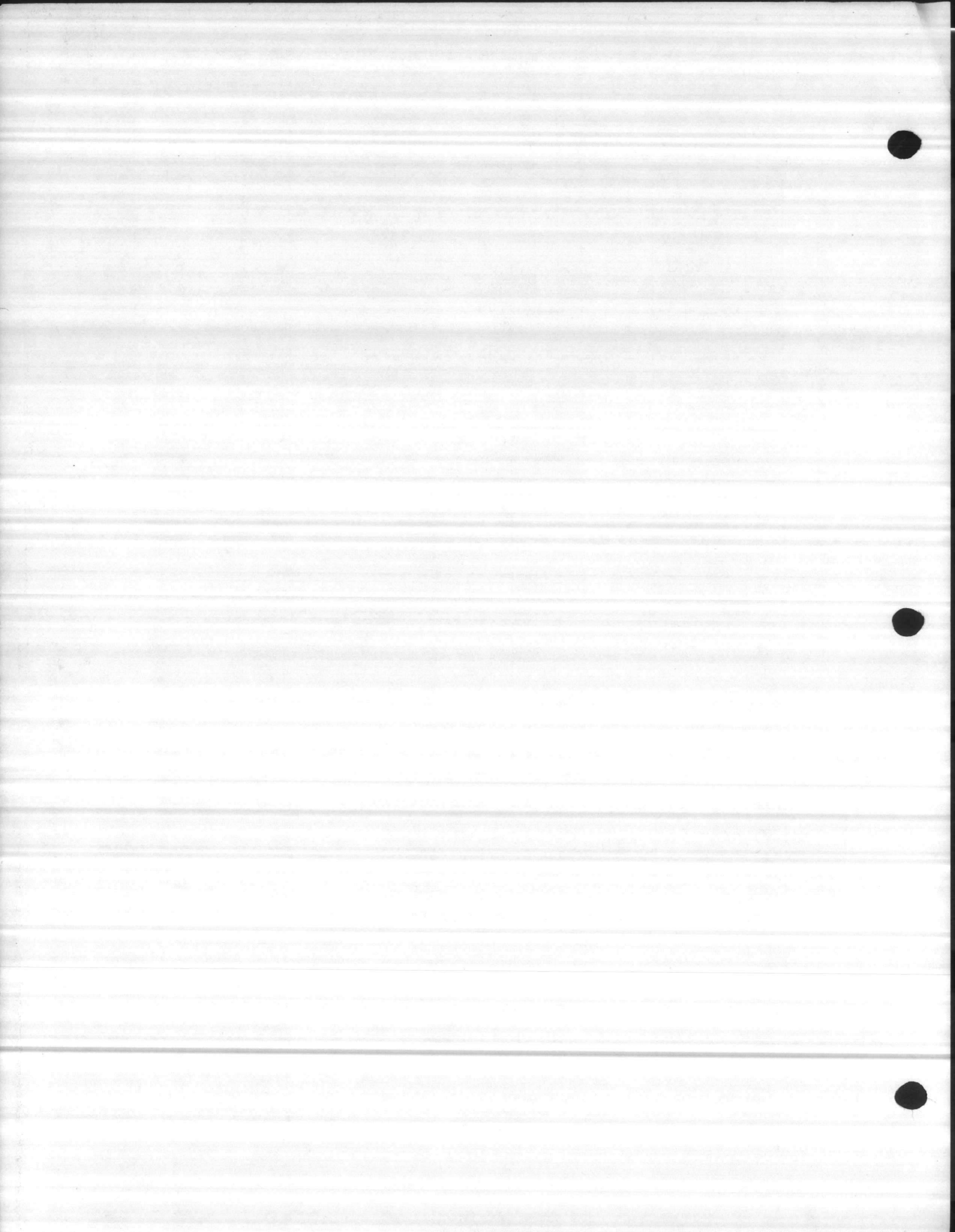
HYDRAULIC SYMBOLS





ITEM NO.	CECO PART NUMBER	SUB-VARIATION				DESCRIPTION	PL	PAGE 1	OF 1	DWG. NO. 201889-01
		01								
		QUANTITY								COMPONENT DESIGNATION
1	DL01382	REF				Document List				
2	902059-01	REF				Wiring Diagram				
3		1				Enclosure, 42x30x9 NEMA 1 Hoffman	A-42C30BLP			
4		1				Inner Panel Hoffman	A-42P30			
5		2				480V., 50A., 3-pole Circuit Bkr. G.E.	TED134050WL			CB 1,2
6		2				CB Mtg. Bkt. CECO	91G-2D			CB 1,2
7	800268-01	8				LP Mtg. Clips				LP
8	800167-02	4				250V., 15A., 1-pole Circuit Bkr.				LP
9		1				LP Mtg. Bkt. CECO	91G-			LP
10		1				Small Card Holder CECO	91G-12A			LP
11		2				15 Amp. Duplex Recpt. G.E.	4090-1			
12		1				Cover Plate W.P. G.E.	9226-5			Enclosure Left Side
13	800156-01	2				3-pos., H-0-A Sel. Switch CECO				S 1,2
14		2				Size 1, 208V. coil Motor Starter G.E.	CR206C023			MS 1,2
15		6				O.L. Heater G.E.	CR123C25.0B			
16		4				Light Base Dialco	103-4001-05-103			LT 1-4
17		4				Lens, Red Dialco	103-1331-403			LT 1-4
18		4				Lamp, 155V. 6 Watt G.E.	6S6-155			LT 1-4
19		1				Cover Plate Sierra	S-8			
20		1				Handy Box G.E.	5655-1			
21		1				120V. 6 hour Cycle Timer Eagle	TMIA622			CT 1
22		2				Air Compressor Thomas	907AA18			AC 1,2
23		2				12W., 3900 ohms fixed Resistor Ohmite	3816			Dim Glow
24		1				Res. Mtg. Bkt. CECO	91G-11			
25		2				PB Switch Norm. Open Salinger	MP1B			PB 1,2
26		1				3-pos. Ctr. off Toggle Switch C-H	7581K7			TS 1
27	800057-02	1				Relay, 120V. 3POT CECO				CR 1
28	800080-01	1				Socket, 11 pin CECO				CR 1
29		1				Gauge, 3 1/2" 0-160" Marshalltown	838-3 1/2			
30		1				Valve, 1/2" Generant	3000-4			Shutoff
31		1				Taper Tube Meter-Air Flow				
32	800100-02	6				0-15 #, make on rise Press. Switch CECO				PS 1-6
33	600578-06	1				Cont./Alt. 120V. CECO	CMC09			
34	600522-06	2				Pump Protector 120V CECO	CMP02			PP 1,2
35		3				Term. Block Buchanan	824AL			TB 1
36		1				End Piece Buchanan	830			TB 1
37		2				OL Resetter Furnas	49D53228-1			
38	700867-01	1				Single Valve Mtg. Bkt. CECO				
39		2				C.B. Operator G.E.	TEFR1B			CB 1,2
40		2				Door Interlock G.E.	343L483G1			CB 1,2
41		1				Press. 4-15PS IGTeTedyne Relief Valve Republic	626B-1-1/4-2			
42	700076-01	1				Neutral Bar				LP

201889-01	PAGE 1	OF 1	REV B	TITLE: BULL. A700 POWERPACK	S.O. 15726 ITEM "A"	DFT 6/27/75	HJG	
	DRAWING NO. 201889-01				CONSOLIDATED ELECTRIC CO.		CHK 7-30-75	
					141 SO. LAFAYETTE FREEWAY • ST. PAUL, MINN. 55107		ENG	
							APP 7/1/75	



DESCRIPTION OF OPERATION
MABS 26 SEWAGE LIFT STATION PANEL
JACKSONVILLE, NORTH CAROLINA
S.O. 15726, ITEM A

Reference Wiring Diagram 902059-01.

This control system uses a Reed type air compressor to force air down a bubbler tube immersed in the sewage wet well, and senses the liquid level in the wet well by measuring the back pressure on the column of air in the bubbler tube. This back pressure is applied to pressure switches which control the ON/OFF operation of two pumps operating in a pump-down mode. The bubbler system air is furnished by one of two Reed air compressors, each of which are run for a period of three hours, after which the opposite compressor takes over on the command of a cycle timer. Additional level sensors are provided for low suction level cutoff and automatic restore of the two pumps, and for high level and low level alarms. Pump Protectors are provided for each pump, which are operated from a normally closed thermal sensor switch (furnished by others), imbedded in the motor windings. These protector circuits automatically shut down the pump when an over-temperature opens the thermal switch. The pump will remain shut down and an over-temperature light turned on, until the operator presses a reset switch.

SEQUENCE OF OPERATION

Referring to Page 2 of the Wiring Diagram, the pumps are controlled by pressure sensors PS3, PS4 and PS5, operating the Model CMC09 Two Circuit Controller/Alternator. A sequence switch is provided to permit the operator to lock the system into a 1-2 or a 2-1 operating sequence. This switch is normally left in the AUTO mode. Assume that control power is available, that the pump HAND-OFF-AUTO selector is in the AUTO mode, and that the wet well level is initially below the stop sensor PS3. As the wet well level rises, PS3 closes first, then PS4 closes calling for the lead pump to start. With the alternator in the position shown, relay CR1 within the alternator is energized, a normally open contact of CR1 seals that relay in thru the stop sensor PS3. The normally open CR1

contact between terminals 11 and 12 of the CMC09 Module now completes a circuit through a normally open CR1 contact of the low level cutoff relay, and the normally open contact in the Pump Protector PPI between terminals 4 and 5, thereby completing the motor starter pilot circuit for Pump No. 1, starting it as the lead pump.

If the influent is such that the lead pump can not handle the flow, the level will continue to rise in the wet well, closing pressure sensor PS5 calling for the lag pump to start. This will energize relay CR3 in the controller, which will seal itself in through the stop sensor PS3. Normally open contacts of CR3 complete both output circuits, between terminals 9 and 10, and 11 and 12 of the Controller. The CR3 contacts between terminals 9 and 10, combined with another normally open contact of cutout relay CR1, and the contact between terminals 4 and 5 of Pump Protector PP2, all combine to complete the start circuit for Pump No. 2, causing that pump to start as the lag pump.

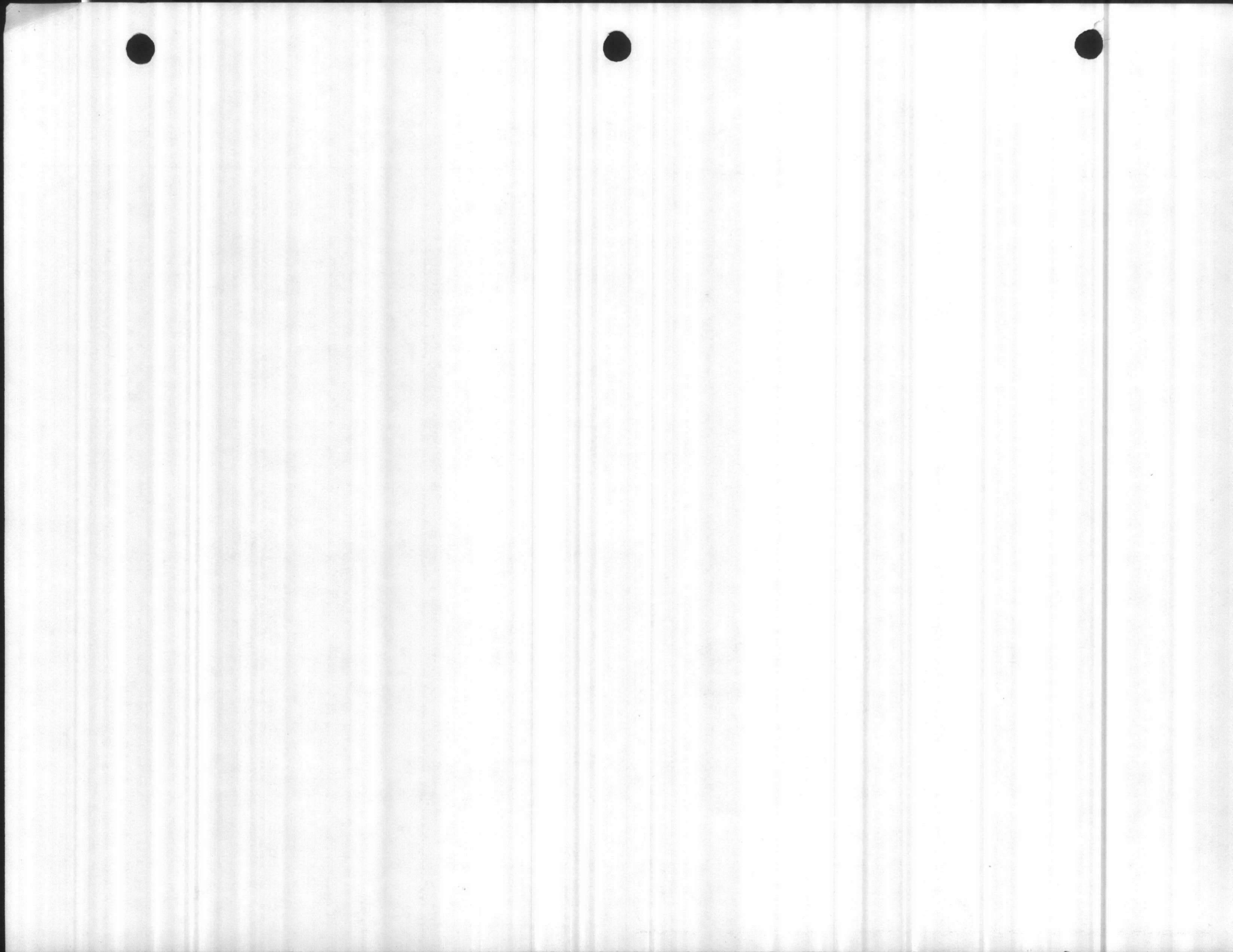
As the pumps run, lowering the level in the wet well, PS5 will open first, then PS4, then the stop sensor PS3 will open. When PS3 opens, it de-energizes relays CR3 and CR1 in the controller, breaking the pilot circuits and causing both motor starter circuits to de-energize, stopping both pumps. At this point in time, the alternator relay changes state, reversing the pumping sequence for the next cycle. The CMC09 Controller/Alternator is further described in IM01052.

If the level in the wet well should continue to rise, pressure sensor PS6 will close lighting the high level alarm light. The indicator lights normally glow at a dim level, to indicate that the bulb filaments are in good condition and also to prolong the bulb life. When an alarm condition exists, the bulb goes from a dim glow to a high intensity. When the level recedes and PS6 opens, the high level alarm light reverts back to the dim glow state.

If the level in the wet well recedes below that at which the pumps would have adequate suction, sensor PS1 will open, dropping out low level cutoff relay CR1, which opens both motor starter pilot circuits, preventing the pumps from running. The pump-stop level setting of PS3 should normally be set at a higher pressure than the settings of either PS1 or PS2. As the level in the wet well begins to rise again, and PS1 closes, relay

TITLE	DESCRIPTION OF OPERATION JACKSONVILLE, N.C. S.O. 15726 ITEM A	DESIGNED TWM	DRAWN	CHECKED <i>John</i> 7-29-73	REVISION A
 Consolidated Electric Company 141 SOUTH LAFAYETTE FREEWAY SAINT PAUL, MINNESOTA 55107		PAGE 1 OF 3	DRAWING NO IM01073		


TITLE	DESCRIPTION OF OPERATION JACKSONVILLE, N.C. S.O. 15726 ITEM A	DESIGNED TWM	DRAWN	CHECKED <i>John</i> 7-29-73	REVISION A
 Consolidated Electric Company 141 SOUTH LAFAYETTE FREEWAY SAINT PAUL, MINNESOTA 55107		PAGE 2 OF 3	DRAWING NO IM01073		

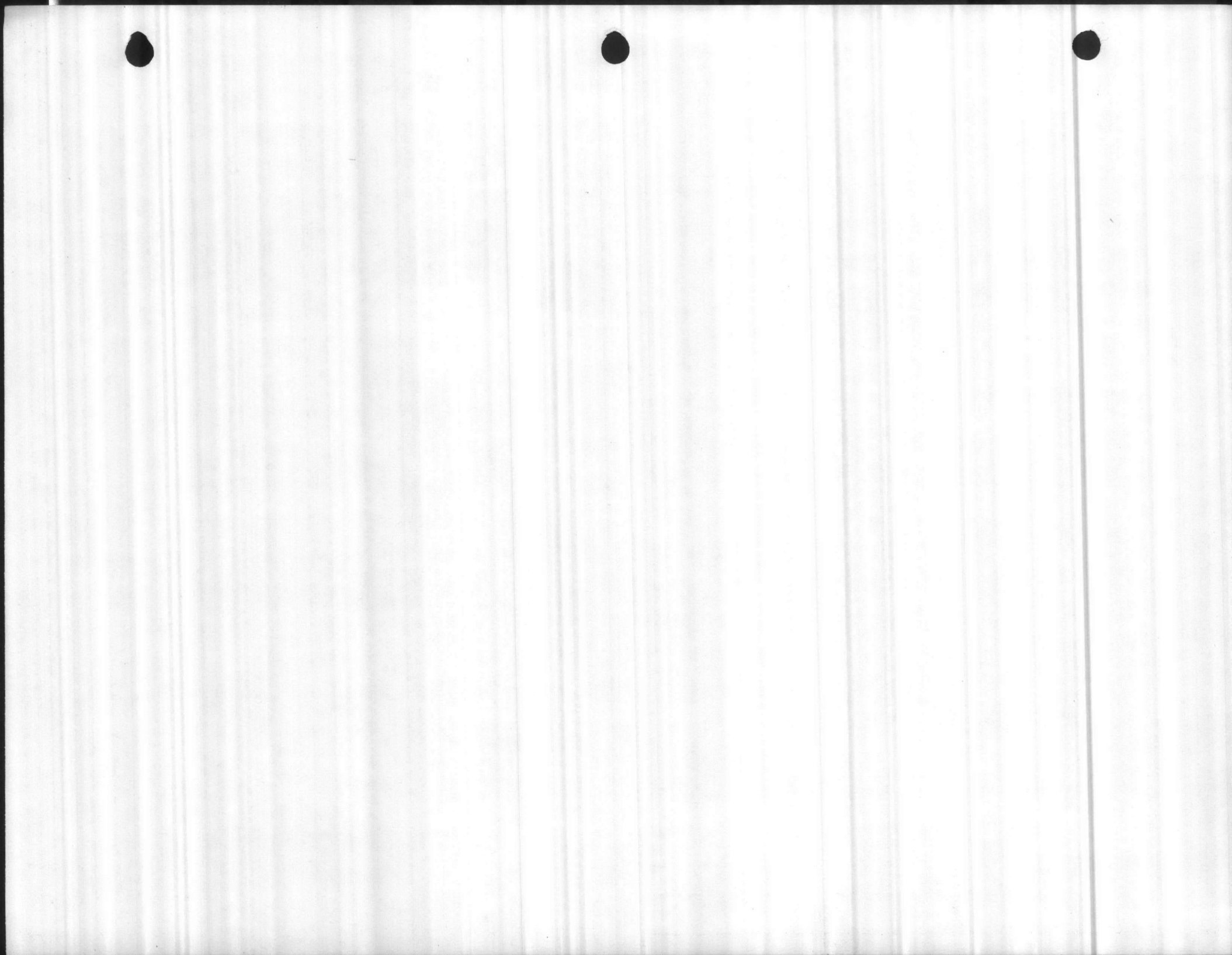


CRI will stay de-energized until the level rises further, closing PS2. At this automatic restoration level, relay CRI will be energized, sealing itself in thru its normally open contact and sensor PS1. This will reclose the contacts of CRI permitting the pumps to start when required. Note that when the low suction cutoff sensor PS1 is opened, and CRI is de-energized, a normally closed CRI contact brings the low level alarm light to full brilliance. This light stays on until sensor PS2 closes on rising level, re-energizing relay CRI.

The Pump Protectors, Model CMP02, operate to disable a pump when its motor temperature rises too high, opening the sensor switch in the pump winding. An over-temperature indicator light is brought to full brilliance when the thermal protection circuit is triggered by the opening of the thermal switch. The CMP02 Protector resets automatically after power failure. Upon occurrence of an over-temperature condition, the pump will stay locked out, and the over-temperature light on, until the operator presses the reset button. The CMP02 Pump Protector is further described in IM00793.

The two air compressors are self contained and operate from a duplex outlet inside the enclosure. Cycle Timer CT1 alternates its switch position every three hours, thereby alternating from one compressor to the other. Therefore, the continuous duty rated compressors are only required to operate on a 50% duty cycle.

TITLE	DESCRIPTION OF OPERATION JACKSONVILLE, N.C. S.O. 15726 ITEM A	DESIGNED TWM	DRAWN	CHECKED <i>Ed. W. W.</i> 7-21-73	REVISION A
	Consolidated Electric Company 141 SOUTH LAFAYETTE FREEWAY SAINT PAUL, MINNESOTA 55107	PAGE 3 OF 3	DRAWING NO IM01073		



DESCRIPTION OF OPERATION

CMC09/CMC10

DUPLEX PUMP CONTROLLER/ALTERNATOR

FEATURES:

- * Independent on, common off is standard. Independent on, independent off is optional.
- * All relay construction. The Alternator is a permanent magnetic latching type relay - not a cam or ratchet which are subject to wear.
- * Redundant "On" switching: When the "Lag Pump On" sensor closes, lead and lag pilot circuits will be completed by separate contacts of CR3, thus providing redundant "On" control for the lead pump.
- * Sequence Selector: An optional sequence selector may be connected to "lock" the controller into a desired sequence (1-2, 2-1, or AUTO).
- * The CMC10 is the same as the CMC09 with the addition of alternator contacts wired to terminals for connection of optional "Next Pump On".
- * Snap-Track mounting. Board is 3" wide by 8½" long (CMC09) or 9" long (CMC10).

GENERAL

This module is designed to control the ON-OFF operation of two pumps with respect to the liquid level such as in a wet well or similar application. The ON-OFF levels are typically sensed by mercury switch type liquid level sensors.

INDEPENDENT ON, COMMON OFF

The following is an example of "Pump Down" independent ON - common OFF operation. Assume that the liquid level is below the bottom sensor, the level is rising and the alternator is in the RESET position as shown.

The "All Off" sensor will close first, completing the sealing circuit. As the liquid level continues to rise, the "Lead Pump On" sensor wired between terminals 4** and 7, will close and energize relay CR1. The N.O. contact of CR1, wired between terminals 11 and 12 will close, thus completing the pilot circuit for Pump No. 1.

If the liquid level should continue to rise, the "Lag Pump On" sensor will close and energize CR3. The redundant N.O. CR3 contacts, wired between terminals 9 and 10, 11 and 12, will close when CR3 energizes. These redundant contacts give positive assurance that both pump pilot circuits are closed when the "Lag Pump On" sensor closes.

The pump(s) must pump down past the "Both Pumps Off" sensor before the sealing circuit will be broken, de-energizing the control relays, which stops the pump(s).

At this point - immediately after the termination of a pumping sequence - the Alternator will change state. This means that the pumps will operate in a reverse sequence on the next pumping cycle.

INDEPENDENT ON, INDEPENDENT OFF

The following is an example of "Pump Down", Independent ON, Independent OFF operation. Assume that the liquid level is below the bottom sensor, the level is rising, and the Alternator is in the RESET position as shown.

The "Lead Pump Off" sensor will close first, completing the sealing circuit for the lead pump relay (CR1). As the level continues to rise, the "Lead Pump On" sensor, wired between terminals 4** and 7, will close and energize relay CR1. The N.O. contact of CR1, wired between terminals 11 and 12, will close, when the relay is energized, thus completing the pilot circuit for Pump No. 1.

If the liquid level should continue to rise, the "Lag Pump Off" sensor will close and complete the sealing circuit for the redundant lag pump relay (CR3). The "Lag Pump On" sensor will close next and energize CR3. The redundant N.O. CR3 contacts, wired between terminals 9 and 10, 11 and 12, will close when CR3 energizes. These redundant contacts give a positive assurance that both pump pilot circuits are closed when the "Lag Pump On" sensor closes.

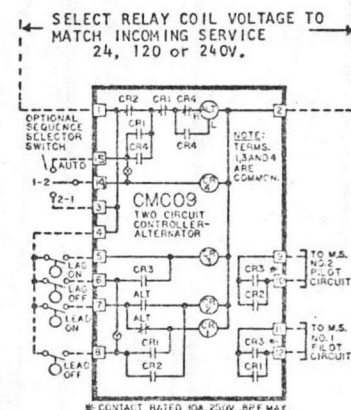
As the liquid level falls, the "Lag Pump On" sensor will open, then the "Lag Pump Off" sensor will open, breaking the lag pump sealing circuit, stopping the lag pump. The lead pump must pump the liquid level down past the lead on and off sensors before its sealing circuit will be broken and the pump stopped. At this point, the Alternator will change state, reversing the starting sequence of the pumps for the next cycle.


SEQUENCE SELECTION


An optional sequence selector may be wired to terminals 3**, 14 and 15 (as shown) and used to "lock" the controller into a desired sequence. When the sequence selector is installed the connection marked X, within the CMC09, will be removed. A pump sequence of 1-2, or 2-1, or AUTO alternation can be selected with this switch.

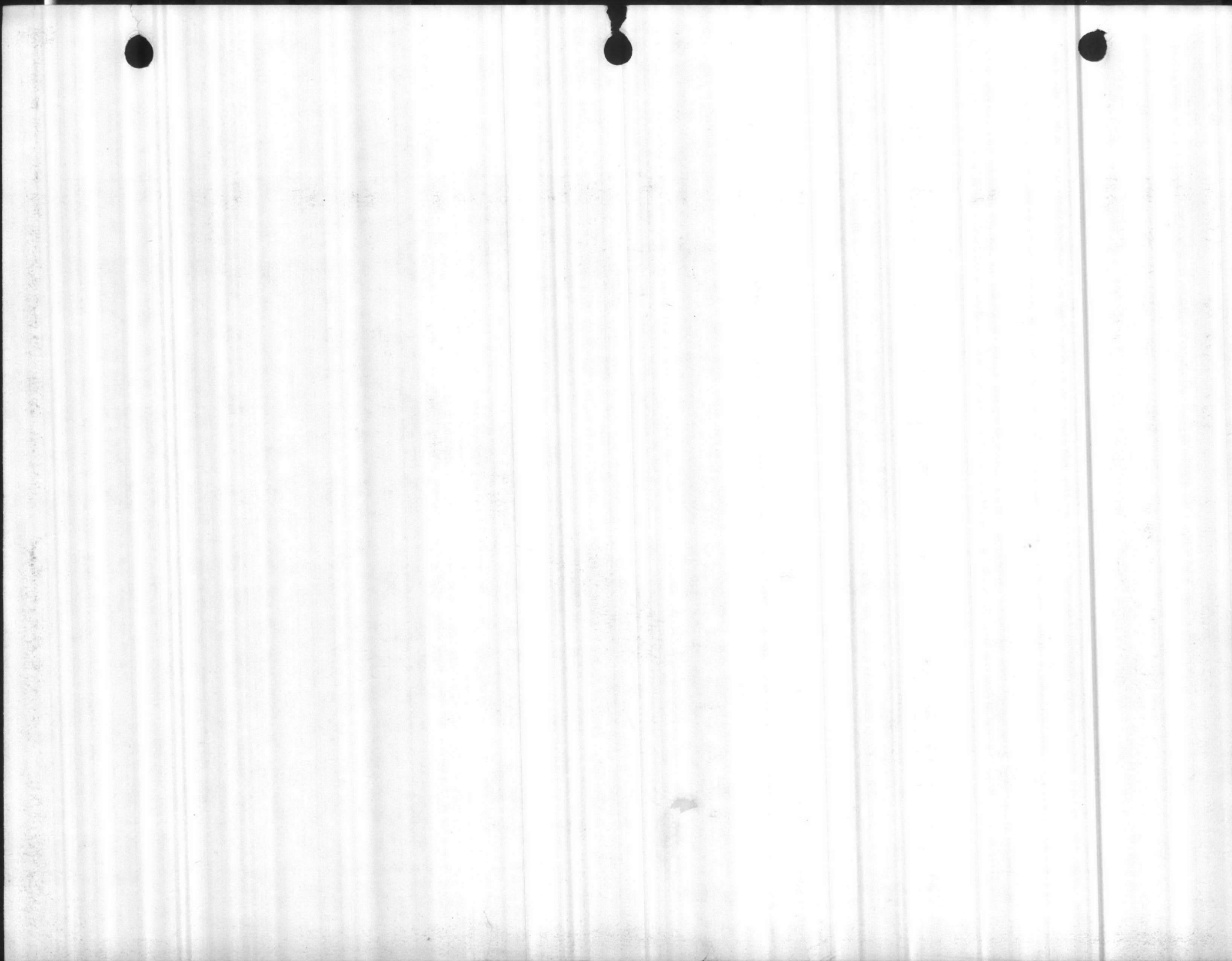
- ** Terminals 1, 3 and 4 are common, thus 1, 3 or 4 may be used for float connection. Do not connect more than two wires to one terminal.

NOTE: It is recommended that the snap-track be mounted with plastic fasteners. If metallic fasteners are used they must be insulated from the copper side of the "CM" Module printed circuit board.



TITLE	DESIGNED	DRAWN	CHECKED	REVISION
DESCRIPTION OF OPERATION CMC09/10		SHD		
 Consolidated Electric Company 141 SOUTH LAFAYETTE FREEWAY SAINT PAUL, MINNESOTA 55107	PAGE	DRAWING NO		
	1 OF 2	1M01052		

TITLE	DESIGNED	DRAWN	CHECKED	REVISION
DESCRIPTION OF OPERATION CMC09/10		SHD		
 Consolidated Electric Company 141 SOUTH LAFAYETTE FREEWAY SAINT PAUL, MINNESOTA 55107	PAGE	DRAWING NO		
	2 OF 2	1M01052		



DESCRIPTION OF OPERATION

CMP02

PUMP OVER-TEMPERATURE PROTECTOR

GENERAL

This Module provides over-temperature lockout of a pump in response to the opening of a thermal switch within the motor housing. Manual reset is required after lock-out, however, automatic setting will occur on application of power. Thus operator attention is only required on actual thermal lockout.

FEATURES

- Self resetting on power application.
- Manual reset required on thermal trip.
- Pilot circuit switching - 250 VAC, 10A., .8 P.F.
- Dim glow or non-dim glow alarm light circuit.
- Operates from normally closed thermal switch (by others).
- Adaptable to other limit applications where manual reset is desired.
- Snap-Track mounting. Module is 3" wide by 3.4" long.

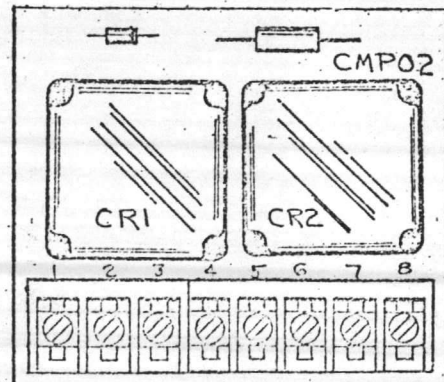
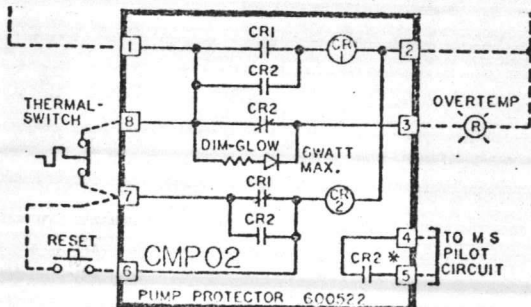
TYPICAL OPERATION - NORMALLY CLOSED THERMAL SWITCH

With connection of thermal switch and reset button as shown, the following is a description of operation. On application of power, the thermal switch within the motor would be below its operating temperature, thus would be closed. CR2 coil would be energized through the CR1-N.C. contact, and would latch in through the N.O. CR2 contact closing in parallel with the CR1 contact.

CR1 is energized by the closure of the CR2-N.O. contact in series with the CR1 coil. CR1 latches in by the closure of the CR1-N.O. contact in parallel with the CR2 contact. Thus both relays are pulled in and latched in for normal operation. The CR2 contact between terminals 4 and 5 will close to complete that part of the pump pilot circuit. The "Overtemp" light will be out, or will be at low brilliance for the dim-glow option.

On opening of the thermal switch due to motor over-temperature, CR2 will drop out. This opens the motor pilot circuit, and also brings the "Overtemp" light to full brilliance. After the motor has been de-energized for a period of time, the thermal switch may close again. However CR2 will be prevented from re-energizing because CR1 is still latched in, holding open the CR1 contact in series with the CR2 coil. The CMP02 circuit can be reset by operating the reset button which applies power to terminal 6 if the thermal switch has re-closed. This re-energizes CR2, resuming normal operation.

NOTE: It is recommended that the snap-track be mounted with plastic fasteners. If metallic fasteners are used, they must be insulated from the copper side of the "CM" Module printed circuit board.



TITLE DESCRIPTION OF OPERATION
CMP02

DESIGNED

RE.

DRAWN

10/17/79

CHECKED

RP

REVISION

A



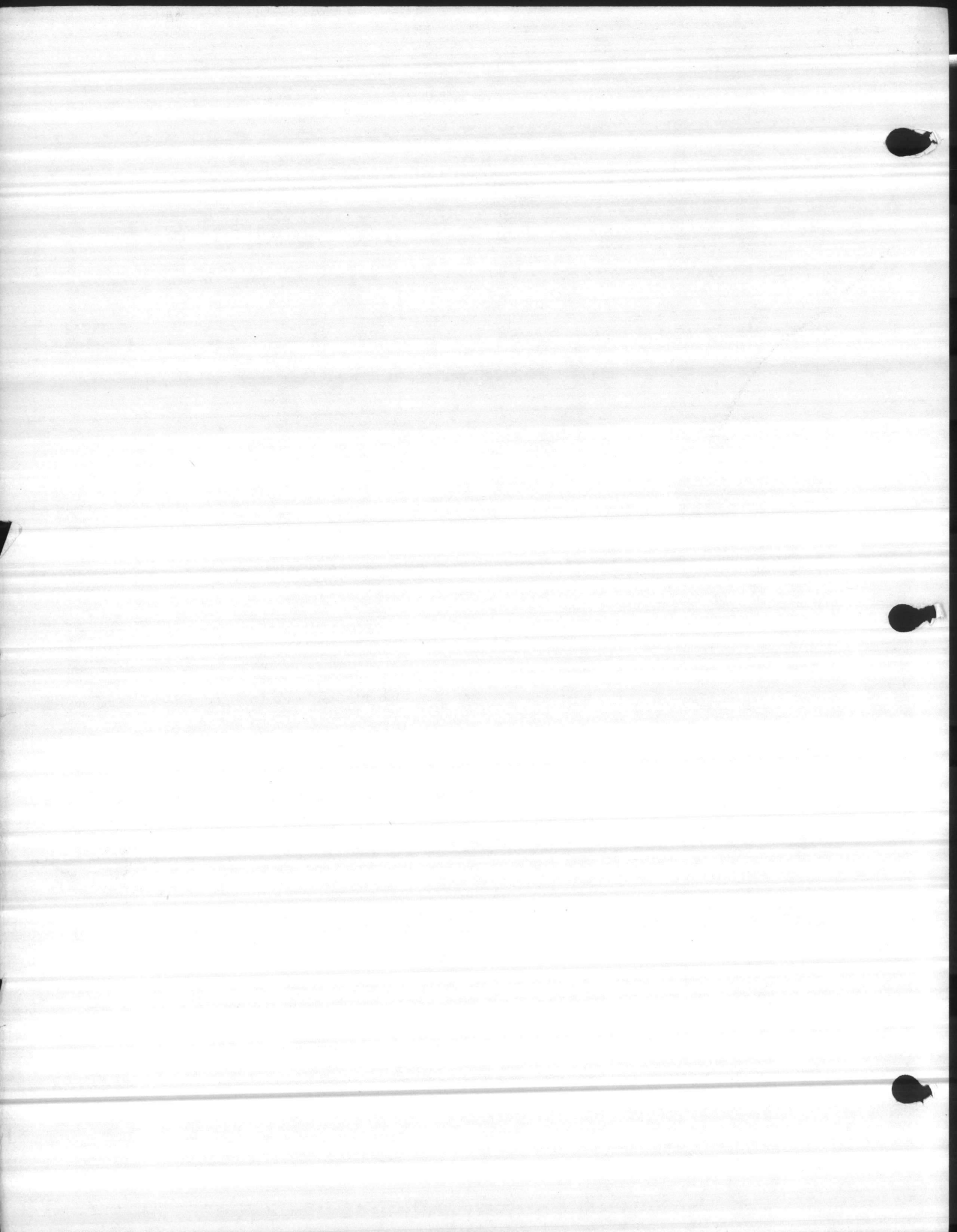
Consolidated Electric Company
141 SOUTH LAFAYETTE FREEWAY
SAINT PAUL, MINNESOTA 55107

PAGE

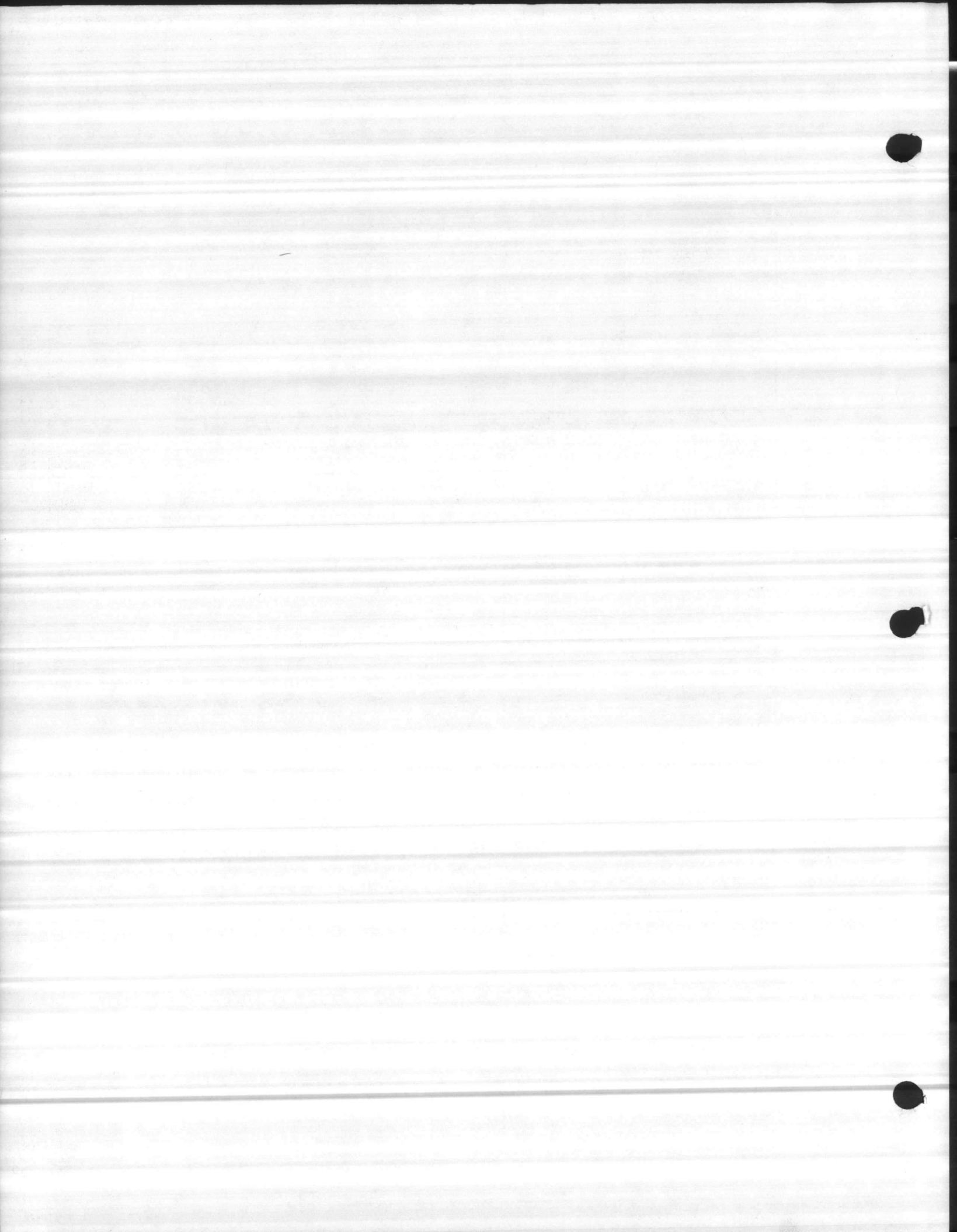
1 OF 1

DRAWING NO

IM00793



ITEM NO.	CECO PART NUMBER	SUB-VARIATION				DESCRIPTION	PL	PAGE 1	OF 1	DWG. NO. 201890-01	COMPONENT DESIGNATION
		01									
1	DL 01382	REF				Document List					
2	902060-01	REF				Wiring Diagram					
3		1				Encl., 90x38x15 NEMA 12 West.				P.O.	
4		1				Ltg. Panel C-H	CH-4			LP	
5		4				250V. 15A. 1-pole Circuit Bkt. C-H	CH-115			LP	
6		1				LP Mtg. Bkt. CECO	91G-5B			LP	
7		1				Card Holder ^{Small} CECO	91G-12A			LP	
8		2				Duplex Recept. ^{15 Amp.} G.E.	4090-1				
9		1				Cover Plate ^{W.P.} G.E.	9226-5			Enclosure Left Side	
10		4				Light Base Dialco	103-4001-05-103			LT 1-4	
11		4				Lens, Red Dialco	103-1331-403			LT 1-4	
12		4				Lamp, 155V. ^{6 Watts} G.E.	6S6-155			LT 1-4	
13		1				Cover Plate Sierra	S-8				
14		1				Handy Box G.E.	5655-1				
15		1				Cycle Timer ^{120V. 6 hour} Eagle	TM1A622			CT 1	
16		2				Air Compressor Thomas	907AA18			AC 1,2	
17		2				Resistor ^{12W. 3900 ohms fixed} Ohmite	3816			Dim Glow	
18		1				Res. Mtg. Bkt. CECO	91G-11				
19		2				PB Switch ^{Norm. Open} Salinger	MP1B			PB 1,2	
20	800156-01	1				3-pos. Ctr. off Sel. Switch				SS 1	
21	800057-02	1				Relay, 120V. ^{3PDT} CECO				CR 1	
22	800080-01	1				Socket, 11 pin CECO				CR 1	
23		1				Gauge, 3 1/2" ^{0-160"} Marshalltown	83B-3 1/2				
24		1				Valve, 1/4" Generant	3000-4			Shutoff	
25	700867-01	1				Single Valve Mtg. Bkt. CECO					
26		1				Taper Tube Meter-Air Flow					
27	800100-02	6				0-15 #. make on rise Press. Sw. CECO				PS 1-6	
28	600578-06	1				Cont./Alt. 120V. CECO	CMC09				
29	600522-06	2				Pump Protector 120V. CECO	CMPO2			PP 1,2	
30		1				ThermoSwitch CECO	2G-91			TH	
31		2				Heater, 150W. 120V. Chromalox	SCB-150			HT 1,2	
32		2				Cleat Recept. Leviton	9063			HT 1,2	
33		1				Press. Relief Valve, 4-15PS IG Teledyne Republic	626B-1-1/4-2				



DESCRIPTION OF OPERATION

SURGE BASIN M.C.C.

JACKSONVILLE, NORTH CAROLINA

S.O. 15726, ITEM B

Reference Wiring Diagram 902060-01.

This control system uses a Reed type air compressor to force air down a bubbler tube immersed in the sewage wet well, and senses the liquid level in the wet well by measuring the back pressure on the column of air in the bubbler tube. This back-pressure is applied to pressure switches which control the ON/OFF operation of two pumps operating in a pump-down mode. The bubbler system air is furnished by one of two Reed air compressors, each of which are run for a period of three hours, after which the opposite compressor takes over on the command of a cycle timer. Additional level sensors are provided for low suction level cutoff and automatic restore of the two pumps, and for high level and low level alarms. Pump Protectors are provided for each pump, which are operated from a normally closed thermal sensor switch (furnished by others), imbedded in the motor windings. These protector circuits automatically shut down the pump when an over-temperature opens the thermal switch. The pump will remain shut down and an over-temperature light turned on, until the operator presses a reset switch.

SEQUENCE OF OPERATION

Referring to Page 2 of the Wiring Diagram, the pumps are controlled by pressure sensors PS3, PS4 and PS5, operating the Model CMC09 Two Circuit Controller/Alternator. A sequence switch is provided to permit the operator to lock the system into a 1-2 or a 2-1 operating sequence, this switch is normally left in the AUTO mode. Assume that control power is available, that the pump HAND-OFF-AUTO selector is in the AUTO mode, and that the wet well level is initially below the stop sensor PS3. As the wet well level rises, PS3 closes first, then PS4 closes calling for the lead pump to start. With the alternator in the position


shown, relay CR1 within the alternator is energized, a normally open contact of CR1 seals that relay in thru the stop sensor PS3. The normally open CR1 contact between terminals 11 and 12 of the CMC09 Module now completes a circuit through a normally open CR1 contact of the low level cutoff relay, and the normally open contact in the Pump Protector PP2 between terminals 4 and 5, thereby completing the motor starter pilot circuit for Pump No. 1, starting it as the lead pump.

If the influent is such that the lead pump can not handle the flow, the level will continue to rise in the wet well, closing pressure sensor PS5 calling for the lag pump to start. This will energize relay CR3 in the Controller, which will seal itself in thru the stop sensor PS3. Normally open contacts of CR3 complete both output circuits, between terminals 9 and 10, and 11 and 12 of the Controller. The CR3 contacts between terminals 9 and 10, combined with another normally open contact of cutout relay CR1, and the contact between terminals 4 and 5 of Pump Protector PP2, all combine to complete the starter circuit for Pump No. 2, causing that pump to start as the lag pump.

As the pumps run, lowering the level in the wet well, PS5 will open first, then PS4, then the stop sensor PS3 will open. When PS3 opens, it de-energizes relays CR3 and CR1 in the Controller, breaking the pilot circuits and causing both motor starter circuits to de-energize, stopping both pumps. At this point in time, the alternator relay changes state, reversing the pumping sequence for the next cycle. The CMC09 Controller/Alternator is further described in IM01052.

If the level in the wet well should continue to rise, pressure sensor PS6 will close lighting the high level alarm light. The indicator lights normally glow at a dim level, to indicate that the bulb filaments are in good condition and also to prolong the bulb life. When an alarm condition exists, the bulb goes from a dim glow to a high intensity. When the level recedes and PS6 opens, the high level alarm light reverts back to the dim glow state.

TITLE	DESIGNED	DRAWN	CHECKED	REVISION
DESCRIPTION OF OPERATION JACKSONVILLE, N.C. S.O. 15726, ITEM B	TWM		<i>Cham</i> 7-29-75	A
 Consolidated Electric Company 141 SOUTH LAFAYETTE FREEWAY SAINT PAUL, MINNESOTA 55107	PAGE	DRAWING NO		
	1 OF 3	IM01074		

TITLE	DESIGNED	DRAWN	CHECKED	REVISION
DESCRIPTION OF OPERATION JACKSONVILLE, N.C. S.O. 15726, ITEM B	TWM		<i>Cham</i> 7-29-75	A
 Consolidated Electric Company 141 SOUTH LAFAYETTE FREEWAY SAINT PAUL, MINNESOTA 55107	PAGE	DRAWING NO		
	2 OF 3	IM01074		



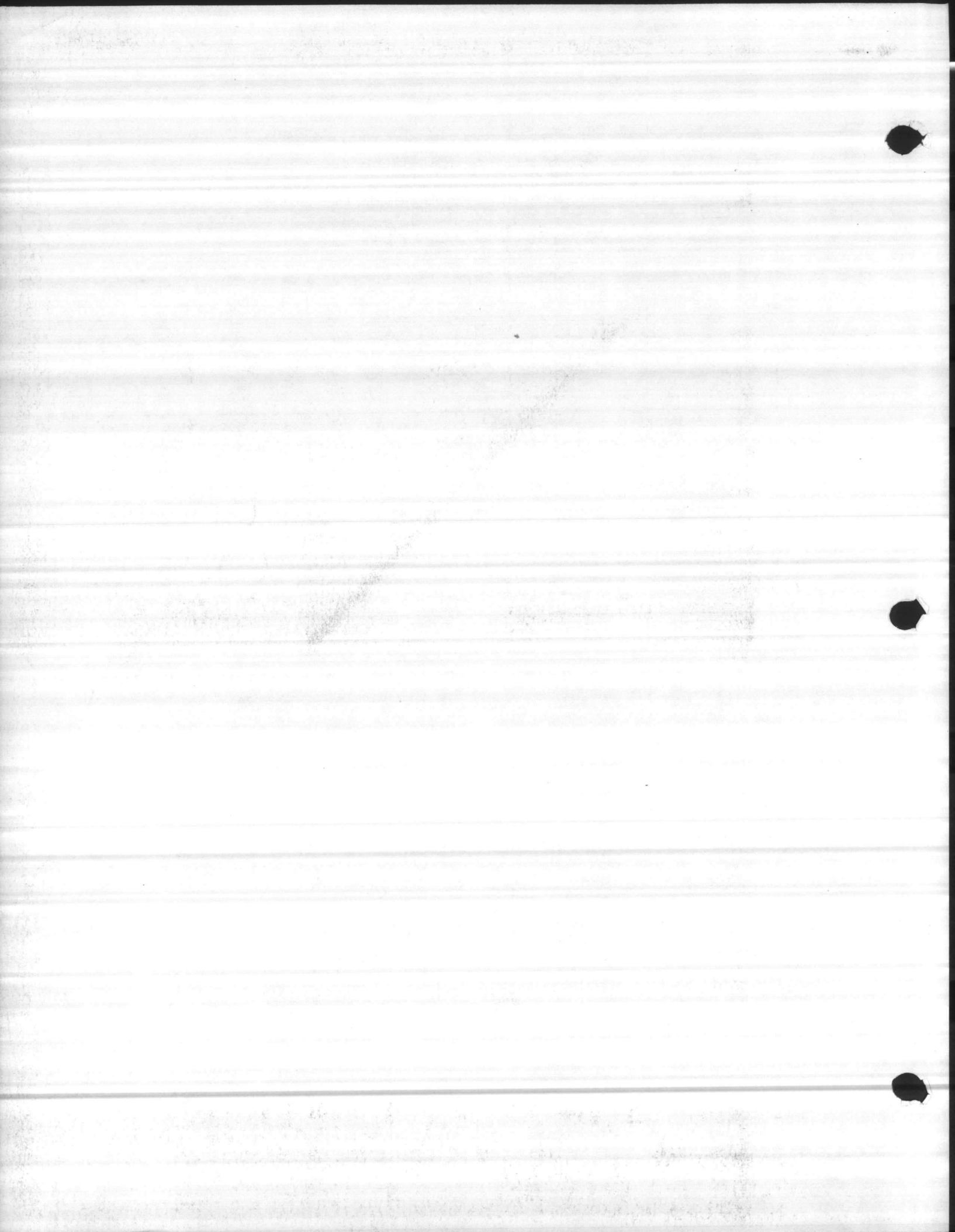
If the level in the wet well recedes below that at which the pumps would have adequate suction, sensor PS1 will open, dropping out low level cutoff relay CR1, which opens both motor starter pilot circuits, preventing the pumps from running. The pump-stop level setting of PS3 should normally be set at a higher pressure than the settings of either PS1 or PS2. As the level in the wet well begins to rise again, and PS1 closes, relay CR1 will stay de-energized until the level rises further, closing PS2. At this automatic restoration level, relay CR1 will be energized, sealing itself in thru its normally open contact and sensor PS1. This will reclose the contacts of CR1 permitting the pumps to start when required. Note that when the low suction cutoff sensor PS1 is opened, and CR1 is de-energized, a normally closed CR1 contact brings the low level alarm light to full brilliance. This light stays on until sensor PS2 closes on rising level, re-energizing relay CR1.

The Pump Protectors, Model CMP02, operate to disable a pump when its motor temperature rises too high, opening the sensor switch in the pump winding. An over-temperature indicator light is brought to full brilliance when the thermal protection circuit is triggered by the opening of the thermal switch. The CMP02 Protector resets automatically after power failure. Upon occurrence of an over-temperature condition, the pump will stay locked out, and the over-temperature light on, until the operator presses the reset button. The CMP02 Pump Protector is further described in IM00793.

The two air compressors are self contained and operate from a duplex outlet inside the enclosure. Cycle Timer CT1 alternates its switch position every three hours, thereby alternating from one compressor to the other. Therefore, the continuous duty rated compressors are only required to operate on a 50% duty cycle.

TITLE	DESCRIPTION OF OPERATION	DESIGNED	DRAWN	CHECKED	REVISION
	JACKSONVILLE, N.C. S.O. 15726, ITEM B	TWM		<i>C. E. W.</i> 7-24-77	A
	 Consolidated Electric Company 141 SOUTH LAFAYETTE FREEWAY SAINT PAUL, MINNESOTA 55107	PAGE	DRAWING NO		
		3 OF 3	IM01074		





DESCRIPTION OF OPERATION

CURTIS ROAD RAW WATER BOOSTER STATION MOTOR CONTROL CENTER

JACKSONVILLE, NORTH CAROLINA

S.O. 15726, ITEM C


Reference Wiring Diagram 902061-01.

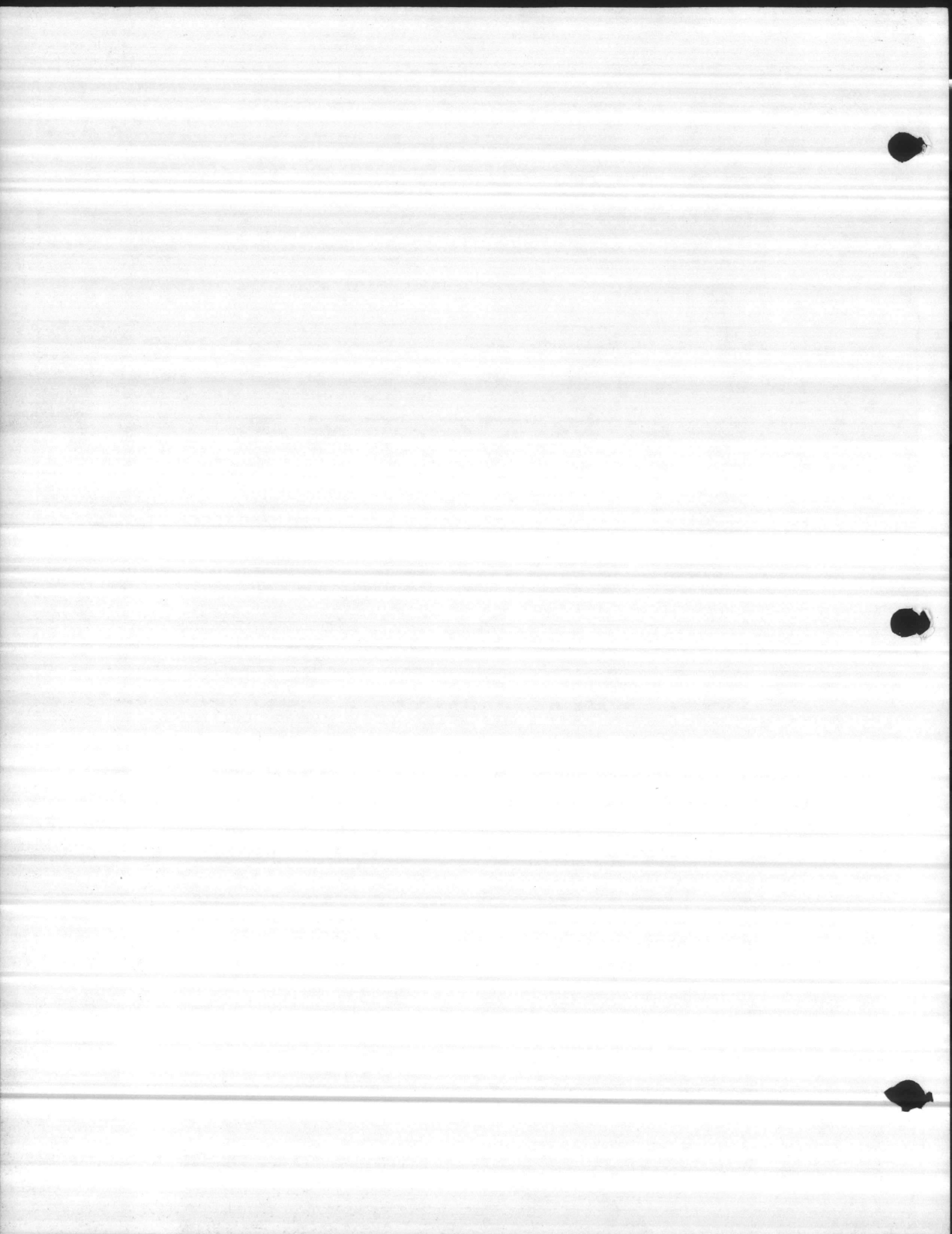
Note that the two booster pumps can be operated either from the main panel at the water plant or locally from pushbuttons in the motor control center units. Note also that low suction pressure cutout circuits are provided, such that if the suction pressure to the boosters is too low, a pressure sensor will open, disabling the pump motor starter and energizing a booster low suction light.

The DC control circuitry from the main water plant will normally be used to operate the two booster pumps. When the operator at the main plant control panel presses the start button for Booster No. 1, it energizes DC relay CR1, which closes a normally open contact across the start button in the motor starter pilot circuit, pulling in the motor starter, which seals itself in thru a normally open auxiliary contact. When the operator at the main panel presses the Booster No. 1 stop button, it will momentarily energize DC relay CR2, which will open its normally closed contact in series with the stop push button of the starter circuit, dropping out the motor starter. With normal suction pressure, the low suction pressure switch will be closed or in the upward position. Operation of the second booster pump is performed in the same manner as the first utilizing DC relays CR3 and CR4.

A phone jack is provided, for use of the sound powered telephone, to communicate to the main panel at the water plant. The operator merely plugs the phone into the phone jack, and presses the call button, signalling the operator at the main plant.

Condensation protection heaters are provided in this unit, operated from a thermostatic switch. When the temperature in the enclosure falls below a preset limit, the thermostatic switch closes energizing the electric heaters. These heaters will stay energized, heating the panel, until the thermostatic switch opens.

TITLE	DESCRIPTION OF OPERATION JACKSONVILLE, N.C. S.O. 15726, ITEM C	DESIGNED TWM	DRAWN	CHECKED <i>clm</i> 7-29-75	REVISION A
	Consolidated Electric Company 141 SOUTH LAFAYETTE FREEWAY SAINT PAUL, MINNESOTA 55107	PAGE 1 OF 1	DRAWING NO IM01075		



DESCRIPTION OF OPERATION

THE NEW RIVER SEWAGE PUMPING STATION MOTOR CONTROL CENTER
 JACKSONVILLE, NORTH CAROLINA
 S.O. 15726, ITEM D

Reference Wiring Diagram 902062-01.

This control system uses sonic transducers to measure the level in the wet well and also the level in a flume, indicating flow. Bulletin B100, Model 9G Float Switches are used to sense high level and low level alarm conditions in the wet well. Output contacts from the level sensing unit are used to operate the three pumps if their HAND-OFF-AUTO selectors are left in the AUTO mode. Contacts are provided to sense high and low level and telemeter back to the annunciator panel, Shop Order Item J, at the Geiger Sewage Treatment Plant. Auxiliary contacts are furnished in the motor starter units also, to telemeter the pump running status to the annunciator panel. A call button and phone jack are provided, as well as a sonalert which can be activated from a call button at the Geiger Treatment Plant Panel. A thermostat is provided, which operates condensation heaters in each vertical section of the enclosure. When the temperature falls to a level which would cause moisture condensation, the switch closes, operating the electric heaters. The heaters will remain in operation until the temperature is elevated enough to open the thermostat.

A remote sonic transducer located above the flume, detects the level of the liquid flowing in the flume. The signal from the remote transducer is sent to the flow receiver, which derives an output proportional to flow in the flume. This signal is used to position the flow indicating recorder.


Another remote sonic transducer is located above the liquid in the wet well, and senses the level of the liquid. It then transmits this information to the level receiving unit in the panel. This unit operates the Wet Well Level Indicator, and derives eight control setpoints. Six of these setpoints are used to control the operation of the three sewage pumps.

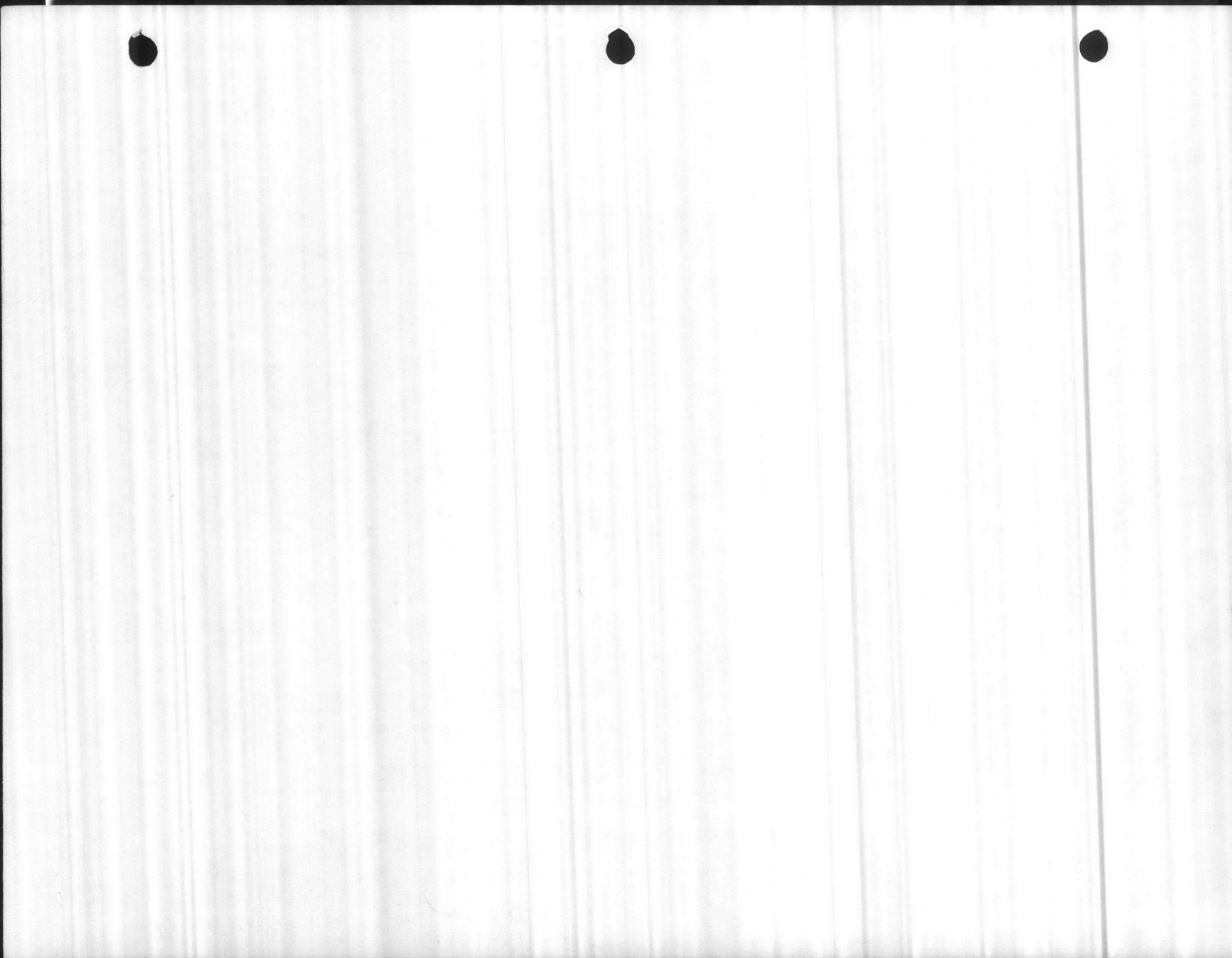
When the level rises above setpoint 2 and reaches setpoint 1, relay CR3 is energized, starting Pump No. 1. When the level falls below setpoint 2, CR3 drops out, stopping Pump No. 1. The other pumps operate in the same way, using CR4 and CR5.

When the high level alarm float switch closes, it energizes relay CR1 and the high level alarm light. A normally open contact of CR1 completes the circuit between terminals 5 and 7, telemetering the high level condition to Shop Order Item J, the annunciator panel at the Geiger Sewage Treatment Plant. In a like manner, if the level in the wet well falls to an abnormally low level, the low level float switch closes, energizing relay CR2 and the low level alarm light. A normally open contact of CR2 completes a circuit from terminals 5 to 8 telemetering the low level condition to the annunciator panel at the Geiger Plant.

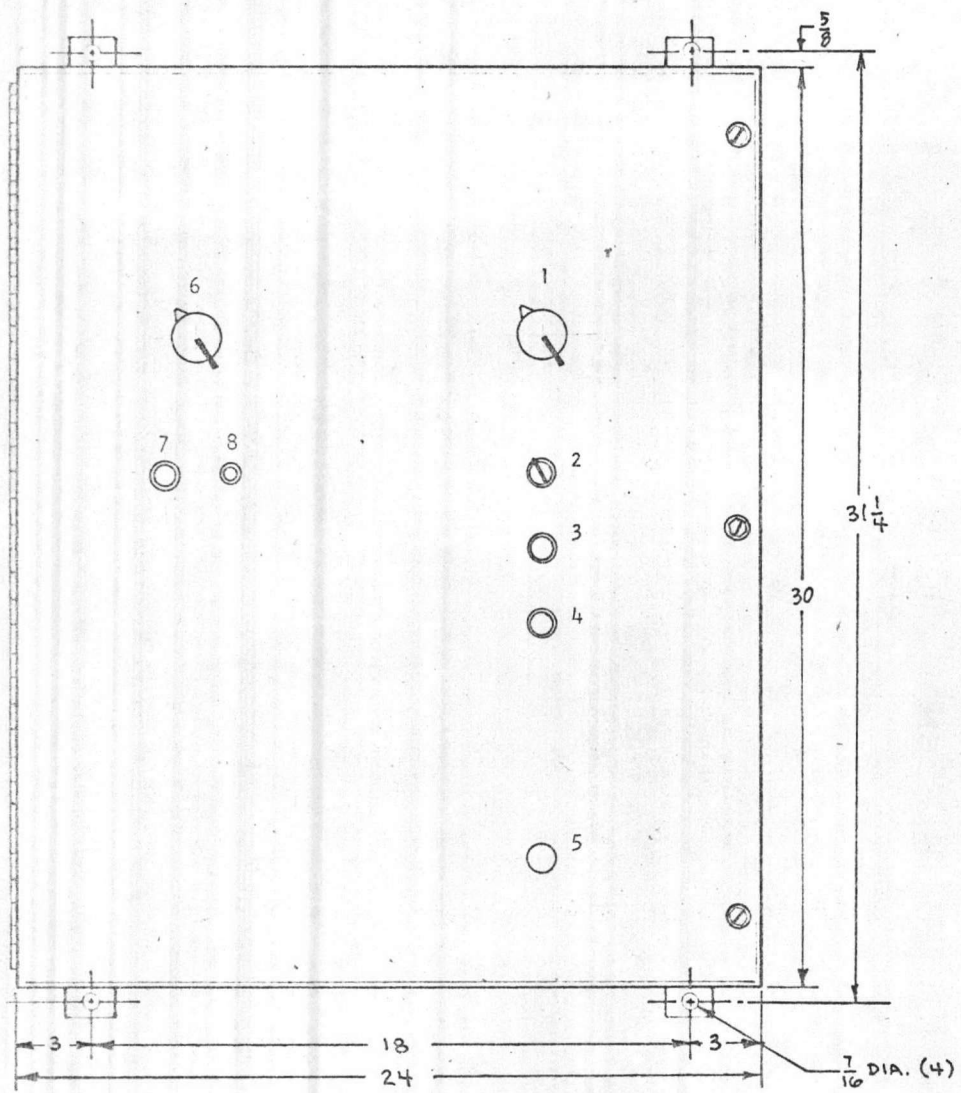
Auxiliary contacts of each starter furnish a pump running signal to the Geiger Plant Panel. For instance when Pump 1 is running, a circuit is completed from terminals 5 to 9, telling the annunciator panel that Pump 1 is running.

TITLE	DESIGNED	DRAWN	CHECKED	REVISION
DESCRIPTION OF OPERATION JACKSONVILLE, N.C. S.O. 15726, ITEM D	TWM		<i>7-30-75</i>	B
 Consolidated Electric Company 141 SOUTH LAFAYETTE FREEWAY SAINT PAUL, MINNESOTA 55107	PAGE 1 OF 2	DRAWING NO IM01076		

TITLE	DESIGNED	DRAWN	CHECKED	REVISION
DESCRIPTION OF OPERATION JACKSONVILLE, N.C. S.O. 15726, ITEM D	TWM			B
 Consolidated Electric Company 141 SOUTH LAFAYETTE FREEWAY SAINT PAUL, MINNESOTA 55107	PAGE 2 OF 2	DRAWING NO IM01076		



A B C D E F G H I J K L M N O

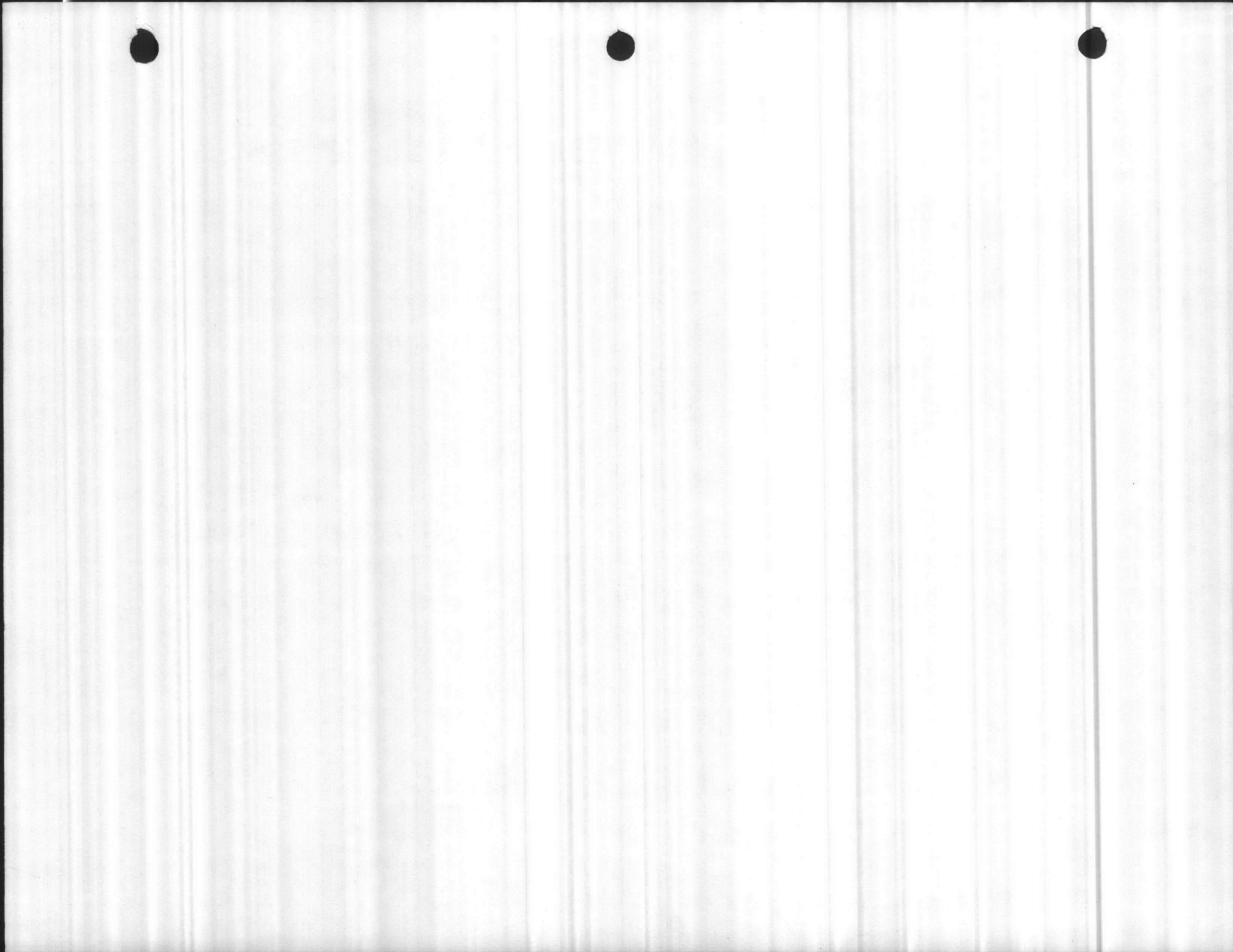


REV.	CO. NO.	DATE	DESCRIPTION	CHK	APP.
A	3723	8/7/75	RELEASED		
B	HJG	2-12-76	CUST'S. CHANGES		

NAMEPLATE AND/OR DEVICES


1. WELL PUMP FUSED DISCONNECT SWITCH
2. SELECTOR SWITCH - MOTOR/AUX. ENGINE
3. START PUSHBUTTON SWITCH
4. STOP PUSHBUTTON SWITCH
5. OVERLOAD RESETTER
6. LIGHTING & REC'P. FUSED DISC. SWITCH
7. CALL PUSHBUTTON SWITCH
8. TELEPHONE JACK

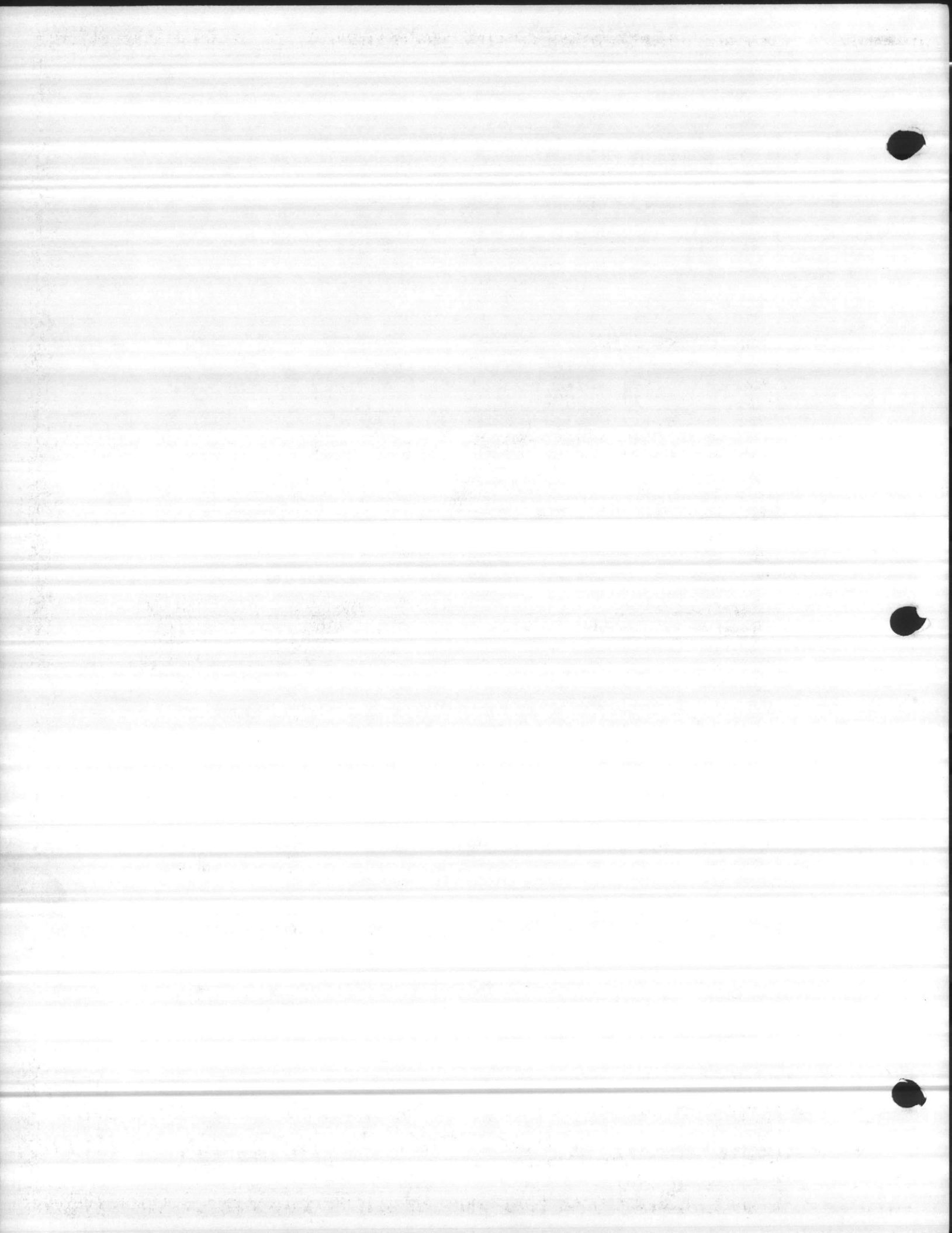
TITLE: DIMENSION DIAGRAM & ARRANGEMENT NEMA 1 ENCLOSURE WELL PUMP POWERPACK CONTROL		ITEM "E"
SHOP ORDER 15726	JOB NAME JACKSONVILLE, N.C.	MATERIAL 14GA. (.075) CRS
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55104		PARENT NO. GRAY HAMMERTONE
TOLERANCES UNLESS OTHERWISE SPECIFIED. TWO PLACE DEC ± .010. THREE PLACE DEC ± .005. FRACTIONS ± 1/64 ANGULAR.	DO NOT SCALE	DESIGNED TWM DRAWN HJG 7/17/75 DATE 7-30-75 CHECKED [Signature]
PART NO. 1M0113		REV. B



SERIAL NUMBER
E1 E2 E3 E4 E5

ITEM NO.	CECO PART NUMBER	SUB-VARIATION					DESCRIPTION	PL	PAGE 1	OF 1	DWG. NO. 201893-XX
		01	02	03	04	05					
		QUANTITY									
1	DL01382	REF	REF	REF	REF	REF	Document List				
2	902064-01	REF	REF	REF	REF	REF	Wiring Diagram				
3	800034-01	1	1	1	1	1	Encl., NEMA 1 CECo <small>30x24x7</small>				
4		1	1	1	1	1	Inner Panel Hoffman	A-30P24			
5		3	3	3	3	3	Term. Block Buchanan	825AL		TB 1	
6		1	1	1	1	1	End Piece Buchanan	850		TB 1	
7		1	1	1	1	1	Term. Block Marathon	308		TB 2	
8		1	1	1	1	1	Lightning Arrestor 3 phase G.E.	9L15BCC003		LA	
9		1	1	1	1	1	LA Mtg. Bkt. CECo	91G-15		LA	
10	700076-01	1	1	1	1	1	5 Ckt. Ground Bar CECo			LP NEUT.	
11		1	1	1	1	1	30A., 3-pole Disc. Sw. ITE	D10S1		DS 2	
12		1	2	1	1	1	Fuse Kit, DS ITE	D12C21		DS 2,1	
13		2	2	2	2	2	DS Handle ITE	D11SF2		DS 2,1	
14		2	2	2	2	2	Relay, 48V. DC 4PDT P&B	KHPI7D12-48		CR 1,2	
15		2	2	2	2	2	Socket 14 pin Rundel	SL-715		CR 1,2	
16		2	2	2	2	2	PB Switch N.O. Salinger	MPI-B		PB 2,3	
17		1	1	1	1	1	PB Switch N.C. Salinger	MPI-R		PB 1	
18	800156-03	1	1	1	1	1	N.O.-N.C., 2 position Switch CECo			SS 1	
19		1	1	1	1	1	60 A., 3-pole Disconnect ITE	D10S2		DS 1	
20		1	1	1	1	1	Fuse Kit, DS ITE	D12D22		DS 1	
21		1	1	1	1	1	240V. coil, Size 2 Motor Starter G.E.	CR206D003		MS 1	
22		1	1	1	1	1	Aux. Interlock N.O. G.E.	CR205X100D		MS 1	
23		3					O.L. Heater G.E.	CR123C25.0B		MS 1	
24			3				O.L. Heater G.E.	CR123C16.3B		MS 1	
25				3			O.L. Heater G.E.	CR123C25.0B		MS 1	
26					3		O.L. Heater G.E.	CR123C25.0B		MS 1	
27						3	O.L. Heater G.E.	CR123C25.0B		MS 1	
28		1	1	1	1	1	Phone Jack Newark Switchcraft	39F656 111			
29		3					Fuse Buss	FRN-35		DS 1	
30			3				Fuse Buss	FRN-25		DS 1	
31				3			Fuse Buss	FRN-35		DS 1	
32					3		Fuse Buss	FRN-35		DS 1	
33						3	Fuse Buss	FRN-35		DS 1	
34		2	2	2	2	2	Fuse Buss	FRN-20		DS 2	

201893-01	PAGE	OF	REV	TITLE:	S.O. 15726 ITEM "E"		DFT	7/1/75	HIG
	1	1	B	POWERPACK CONTROL			CHK	7/2/75	
	DRAWING NO.			 CONSOLIDATED ELECTRIC CO. 141 SO. LAFAYETTE FREEWAY • ST. PAUL, MINN. 55107				ENG	
	201893-01							APP	7/7/75



DESCRIPTION OF OPERATION
 WELL PANELS FOR WELLS N,O,P,Q,R
 JACKSONVILLE, NORTH CAROLINA
 S.O. 15726, ITEM E


Reference Wiring Diagram 902063-01.

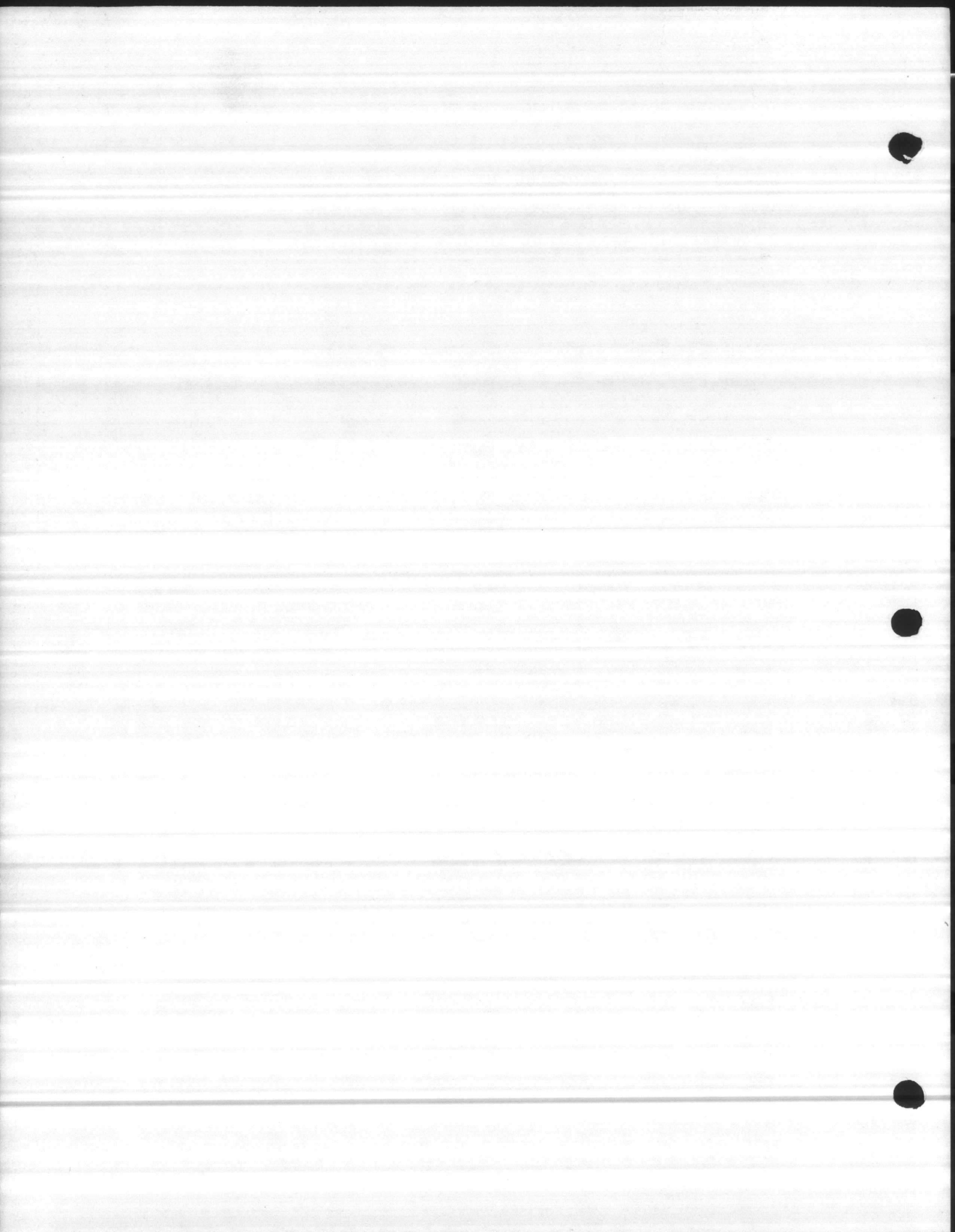
The operation of the well pump is controlled either from start and stop buttons at the well panel, or from remote start and stop buttons at the main control panel in the water plant. The motor starter circuit is interlocked with an engine drive, by selector switch SS1. Only when the selector is in the MOTOR position, will the motor starter be capable of energizing from either local or remote control. When the switch is in the ENGINE position, the engine start circuit will be permitted to operate, but the motor starter circuit will be locked out.

For local control, the operator starts the pump by pressing the start button, which energizes starter MS1, which seals itself in through the normally closed stop button and normally closed relay contact CR2. The operator stops the pump by pressing the stop button which de-energizes the starter.

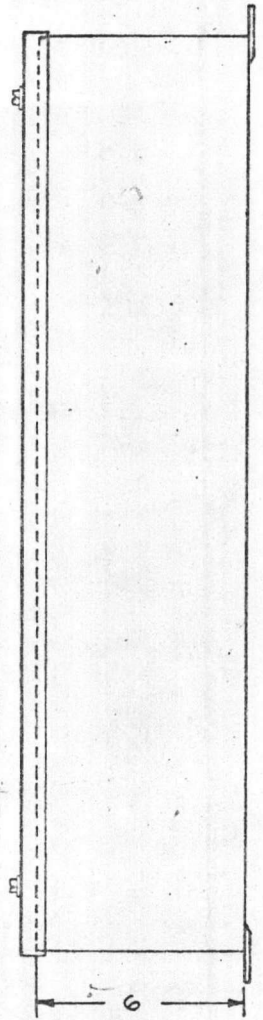
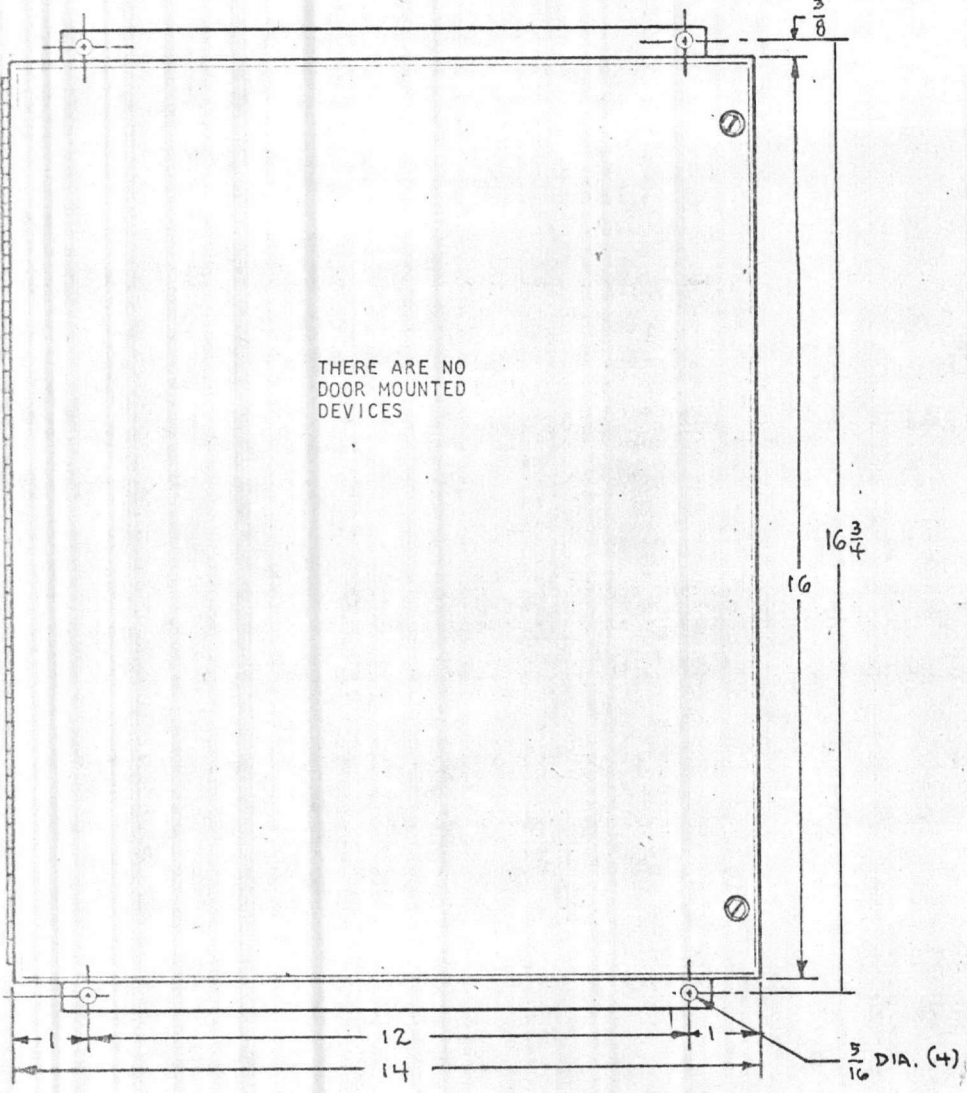
For remote control from the main panel at the water plant, the operator presses the start button at the water plant, momentarily energizing dc relay CR1, which completes a circuit around the start button, energizing the starter which seals itself in with the MS1 auxiliary contact. When the operator at the main plant presses the stop button for this well, relay CR2 is momentarily energized, which opens the normally closed CR2 contact in series with the stop button, de-energizing the starter and stopping the pump.

A normally open motor starter auxiliary contact will complete a circuit between terminal 7 and terminal 5, lighting a run light at the main plant panel. When the operator wishes to talk to the operator at the main plant panel, he plugs the sound powered telephone into the phone jack, and presses the call button completing a circuit between terminals 6 and 7 and lighting a light at the main panel.

TITLE DESCRIPTION OF OPERATION, JACKSONVILLE, N.C. S.O. 15726, ITEM E	DESIGNED TWM	DRAWN	CHECKED <i>Jim</i> 7-30-75	REVISION A
 Consolidated Electric Company 141 SOUTH LAFAYETTE FREEWAY SAINT PAUL, MINNESOTA 55107	PAGE 1 OF 1	DRAWING NO IM01077		

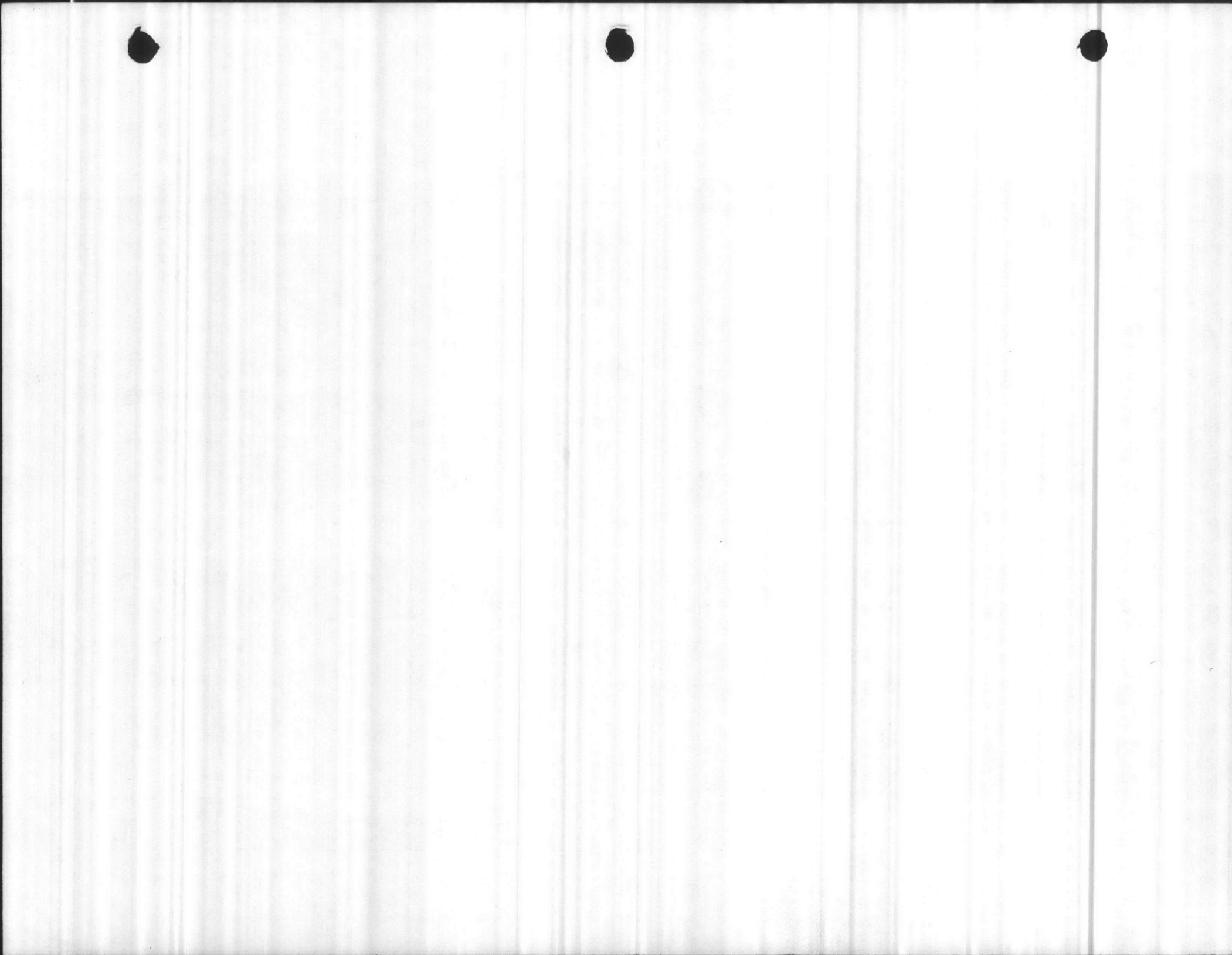


A B C D E F G H I J K L M N O P



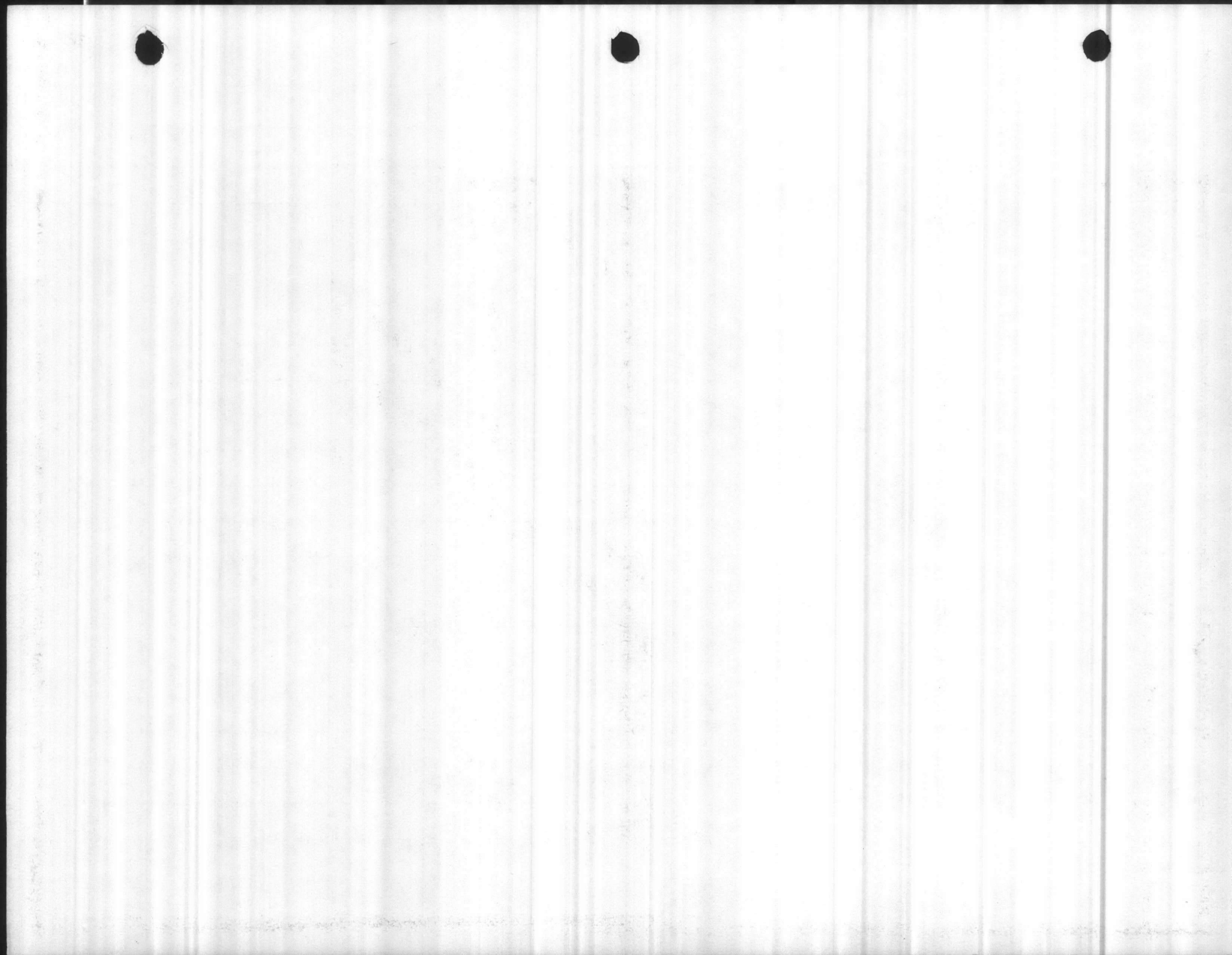
REV.	CO. NO.	DATE	DESCRIPTION	CHK.	APP.
A	3723	8/7/75	RELEASED		

TITLE: DIMENSION DIAGRAM NEMA 1 ENCLOSURE CLEARWELL PROBE CONTROL		ITEM "F"
SHOP ORDER 15726	JOB NAME JACKSONVILLE, N.C.	MATERIAL 14GA. (.075) CRS
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN 55107		FINISH GRAY HAMMERTONE
TOLERANCES UNLESS OTHERWISE SPECIFIED: TWO PLACE DEC. ± .010 THREE PLACE DEC. ± .005 FRACTIONS ± 1/64 ANGULAR.	DO NOT SCALE	DRAWING NO. IM01114 DESIGNED TWM DATE 7-30-75 DRAWN HJG 7/17/75 CHECKED [signature] REV. A

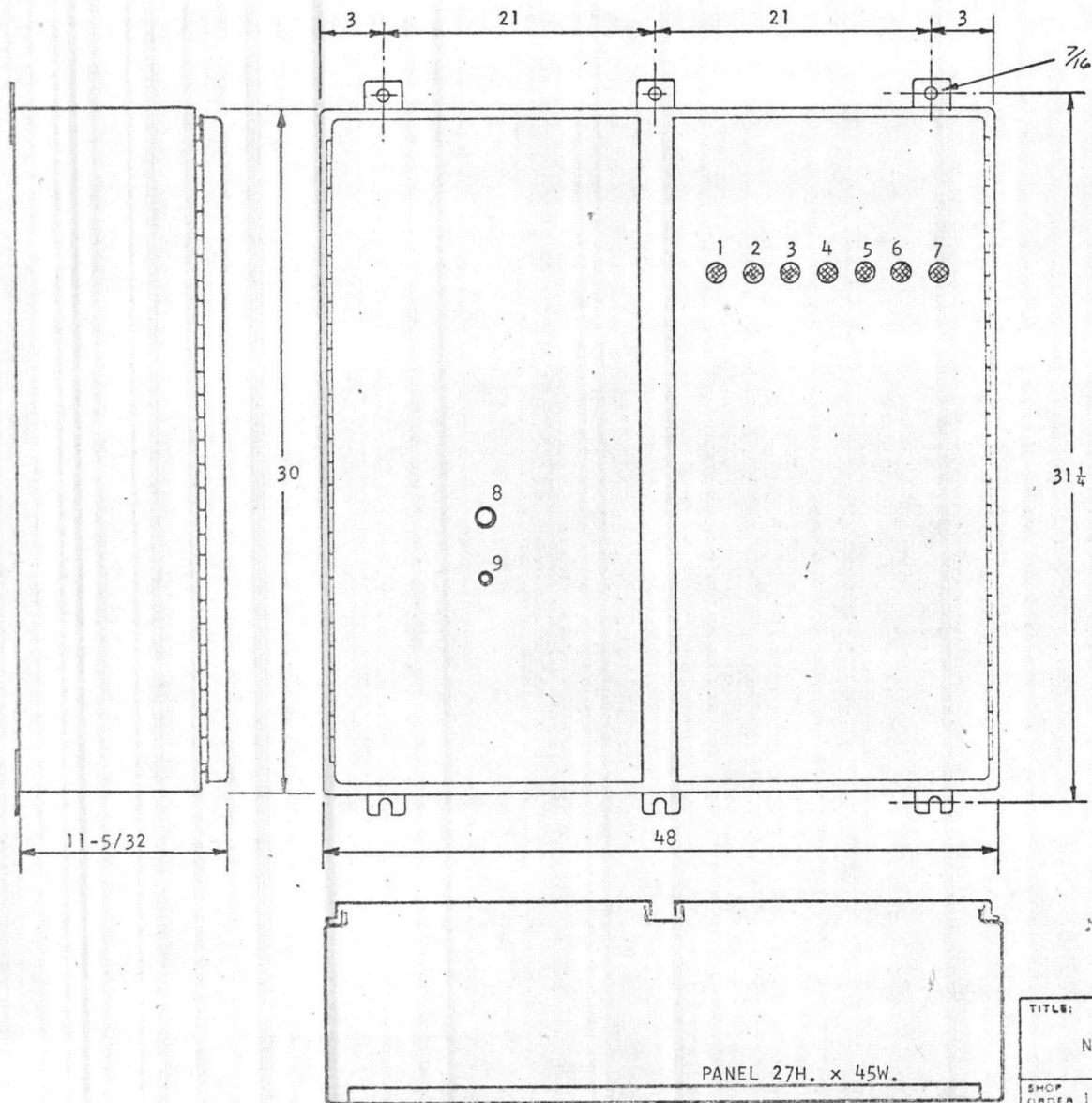


ITEM NO.	CECO PART NUMBER	SUB-VARIATION				K	DESCRIPTION	PL	PAGE 1	OF 1	DRAWING NO. 201894-01	SPECS. OR MFG'S P/N	COMPONENT DESIGNATION
		01											
1	DL01382	REF					Document List						
2	902064-01	REF					Wiring Diagram						
3		1					Enclosure NEMA 1 Hoffman				A-1614CH		
4		1					Inner Panel Hoffman				A-16P14		
5		1					Term. Block Marathon				316	TB 1	
6		2					Probe Relay Warrick				1G1D0	PR 1,2	
7	800057-02	1					Relay, 120V. ^{3PDT} CECO					CR 1	
8	800080-01	1					Socket 11 pin CECO					CR 1	
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													

PL	PAGE 1	OF 1	REV. A	TITLE	BULLETIN D100 PROBE CONTROL S.O. 15726 ITEM "F"			DRFT	7/1/75	HJG
	DRAWING NUMBER 201894-01				 CONSOLIDATED ELECTRIC CO. 141 SO. LAFAYETTE FREEWAY • ST. PAUL, MINN. 55107	CHKD	7-30-75	<i>cfm</i>		
								ENG		<i>cfm</i>
								APP	8/7/75	<i>cfm</i>



A B C D E F G H I J K L M N O

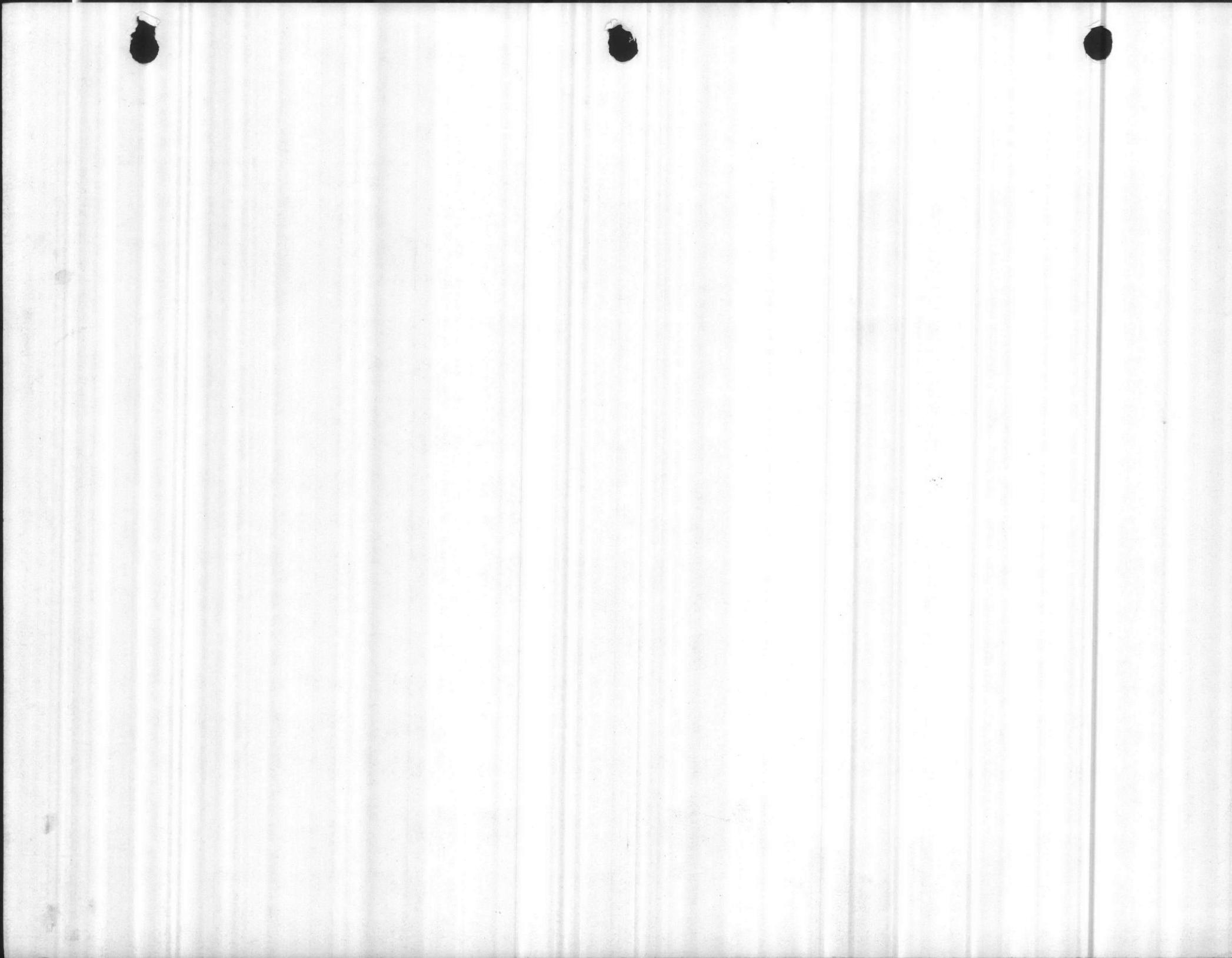


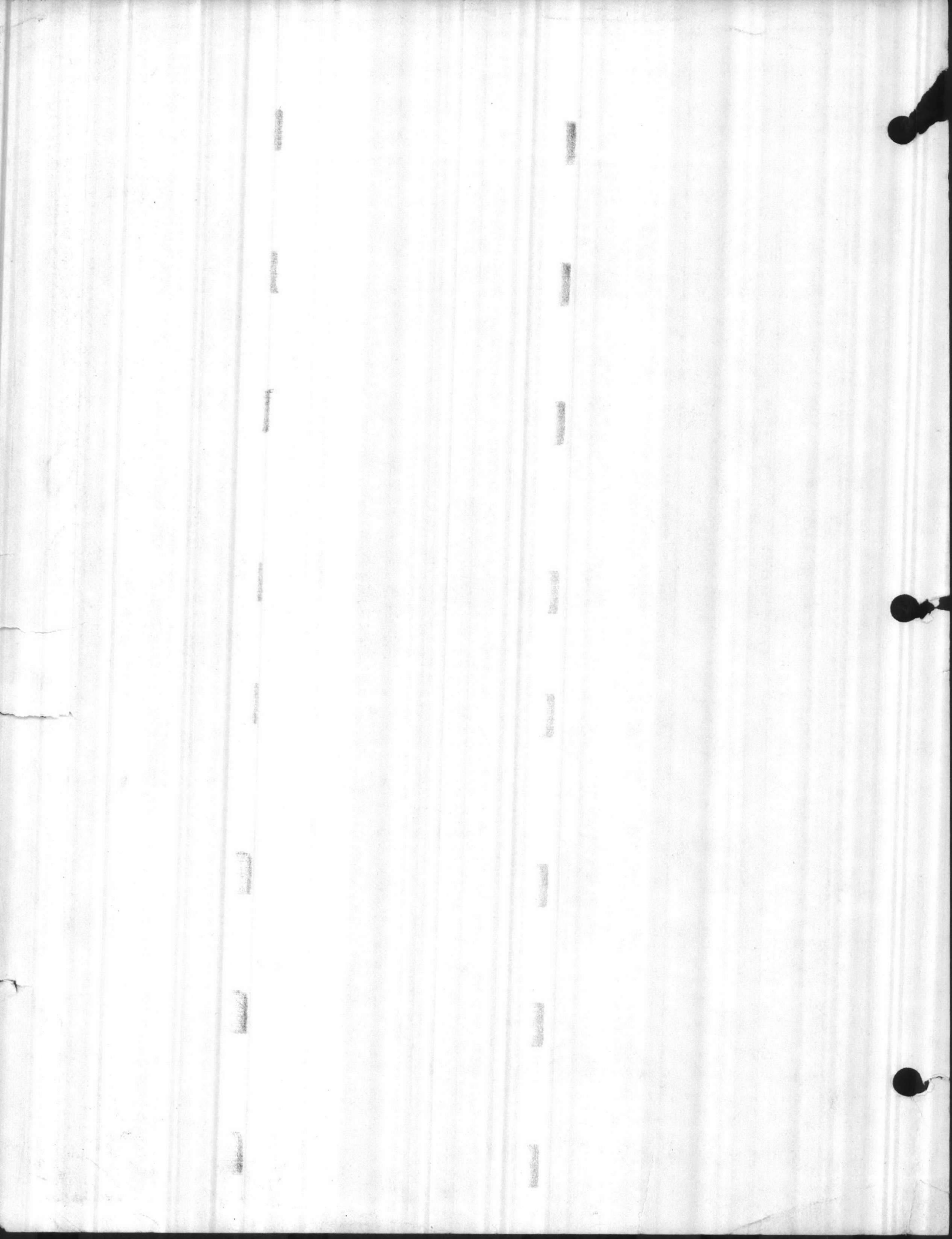
REV	CO NO	DATE	DESCRIPTION	CHK	APP
A	3723	8/7/75	RELEASED		<i>ch</i>
B	HJG	2-11-76	CUST'S. CHANGES		<i>ch</i>

NAMEPLATE AND/OR DEVICE

1. AMBER INDICATING LIGHT - WELL NO. 2 REQUIRED
2. AMBER INDICATING LIGHT - WELL NO. 3 REQUIRED
3. AMBER INDICATING LIGHT - WELL NO. 5 REQUIRED
4. AMBER INDICATING LIGHT - WELL NO. 7 REQUIRED
5. AMBER INDICATING LIGHT - WELL NO. 8 REQUIRED
6. AMBER INDICATING LIGHT - WELL NO. 10 REQUIRED
7. AMBER INDICATING LIGHT - WELL NO. 11 REQUIRED
8. CALL PUSHBUTTON SWITCH
9. TELEPHONE JACK

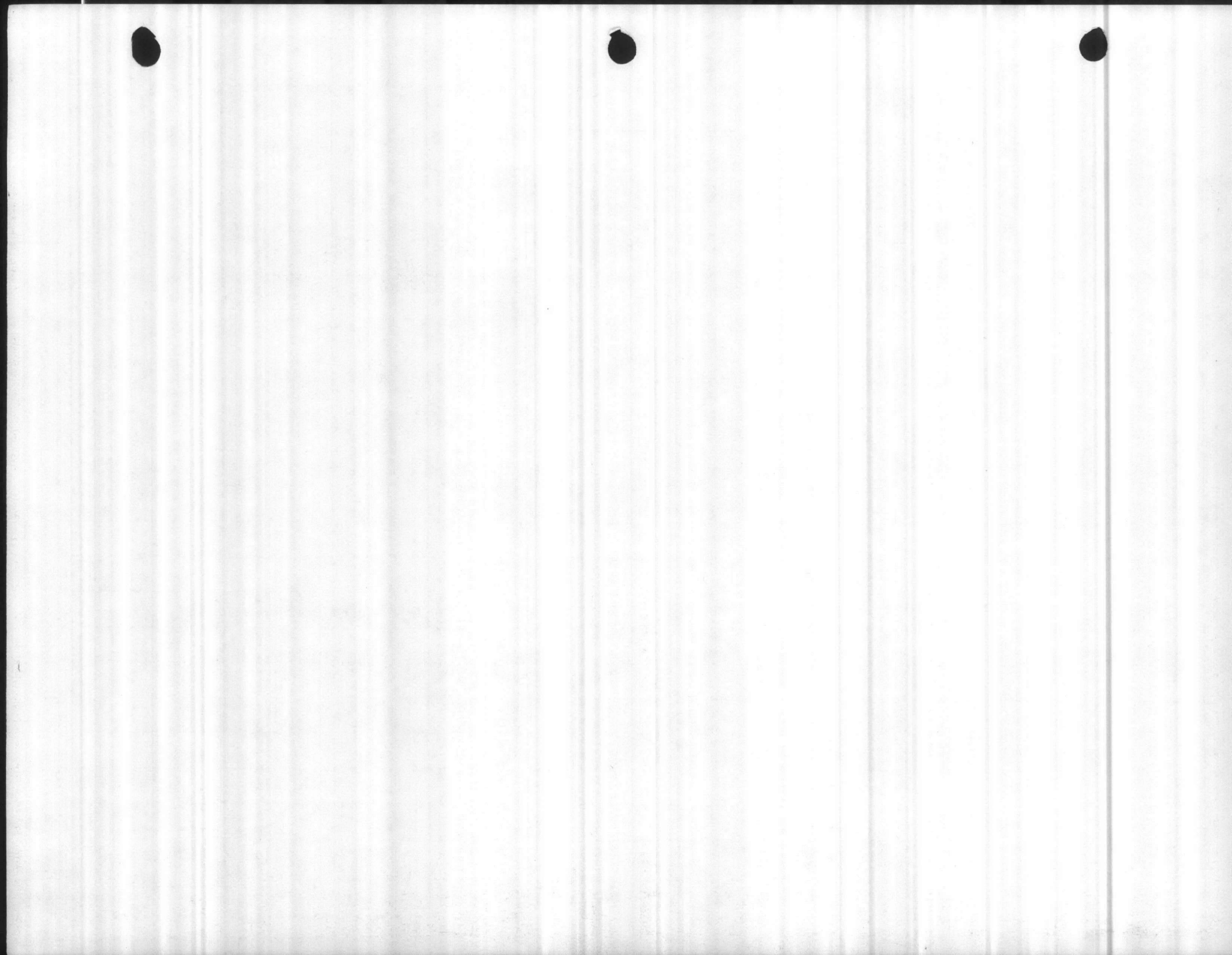
TITLE: DIMENSION AND ARRANGEMENT NORTHWEST CORNER WELL CONTROL PANEL		ITEM "G"
SHOP ORDER 15726	JOB NAME JACKSONVILLE, NORTH CAROLINA	MATERIAL 14GA. (.075) C.P.S.
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN.		FINISH GRAY HAMMERTONE
TOLERANCES UNLESS OTHERWISE SPECIFIED: FRACTIONS: .005 FRACTIONS: .005 ANGULAR	DO NOT SCALE	DATE 9-1-75 TWM HJG 7/30/75 <i>ch</i>
IM01115		B






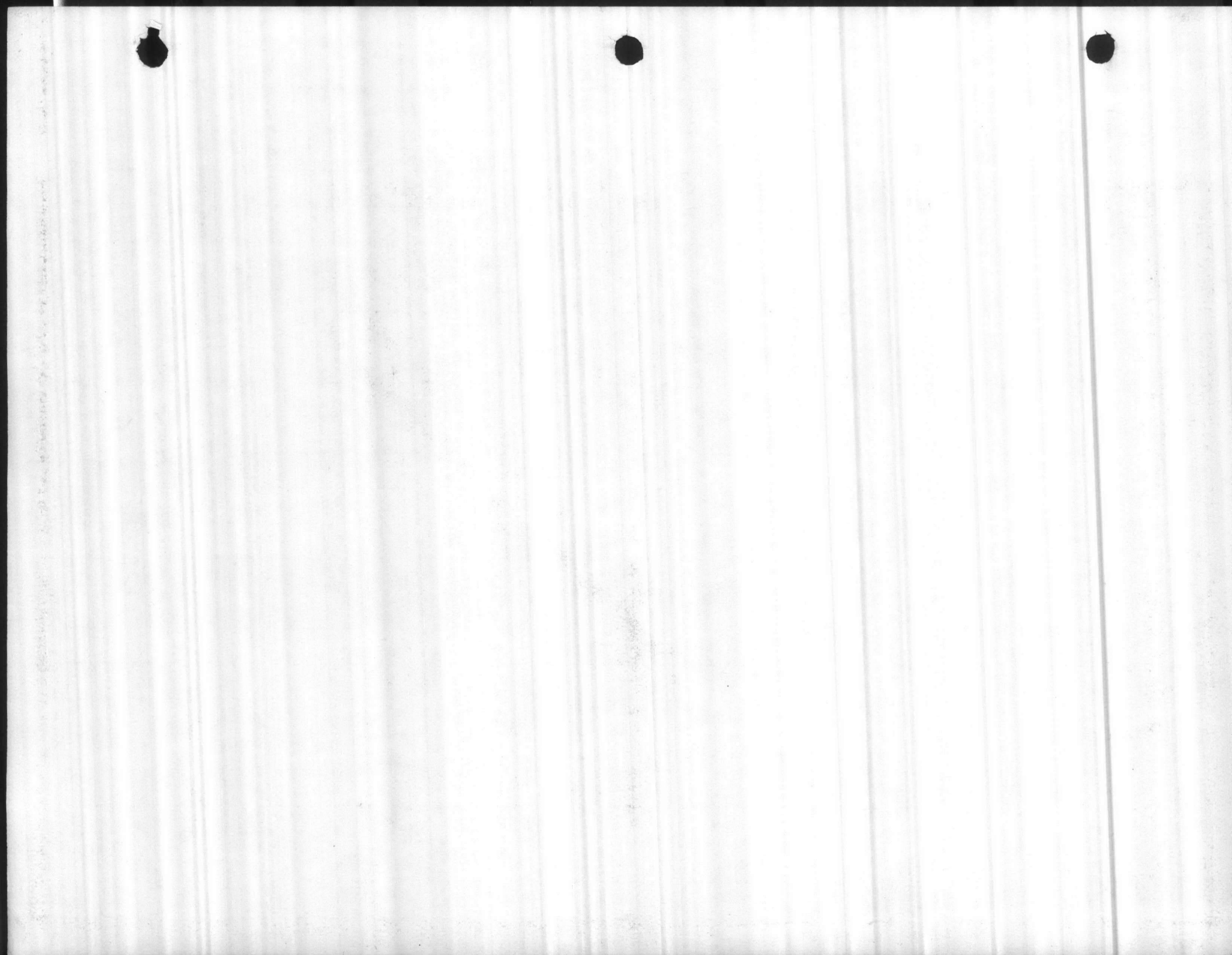
ITEM NO.	CECO PART NUMBER	SUB-VARIATION				K	DESCRIPTION	PL	PAGE 1	OF 1	DRAWING NO. 201892-01	SPECS. OR MFG'S P/N	COMPONENT DESIGNATION	
		01												
1	DL01382	REF					Document List							
2	902062-01	REF					Wiring Diagram							
3		1					3 Unit, NEMA 12 M.C.C. West.					See P.O.		
4		1					Thermoswitch CECO				2G-91	TH		
5		3					Heater, 120V. ^{150 Watts} Chromalox				SCB-150	HT 1-3		
6		3					Screw Base Receptacle Leviton				9063	HT 1-3		
7		1					Term. Block Marathon				318	TB 1		
8	800057-02	5					Relay, 120V. ^{3PDT} CECo					CR 1-5		
9	800080-01	5					Socket 11 pin CECo					CR 1-5		
10		1					PB Switch ^{Norm. Open} Salinger				MPIB	PB 1		
11		1					Telph. Jack Newark Switchcraft				39F656 111			
12	800085-02	1					Audible Alarm CECO							
13		2					Light Base Dialco				103-4001-05-103	LT 1,2		
14		2					Lens, Red Dialco				103-1331-403	LT 1,2		
15		2					Lamp, 155V. ^{6 Watts} G.E.				6S6-155	LT 1,2		
16		2					Level Receiver Inventron				PC-15-5-SP3	By Others	X	
17		1					Level Indicator Inventron					By Others	X	
18		1					Indicator/ Recorder, Flow Inventron				4-1-R	By Others	X	

PL	PAGE 1	OF 1	REV. C	TITLE NEW RIVER M.C.C.	S.O. 15726 ITEM "D"	DRFT 7/29/75	HJG
	 CONSOLIDATED ELECTRIC CO. 141 SO. LAFAYETTE FREEWAY • ST. PAUL, MINN. 55107				CHKD 7-30-75	<i>[Signature]</i>	
					ENG	<i>[Signature]</i>	
					APP 8/7/75	<i>[Signature]</i>	
DRAWING NUMBER 201892-01							



ITEM NO.	CECO PART NUMBER	SUB-VARIATION				K	DESCRIPTION	PL	PAGE 1	OF 1	DRAWING NO. 201895-01	SPECS. OR MFG'S P/N	COMPONENT DESIGNATION
		01											
1	DL01382	REF					Document List						
2	902065-01	REF					Wiring Diagram						
3		1					Encl., ^{30x48x10} NEMA 12 Hoffman				A-304810WFLP		
4		1					Inner Panel Hoffman				A-48P30		
5		7					120V. ³ NO Load Relay C-H				9575-H2732-66	LR 1-7	
6		7					Light Base Dialco				103-4001-05-103	LT 1-7	
7		7					Lens, Amber Dialco				103-1333-403	LT 1-7	
8		7					Lamp, 155V. ⁶ Watts G.E.				6S6-155	LT 1-7	
9		1					Switch, PB ^{Norm. Open} Salinger				MP1B	PB 1	
10													
11		1					Telph. Jack ^{Newark} Switchcraft				39F656 111		
12		14					Relay, 48V. DC ^{4PDT} P&B				KHP17D12-48	CR 1-14	
13		14					Socket ^{14 pin} Rundel				SL-715	CR 1-14	
14		1					1-pole, 10A. Trip Circuit Bkr. West.				HQCL-1010	CB 1	
15		2					Surface Mtg. Clip West.				K82216	CB 1	
16		40					Term. Section Buchanan				625	TB 1	
17		4					End Piece Buchanan				630	TB 1	
18													

PL	PAGE 1	OF 1	REV. B	TITLE N.W. CORNER WELL CONTROL	S.O. 15726, ITEM "G"	DRFT 7/30/75	HJG
	DRAWING NUMBER 201895-01				 CONSOLIDATED ELECTRIC CO. 141 SO. LAFAYETTE FREEWAY • ST. PAUL, MINN. 55107	CHKD 8-1-75	efm
						ENG	TWM
						APP 8/7/75	efm



DESCRIPTION OF OPERATION


WELL CONTROL PANEL AT THE NORTHWEST CORNER OF THE WATER PLANT
JACKSONVILLE, NORTH CAROLINA
S.O. 15726, ITEM G

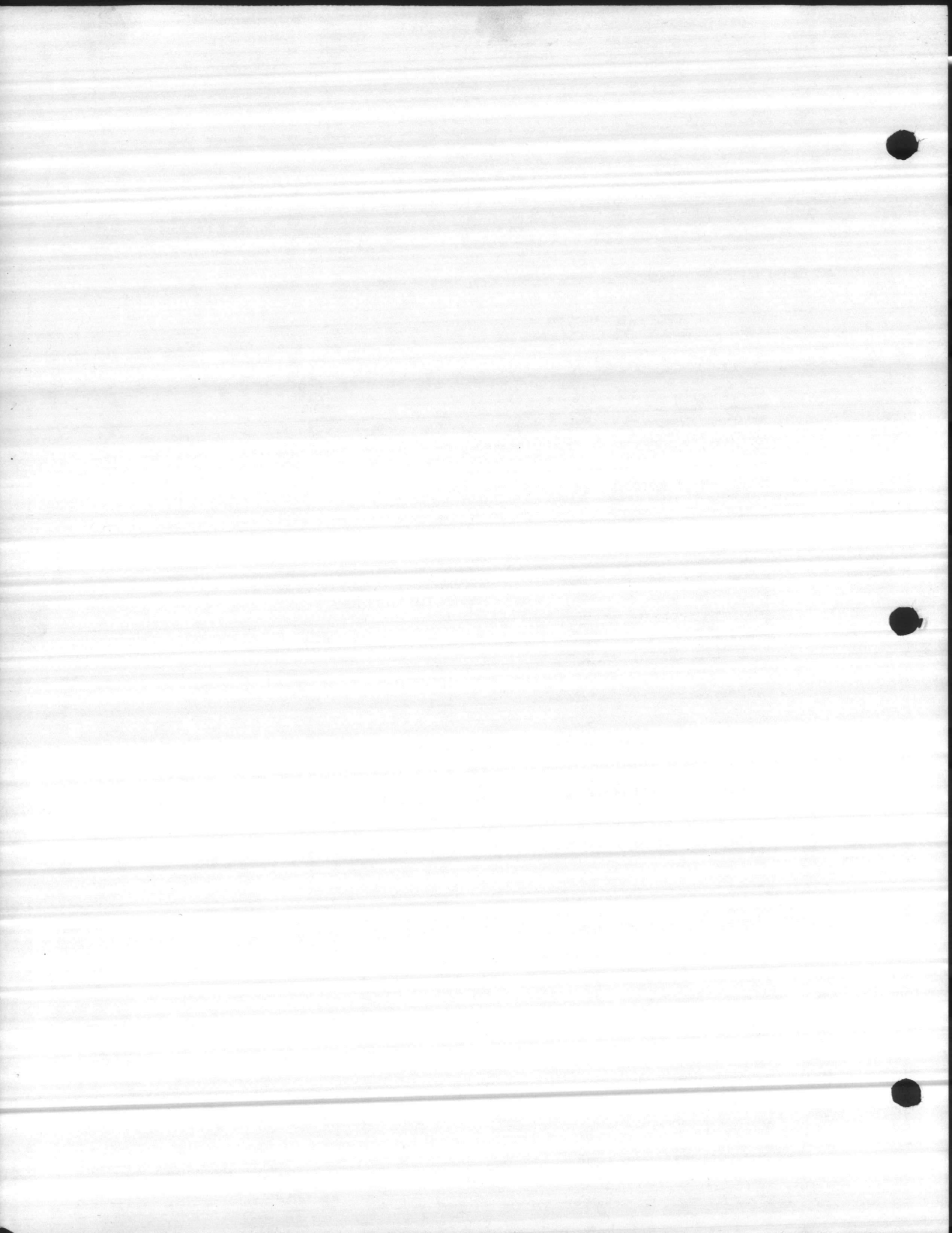
Reference Wiring Diagram 902065-01.

This control panel receives start and stop signals from the main panel via 48 volt DC control relays, and energizes load relays calling for the well to run. A contact of each load relay is used to transmit a well required signal back to the main panel. A phone jack and call button are provided for communication to the main panel.

When Well #2 is called for at the main panel, the operator presses a button which supplies -48 volts DC to terminal 4, momentarily energizing relay CR1. A normally open CR1 contact energizes relay LR1 which seals itself in through the normally closed CR2 contact. Whenever LR1 is energized, the Well #2 required light is also turned on. A normally open load contact of load relay LR1 completes a circuit between terminals 26 and 27, which is carried via #10 wires to the remote well causing that well pump to start. A lightning arrestor is included that is wired across each of these load relay output contacts, to protect the control circuit for each remote well.

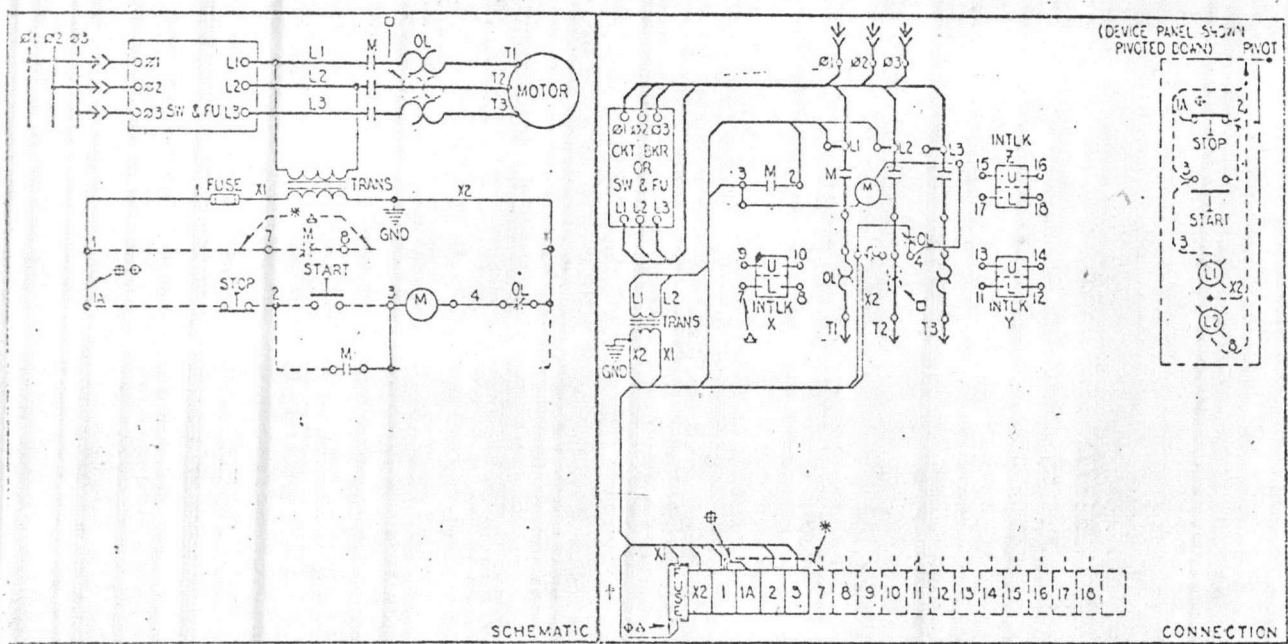
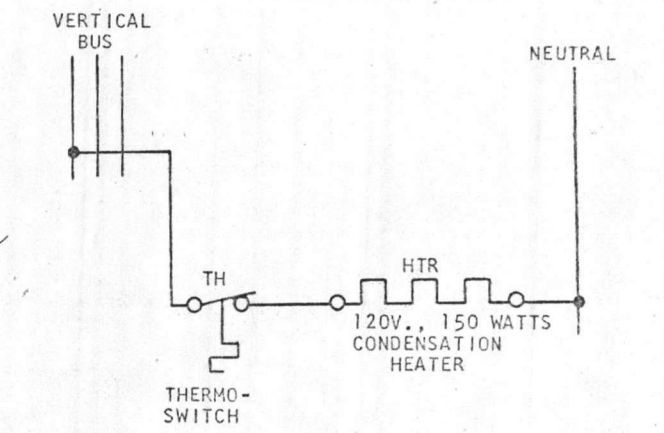
When the operator at the main panel wants to stop Well 2 he presses the stop button supplying -48 volts DC to terminal 5, momentarily energizing relay CR2, which breaks the circuit of LR1, de-energizing that relay and stopping the pump. The remaining six well control circuits operate in the identical manner of that for Well No. 2.

TITLE	DESCRIPTION OF OPERATION JACKSONVILLE, N.C. S.O. 15726, ITEM G	DESIGNED TWM	DRAWN	CHECKED <i>Chen</i> 8-1-75	REVISION A
	Consolidated Electric Company 141 SOUTH LAFAYETTE FREEWAY SAINT PAUL, MINNESOTA 55107	PAGE 1 OF 1	DRAWING NO IM01079		



REV.	CO. NO.	DATE	DESCRIPTION	CHK.	APP.
A	3723	2/7/75	RELEASED		
B	HJG	3-4-76	CUST'S. CHANGES		

SEE P/L 201896-01.



SCHEMATIC

CONNECTION

NOTES FOR TYPE "A" WIRING

1- TERMINAL BLOCKS NOT FURNISHED. CONTROL FUSE FURNISHED

2- CONNECT TERMINAL POINT "1A" ON "STOP" PUSHBUTTON TO TERMINAL POINT "1" ON FUSE.

3- WHEN LIGHT "L1" IS FURNISHED INSTALL JUMPER FROM TERMINAL "1" ON FUSE TO TERMINAL "1A" ON INTERLOCK.

NOTES FOR TYPE "B" WIRING

1- CUSTOMER SHOULD REMOVE JUMPER "1A" TO "1A" WHEN REQUIRED FOR REMOTE CONTROL.

2- WHEN LIGHT "L2" IS FURNISHED INSTALL JUMPER FROM TERMINAL BLOCK "1" TO "1A".

3- CONTROL DEVICES AND INTERLOCKS ARE FURNISHED PER COMBINATION LISTED IN THE CONNECTION DIAGRAM COLUMN OF THE UNIT SPECIFICATION SHEET.

4- THERMO-CL. HEATER IS PROVIDED ONLY WHEN REQUIRED BY UNIT SPECIFICATION SHEET.

COMBINATION TABLE

CONTROL DEVICES		WIRING EQUIVATION		CONTACT POSITION	
L1	L2	START	STOP	DEVICE	INTLK
		X		1	1
			X	2	2
		X	X	3	3
				4	4
		X		5	5
			X	6	6
		X	X	7	7
				8	8
		X		9	9
			X	10	10
		X	X	11	11
				12	12
		X		13	13
			X	14	14
		X	X	15	15
				16	16

NO CONTROL DEVICES MOUNTED IN UNIT

2289A03

COMBINATION STARTER

FULL VOLTAGE
NON-REVERSING

NEMA
SIZE
1-2-3-4

WESTINGHOUSE ELECTRIC CORPORATION

MOTOR CONTROL CENTER - TYPE W -
STANDARD UNIT WIRING DIAGRAM

L.V.D.E. DIVISION

CHICAGO, ILL. 2289A03

TITLE: WIRING DIAGRAM
M.C.C. FOR GEIGER WATER DISTRIBUTION PUMPS

S.O. ITEM "H"

SHOP ORDER 15726 JOB NAME JACKSONVILLE, N.C.

MATERIAL

CONSOLIDATED ELECTRIC COMPANY
141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107

TOLERANCES UNLESS OTHERWISE SPECIFIED: TWO PLACE DEC. ± .010 THREE PLACE DEC. ± .005 FRACTIONS ± 1/64 ANGULAR

DO NOT SCALE

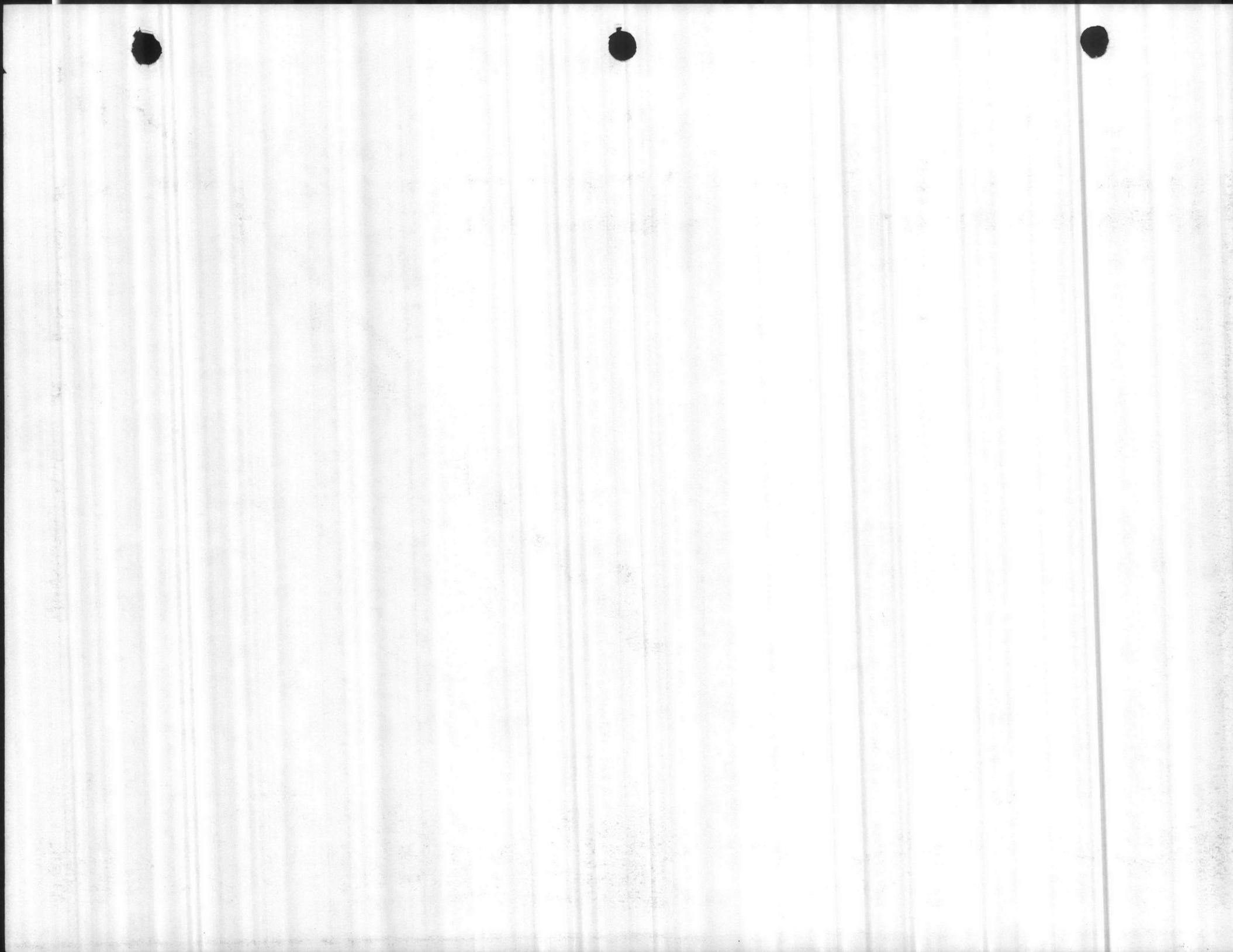
DESIGNED TWM DATE 7-1-75

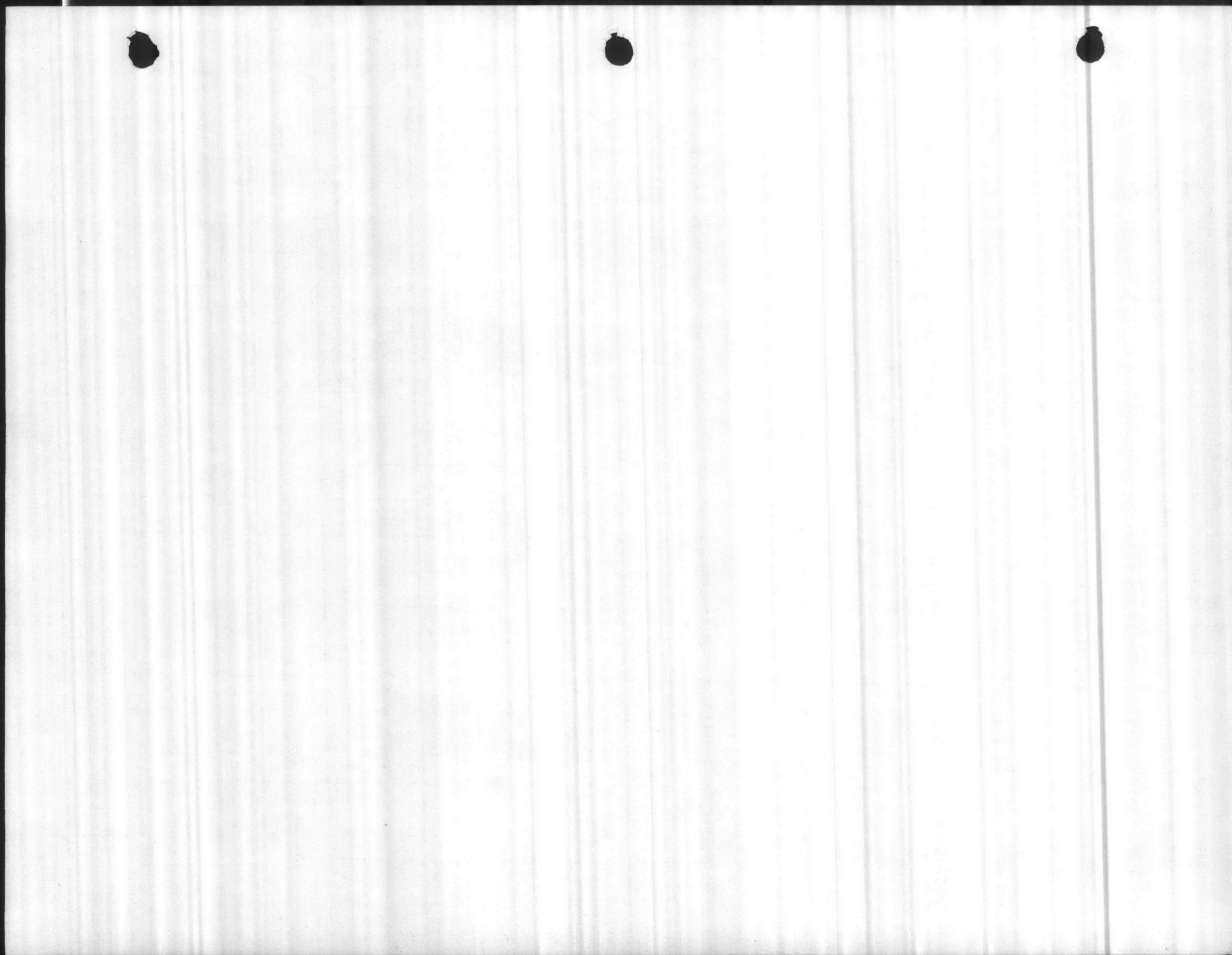
DRAWN HJG 7/26/75

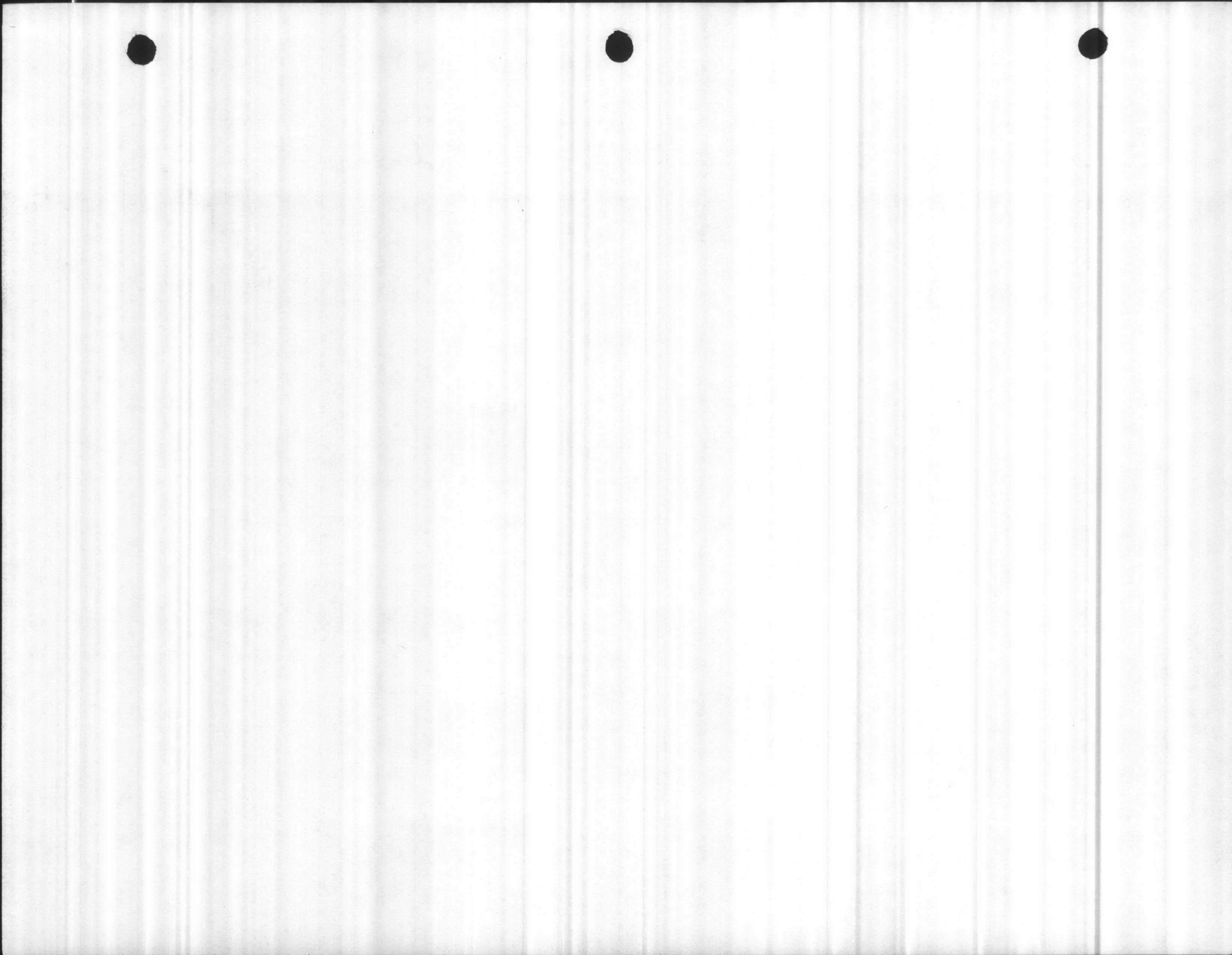
CHECKED [Signature]

FRAMING NO. 902066-01

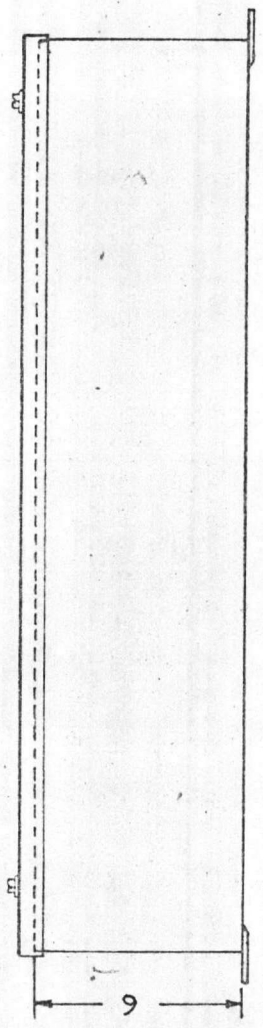
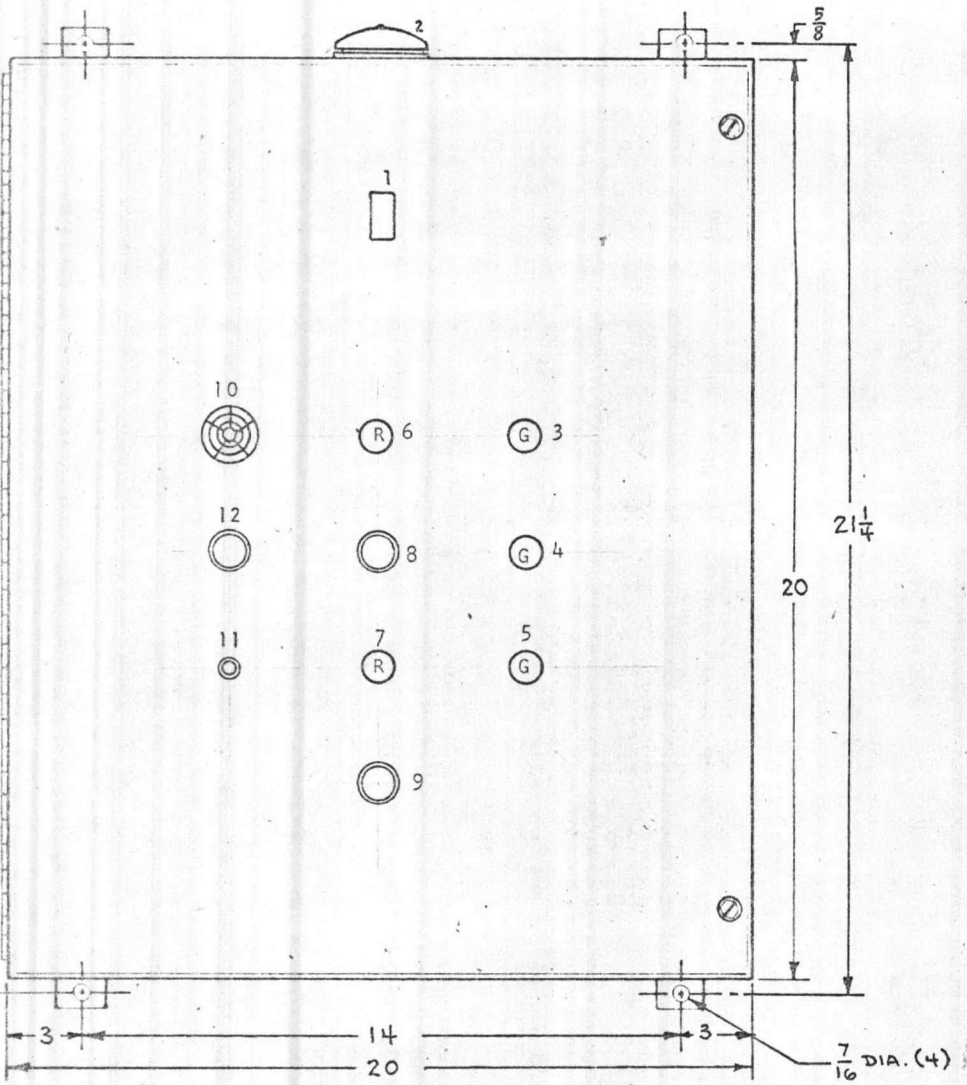
REV. B







A B C D E F G H I J K L M N O



REV.	CO. NO.	DATE	DESCRIPTION	CHK	APP
A	3723	8/1/75	RELEASED		
B	HJG	2-13-76	CUST'S. CHANGES		

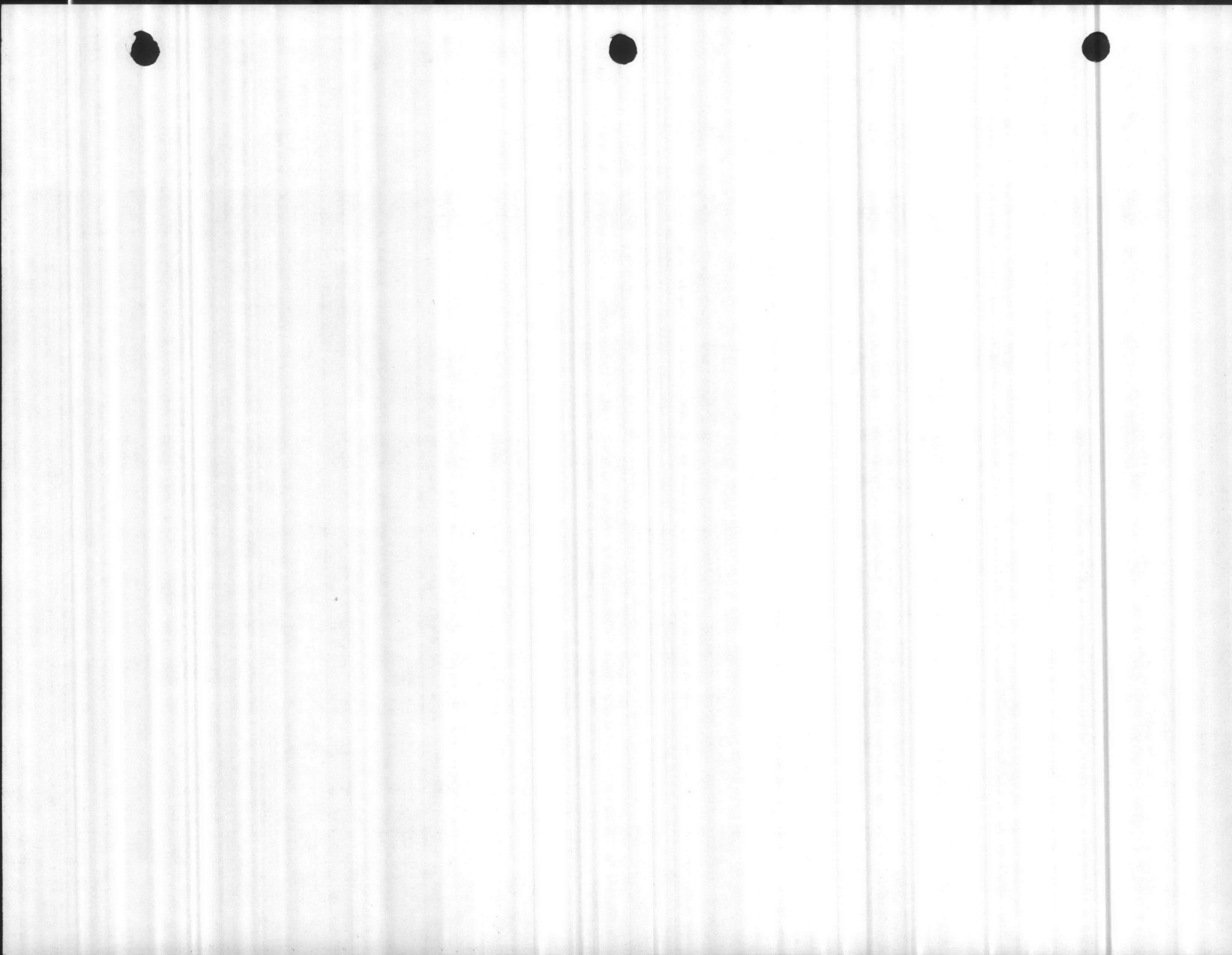
NEMAPLATE AND/OR DEVICE

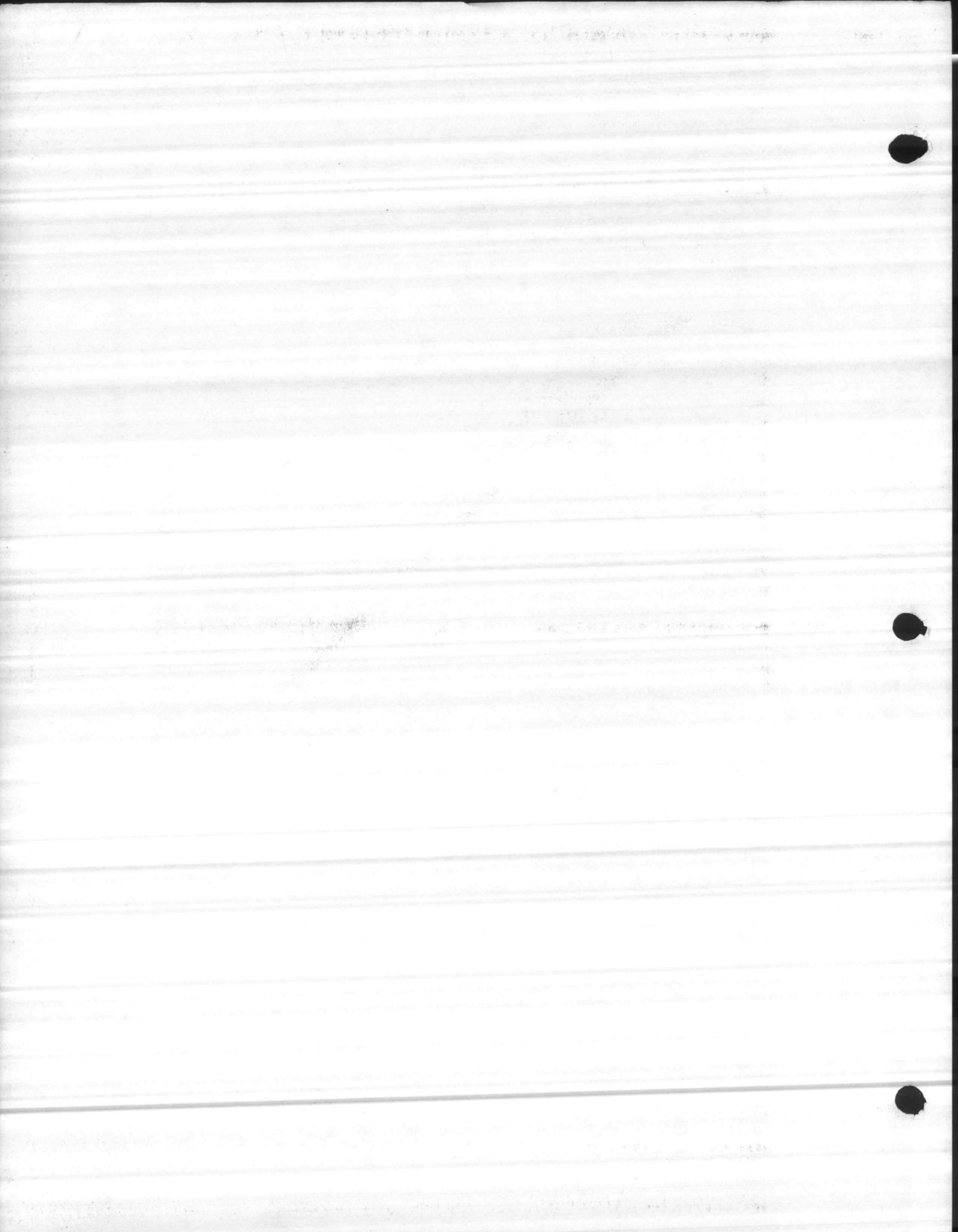
1. CONTROL POWER CIRCUIT BREAKER
2. ALARM BELL
3. INDICATING LIGHT-GREEN-PUMP 1 RUNNING
4. INDICATING LIGHT-GREEN-PUMP 2 RUNNING
5. INDICATING LIGHT-GREEN-PUMP 3 RUNNING
6. INDICATING LIGHT-RED-HIGH LEVEL ALARM
7. INDICATING LIGHT-RED-LOW LEVEL ALARM
8. SILENCE PB SWITCH-HIGH LEVEL ALARM
9. SILENCE PB SWITCH-LOW LEVEL ALARM
10. CALL BELL
11. TELEPHONE JACK
12. CALL PUSHBUTTON

TITLE: DIMENSION DIAGRAM & ARRANGEMENT NEMA 1 ENCLOSURE ANNUNCIATOR PANEL-GEIGER S.T.P.	ITEM "J"
---	----------

SHOP ORDER 15726	JOB NAME JACKSONVILLE, N.C.	MATERIAL 14GA. (.075) CRS
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55101		GRAY HAMMERTONE

TOLERANCES UNLESS OTHERWISE SPECIFIED. TWO PLACE DEC. ± .010 THREE PLACE DEC. ± .005. FRACTIONS ± 1/64. ANGULAR	DO NOT SCALE	DESIGNED TWM DATE 7-1-75	DRAWN HJG 7/17/75 CHECKED	IM01118	REV. B
---	--------------	-----------------------------	------------------------------	---------	--------





DESCRIPTION OF OPERATION
 GEIGER SEWAGE TREATMENT PLANT ANNUNCIATOR PANEL
 JACKSONVILLE, NORTH CAROLINA
 S.O. 15726, ITEM J


Reference Wiring Diagram 902068-01.

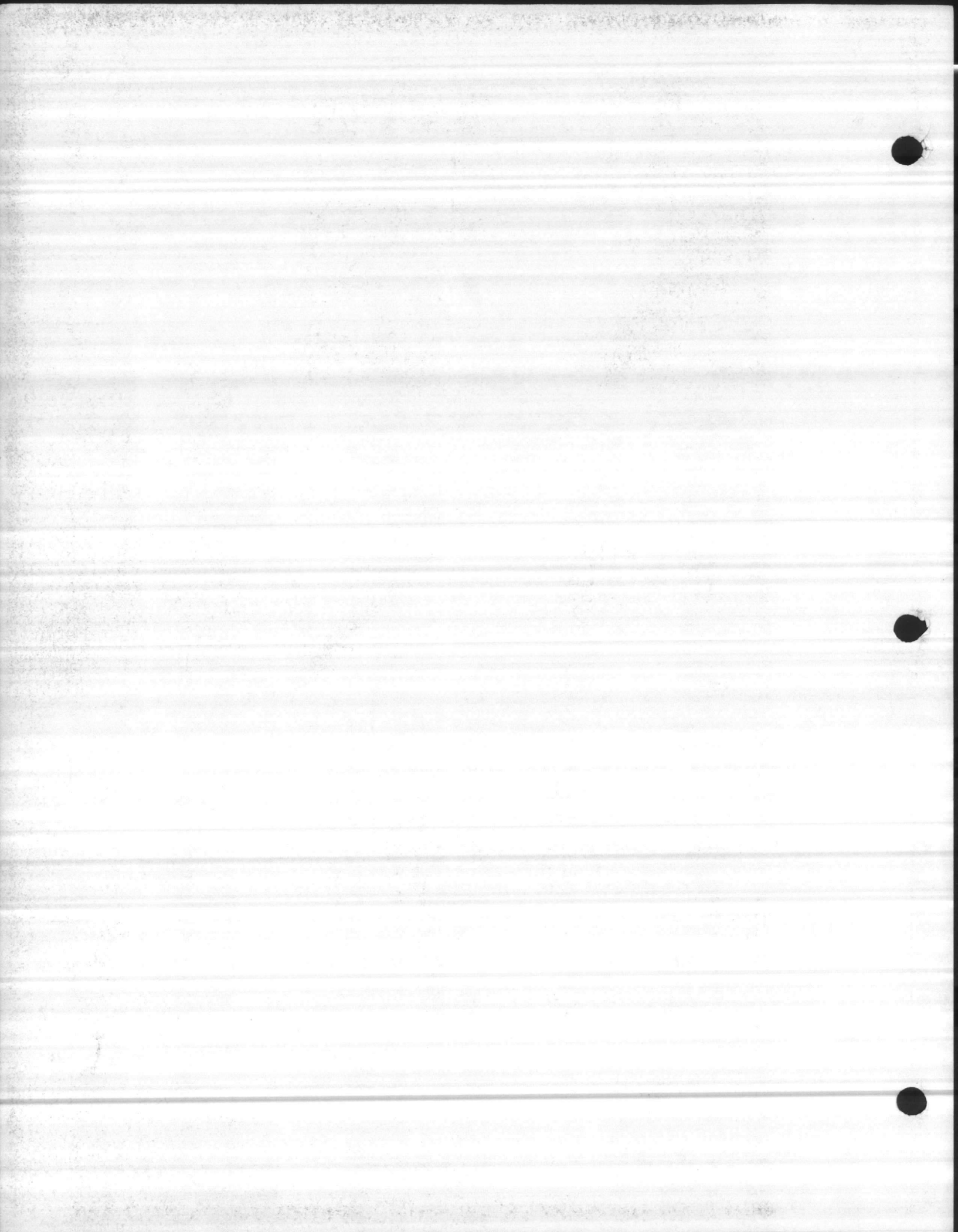
The Model CMX01 Remote Control Transmitter is used here to furnish 50 volt DC power, used to control the 48 volt DC relays, for telemetering between this panel and Item "D" at the New River Sewage Pumping Station. Further information on the CMX01 Transmitter is supplied in the description IM00778.

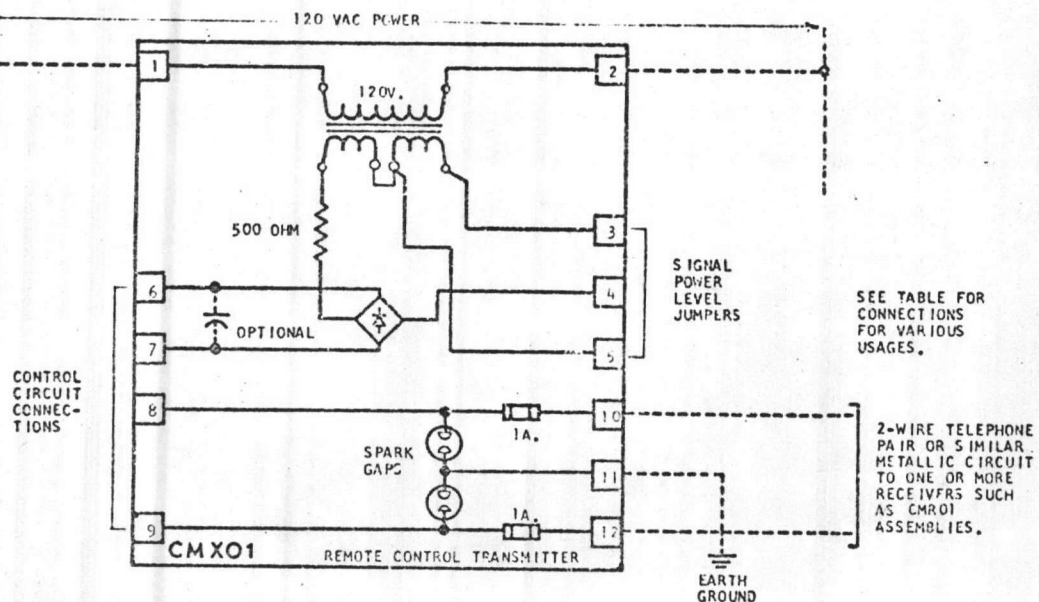
Communication between the two panels is provided by the sound powered phone which plugs into the phone jack, and a call button which can be pressed, sounding the sonalert at the other end. Relays CR1 thru CR5 perform the alarm functions and the pump running status functions as shown on the drawing.

When a high alarm occurs, a contact at the remote panel at the New River Sewage Pumping Station completes a circuit between terminal 5 and terminal 7 energizing relay CR1. A normally open CR1 contact sounds the alarm bell through a normally closed CR6 contact while a second CR1 contact brings the high level alarm light to full brilliance. Pressing the silence button for the high level alarm energizes relay CR6 which de-activates the alarm bell and seals the relay CR6 in through the normally open CR1 contact. When the high alarm condition is removed, CR1 is de-energized, and relay CR6 is reset.

A low level alarm will activate relay CR2 and bring the low level alarm light to full brilliance while activating the alarm bell. A low level alarm can be silenced in the same manner as the high level alarm. Lights are provided for pump running status which are also of the dim-glow type.

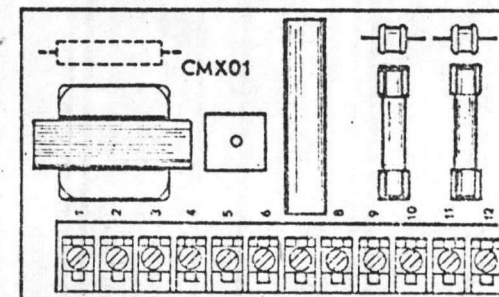
TITLE DESCRIPTION OF OPERATION JACKSONVILLE, N.C. S.O. 15726, ITEM J	DESIGNED TWM	DRAWN	CHECKED <i>Chern</i> 7-30-75	REVISION A
 Consolidated Electric Company 141 SOUTH LAFAYETTE FREEWAY SAINT PAUL, MINNESOTA 55107	PAGE 1 OF 1	DRAWING NO IM01082		





The CMX01 is designed to transmit a 50 or 100 Volt half or full wave DC signal to a remote alarm receiver such as the CMR01 or CMR02. Spark gaps and 1 Amp. fuses provide sufficient lightning and transient protection.

- FULL WAVE DC 100 VOLT . . . CONNECT TERMINAL 7 TO TERMINAL 8 AND TERMINAL 3 TO TERMINAL 4. WIRE CONTROL CONTACT BETWEEN TERMINALS 6 AND 9.
- FULL WAVE DC 50 VOLT (ON/OFF) . . . CONNECT TERMINAL 7 TO TERMINAL 8 AND TERMINAL 5 TO TERMINAL 4. WIRE CONTROL CONTACT BETWEEN TERMINALS 6 AND 9.
- FULL WAVE DC 50 VOLT (REVERSING POLARITY) . . . CONNECT TERMINAL 3 TO TERMINAL 4 AND TERMINAL 5 TO TERMINAL 8. WIRE CONTROL CONTACT #1 BETWEEN TERMINAL 6 AND 9. WIRE CONTROL CONTACT #2 BETWEEN TERMINAL 7 AND 9 (CONTROL CONTACTS #1 & #2 MUST NEVER BE CLOSED AT THE SAME TIME).
- HALF WAVE DC 100 VOLT . . . CONNECT TERMINAL 3 TO TERMINAL 8. WIRE CONTROL CONTACT #1 BETWEEN TERMINAL 6 AND 9. WIRE CONTROL CONTACT #2 BETWEEN TERMINALS 7 AND 9.
- HALF WAVE DC 50 VOLT . . . CONNECT TERMINAL 5 TO TERMINAL 8. WIRE CONTROL CONTACT #1 BETWEEN TERMINAL 6 AND 9. WIRE CONTROL CONTACT #2 BETWEEN TERMINALS 7 AND 9.



NOTE: It is recommended that the snap-track be mounted with plastic fasteners. If metallic fasteners are used they must be insulated from the copper side of the "CM" Module printed circuit board.

TITLE: SINGLE OR DUAL FUNCTION REMOTE CONTROL TRANSMITTER CMX01

DRAWN DESIGNED P.E.

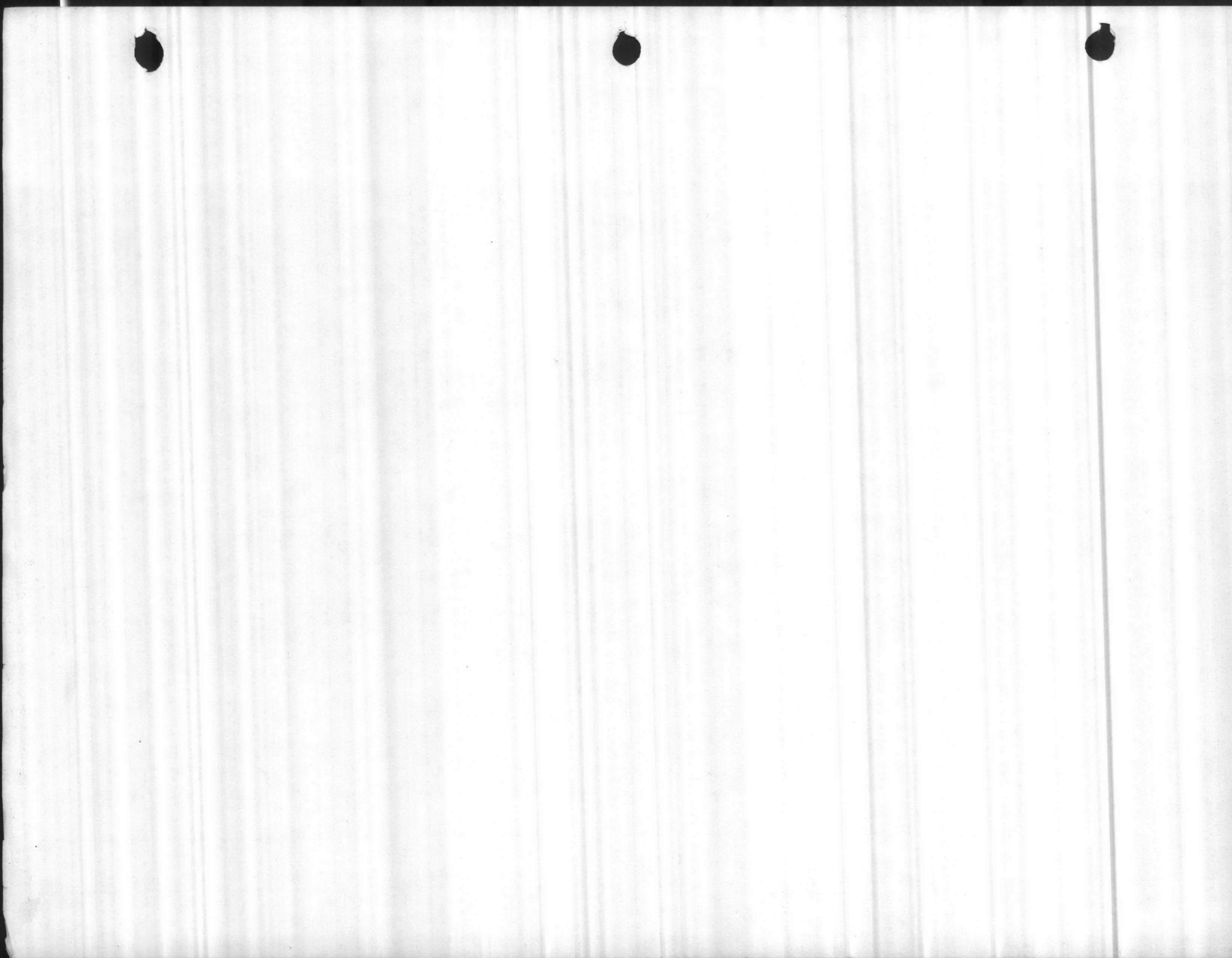
CONSOLIDATED ELECTRIC COMPANY
141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107

CHECKED RP

PAGE 1 OF 1

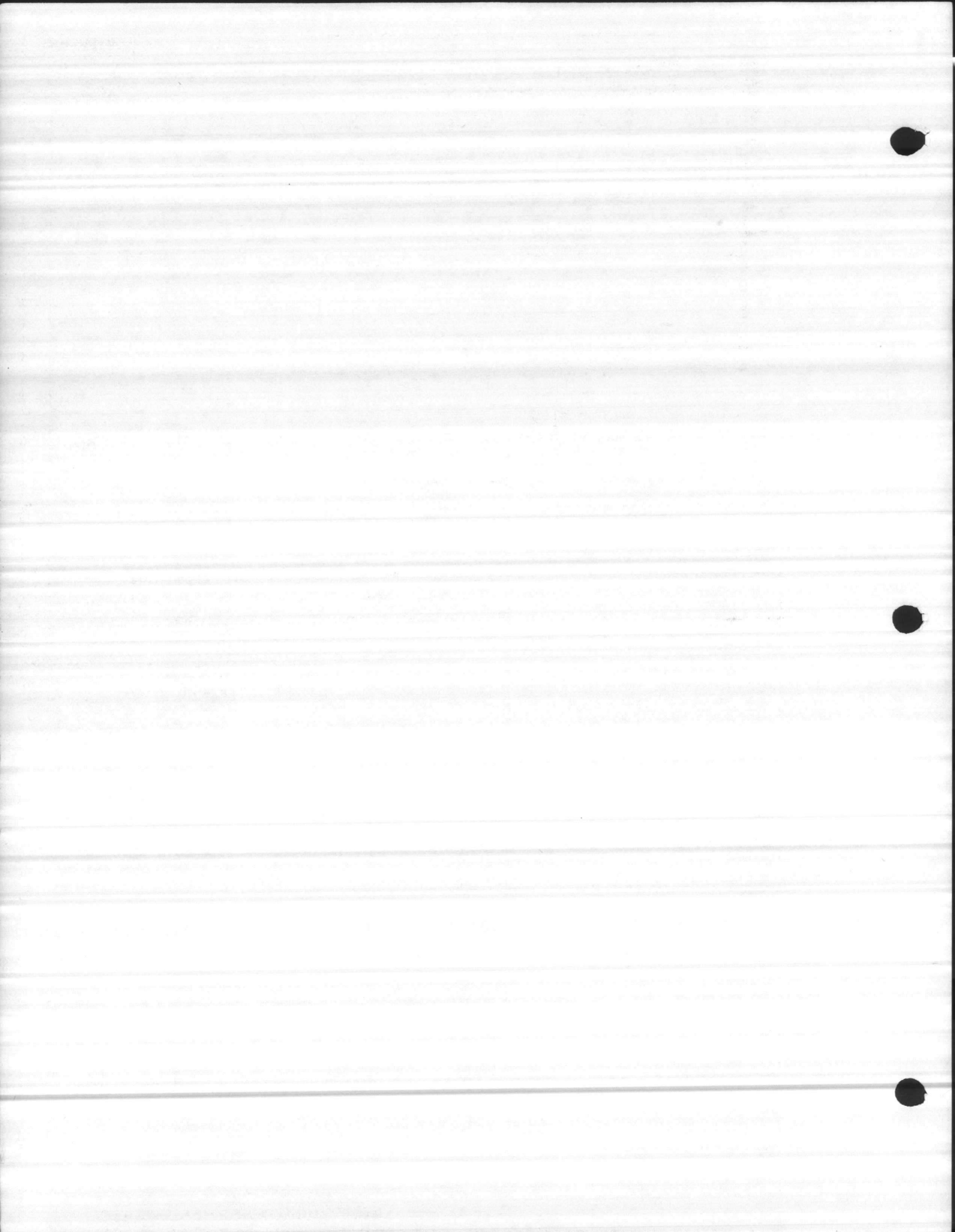
DRAWING NO. IM00778

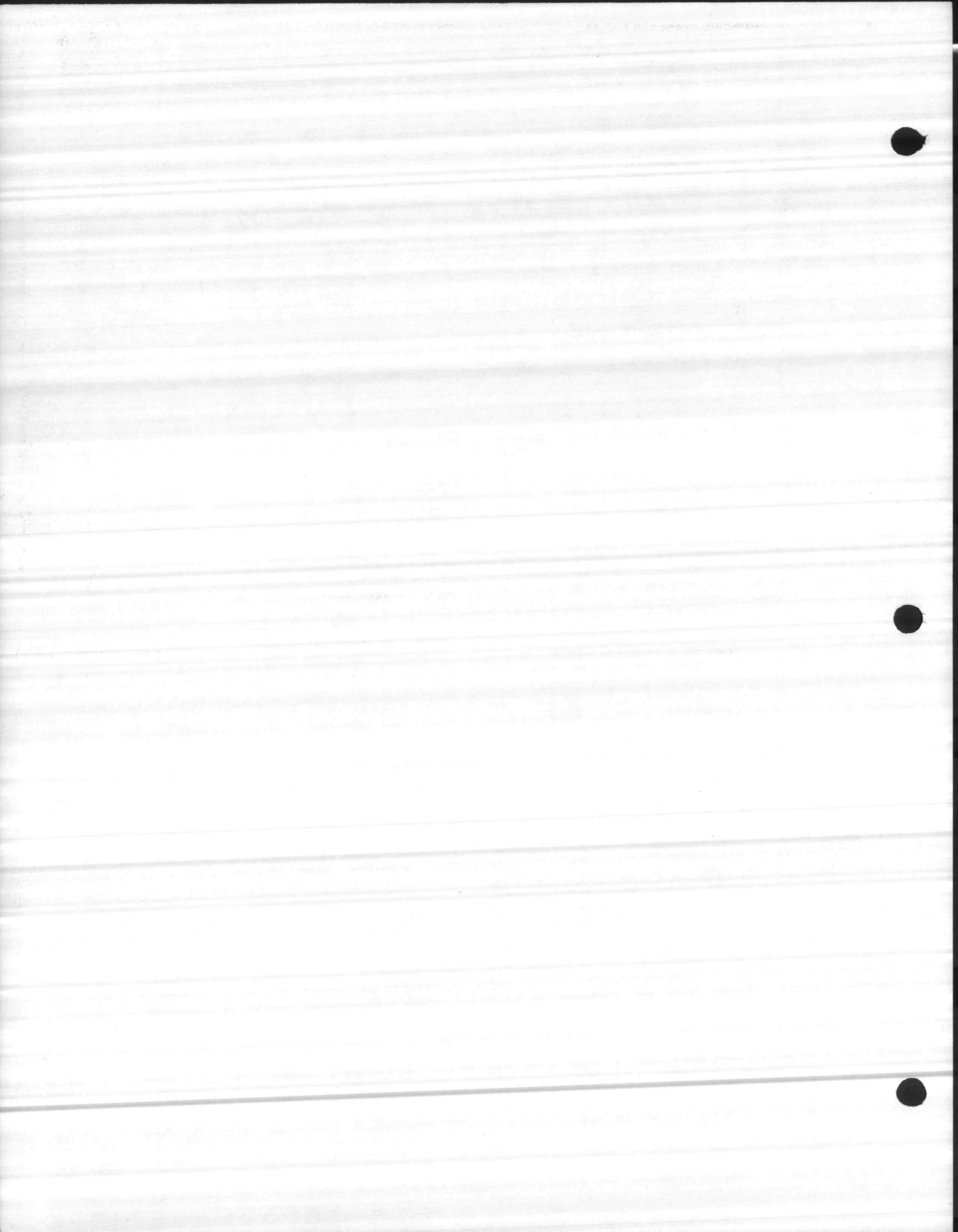
REV. A



ITEM NO.	CECO PART NUMBER	SUB-VARIATION				DESCRIPTION	PL	PAGE 1 OF 2	DWG. NO. 201899-01	COMPONENT DESIGNATION
		01								
		QUANTITY								
1	DL01382	REF				Document List				
2	902069-01	REF				Wiring Diagram				
3		1				Console, 48" NEMA 1 Hoffman	C-1448BD			
4		1				Top Unit 48" Hoffman	C-1448T			
5		1				Sub-Panel 48" Hoffman	C-1448P2			
6		80				Term. Section Buchanan	625		TB 1	
7		4				End Piece Buchanan	630		TB 1	
8	800085-02	1				Audible Alarm 120V. CECO			ALARM	
9	600566-06	2				Alarm Module 120V. CECO	CMA09		AM 1,2	
10	600574-11	2				Controller Mod. 120V. CECO	AN-11		CM 1,2	
11	800092-01	2				Meter, 5 1/2" CECO			LM 1,2	
12	800093-08	2				Scales For Meter CECO			LM 1,2	
13	800057-02	30				Relay, 120V. 3PDT CECO			CR 1-4 CR 7-30	
14	800079-02	2				Relay, Latching 2PDT 120V. CECO			CL 1,2	
15	800080-01	34				Socket, 11 pin CECO			CR, CL	
16		16				Resistor 3900 ohm, 12 Watts Ohmite	3816		Dim Glow	
17		2				Motorized, on delay, 30 min. Timer, 120V. Eagle	BR19A6		TM 1,2	
18	800073-02	1				Pwr. Supply 120/12 @ 1.5 Amps CECO			PWR 2	
19		1				Fuseholder Marathon	F30A1SP		F 1	
20		1				Fuse, 1 Amp. Buss	NON-1		F 1	
21	600496-01	8				Signal Adjust Pot. CECO	CMZ-01		MCU 1-4	
22		2				3 pos. Sel. Switch A-B	800T-J2A		SS 2,4	
23		6				Ctr. Off-Momentary Sel. Sw. SPDT A-B	800T-J91A		SS 5,7,8, 10,12,13	
24		6				2 pos. Maintained Sel. Sw. SPDT A-B	800T-H2A		SS 1,3,6, 9,11,14	
25		16				6W Lamp, 155V. G.E.	6S6-155V.		LT 1-24	
26	800195-01	16				Lamp Base			LT 1-24	
27	800196-01	2				Lens, Red			LT 1,2	
28		2				Type 185 Vertical Meter, 0-100% G.E.			VM 1,3	
29	800196-03	6				Lens, Amber			LT 3,12, 21,24	
30	800196-05	4				Lens, White			LT 4,11, 13,20	
31	800196-02	2				Lens, Green			LT 10,19	
32	800196-04	2				Lens, Blue			LT 5,14	
33		2				Type 185, Vertical Meter 0-100% G.E.	185014NDND1J		VM 2,4	
34		4				Bezel Kit G.E.	4149K16G778		VM 1-4	
35		1				Cem Card Case Bristol	MY814MY		X	
36		2				Ind./ Recorder Bristol	2711-10A-200-104-010-00N-00R-100	REC 1,2	X	
37		1				Dual Indicator Bristol	2751-20C-522-DE1-220	IND 1	X	
38		1				Pwr. Supply Bristol	2007-20B-100	PWR 1	X	
39		1				Single Indicator Bristol	2751-10C-120-001-000	IND 2	X	
40		3				Sq. Root Card Bristol	374471-01-0		X	
41		1				Mtg. Plate, C.B. West.	1258C07G01	CB 1		
42		2				Sw., P.B. Salinger	MP1B	PB 1,2		
43		1				Circuit Bkr. West.	HQCL 1015	CB 1		
							NOTE: Items 35-40 Furnished to CECO by			
							McMahan Co.			

201899-01	PAGE 1 OF 2	REV <i>e</i>	TITLE: CONTROL CONSOLE CAMP GEIGER S.T.P.	S.O. 15726 ITEM "K"	DFT 7/25/75	HJG	
	DRAWING NO. 201899-01			CONSOLIDATED ELECTRIC CO.		CHK 7/20/75	<i>[Signature]</i>
				141 SO. LAFAYETTE FREEWAY • ST. PAUL, MINN. 55107		ENG	TJM
						APP 7/1/75	<i>[Signature]</i>





DESCRIPTION OF OPERATION

FILTER CONSOLE AT THE CAMP GEIGER SEWAGE TREATMENT PLANT

JACKSONVILLE, NORTH CAROLINA

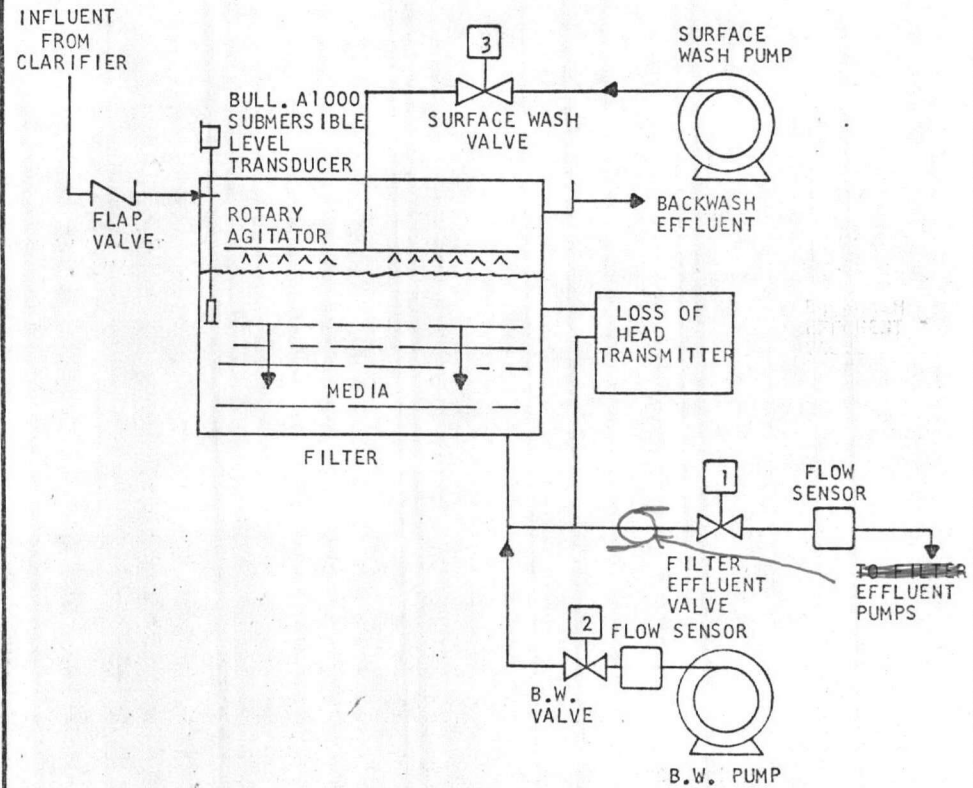
S.O. 15726, ITEM K

Reference Wiring Diagram 902069-01.
Reference Flow Diagram on Page 2 of this Description.

As shown on Page 1 of the Wiring Diagram, the flow through Filter #1 is controlled by monitoring the level in the filter using a Bulletin A1000 Submersible Level Transducer. This level signal is then compared to the pre-adjusted setpoint of a setpoint controller, and the deviation signal is used to modulate the filter effluent valve.

The level signal from the Bulletin A1000 Submersible Transducer is first fed to the Bulletin G500, Model AN-11 Controller. This Controller furnishes a meter output to indicate the water level in the filter, and conditioned analog output to the 'level' input of the proportional controller. This Controller tries to maintain the water level at the adjusted setpoint by varying the opening of the effluent valve. The setpoint for Filter No. 1 can be re-adjusted with a pot on top of SPC1 inside the console. A 4-20 ma. signal from pins 7 and 8 of SPC1 directs the opening of Filter 1 Effluent Valve, via position controller VPC1 on Page 3 of the Wiring Diagram.

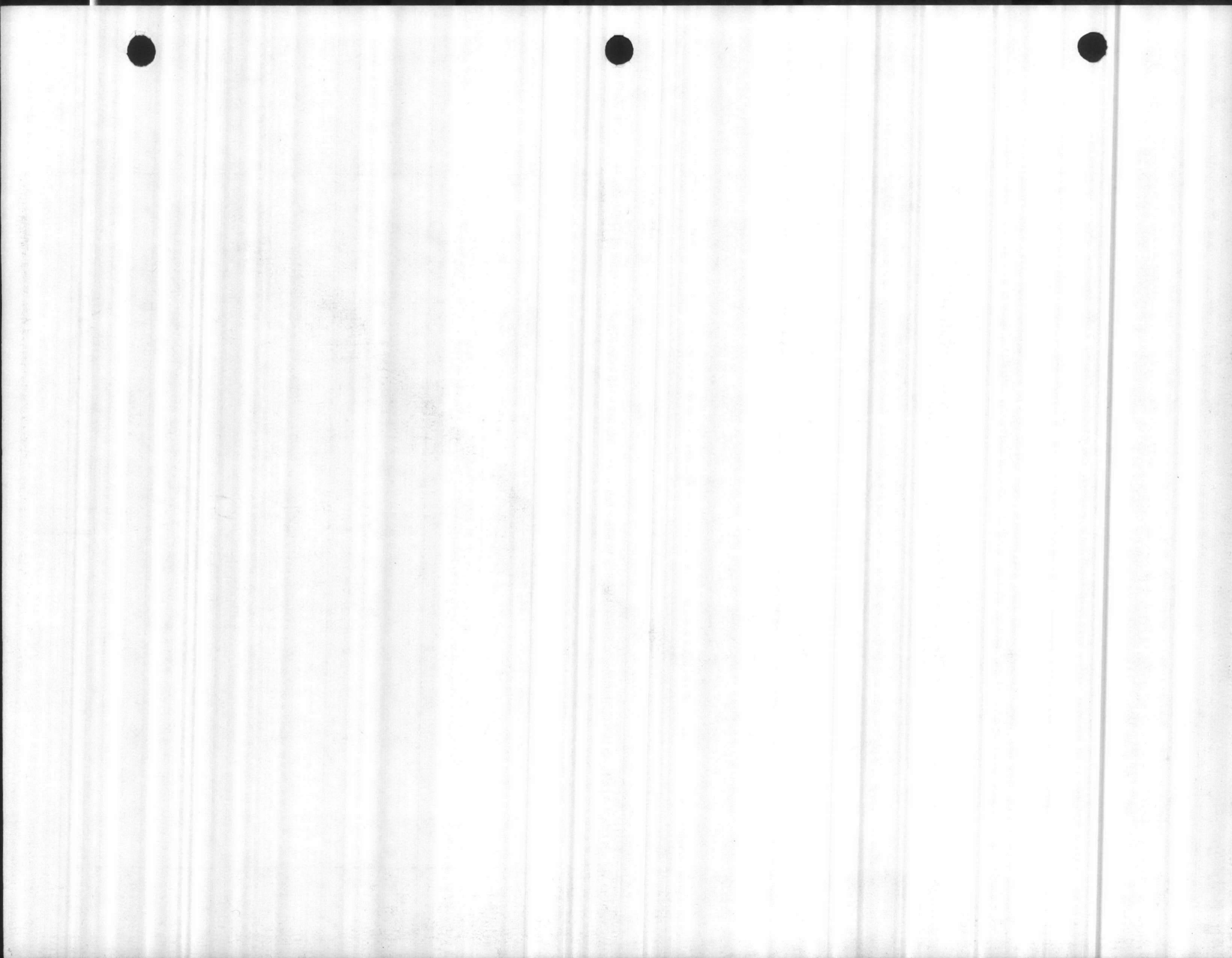
The control output on the AN-11 Controller is used to energize relay CR1, to enable the two filter effluent pumps to run. When the water in the filter gets below a pre-adjusted setpoint, the control output contact opens, de-energizing relay CR1, which disables both filter effluent pumps. If the level in the filter gets too high, the high alarm contact in the AN-11 Controller will close, energizing relay CR2 in the Model CMA09 Alarm Module. This turns on the High Water in Filter #1 alarm light and energizes the audible annunciator. When the operator presses the silence button, it energizes relay CR1 in the alarm module, disabling the audible annunciator and sealing itself in. When the alarm condition goes away, and the high alarm output contact opens, relays CR2 and CR1 in the Alarm Module de-energize, turning off the light.



CAMP GEIGER
TERTIARY SEWAGE
FILTER
FLOW DIAGRAM

TITLE	DESCRIPTION OF OPERATION JACKSONVILLE, N.C. S.O. 15726, ITEM K	DESIGNED	TWM	DRAWN		CHECKED	<i>Ch...</i> 3-9-74	REVISION	C
	Consolidated Electric Company 141 SOUTH LAFAYETTE FREEWAY SAINT PAUL, MINNESOTA 55107	PAGE	1 OF 6	DRAWING NO			IM01083		

TITLE	DESCRIPTION OF OPERATION JACKSONVILLE, N.C. S.O. 15726, ITEM K	DESIGNED	TWM	DRAWN		CHECKED	<i>Ch...</i> 2-1-75	REVISION	C
	Consolidated Electric Company 141 SOUTH LAFAYETTE FREEWAY SAINT PAUL, MINNESOTA 55107	PAGE	2 OF 6	DRAWING NO			IM01083		



The level control circuit for Filter #2 is identical to that for Filter #1. Each filter has an indicating recorder which records the flow through the filter from an electronic transmitter signal.

The head-loss across each filter is displayed on a dual indicator. Each channel of this indicator includes an alarm contact, which closes when head-loss exceeds a preset value. For Filter #1, a high head-loss will energize 24 volt relay CR5, which will initiate a backwash sequence.

A backwash control switch is provided, to permit the operator to manually initiate a backwash sequence or to manually stop the backwash sequence. Note that the two filters are interlocked with contacts of their latch relays CL1 and CL2, such that if Filter #2 is backwashing, Filter #1 may not be initiated into a backwash sequence. This assures that one of the two filters is always on line.

BACKWASH SEQUENCE

The backwash sequence for each of the two filters is identical, therefore only Filter #1 will be described here. Referring to Page 3 of the Wiring Diagram, assume that the backwash control switch is left in the Center or OFF position, and that Filter #2 is in service. Because Filter #2 is in service, the normally closed contact of latch relay CL2 is closed, permitting the N.O. CR5 contact to complete the circuit to the latch input of relay CL1, when it closes due to high lead loss in Filter #1. When CR5 then causes CL1 to latch, a normally closed CL1 contact turns off the Filter #1 in Service Light, and a normally open CL1 contact turns on the Filter #1 in Backwash Light. Another normally open CL1 contact energizes relays CR4A, CR4B and CR4C. The sequence for operating the valves in the automatic backwash sequence is to first close the filter effluent valve, then the backwash valve is opened and finally the surface wash valve is opened.

Note that the manual control selector switches for each valve are disabled by N.C. contacts of relays CR4A thru CR4C when the filter enters the filter backwash cycle, and these selector switches stay disabled until the backwash cycle has been completed.

Upon initiation of backwash in Filter #1, a circuit is completed through contacts 9 and 6 of CR4C, normally closed contacts 7 and 1 of CR3 (the backwash stop relay for Filter #1), and the normally open contacts 7 and 4 of relay CR4A to the coil of relay CR10. This will drive the Filter Effluent Valve #1 to the fully closed position, which will then energize relay CR8. Note that the 120 volt power is removed from terminal 9 of valve position controller VPC1 at the time that the filter goes into backwash, so that there will not be opposing close and open output signals to the valve positioner. This control power to the valve positioner is removed by the normally closed contact of CL1 located on Page 4.

As soon as Filter Effluent Valve #1 is fully closed, a normally open CR8 contact in series with a normally open CR4A contact will apply power to the open input of the Backwash Valve #1 positioner. When this valve has reached the fully opened position, relay CR11 is energized.

Referring to Page 6 of the Wiring Diagram, a normally open CR11 contact in series with a CR4C normally open contact will apply power to one of the backwash pump control relays depending upon which position the Backwash Pump selector is in. Assuming the Backwash Pumps H-0-A selector is in the AUTO position, the appropriate relay will furnish a contact closure to start one of the Backwash Pumps. Another normally open contact of each of these relays will operate a "backwash pump required" light.

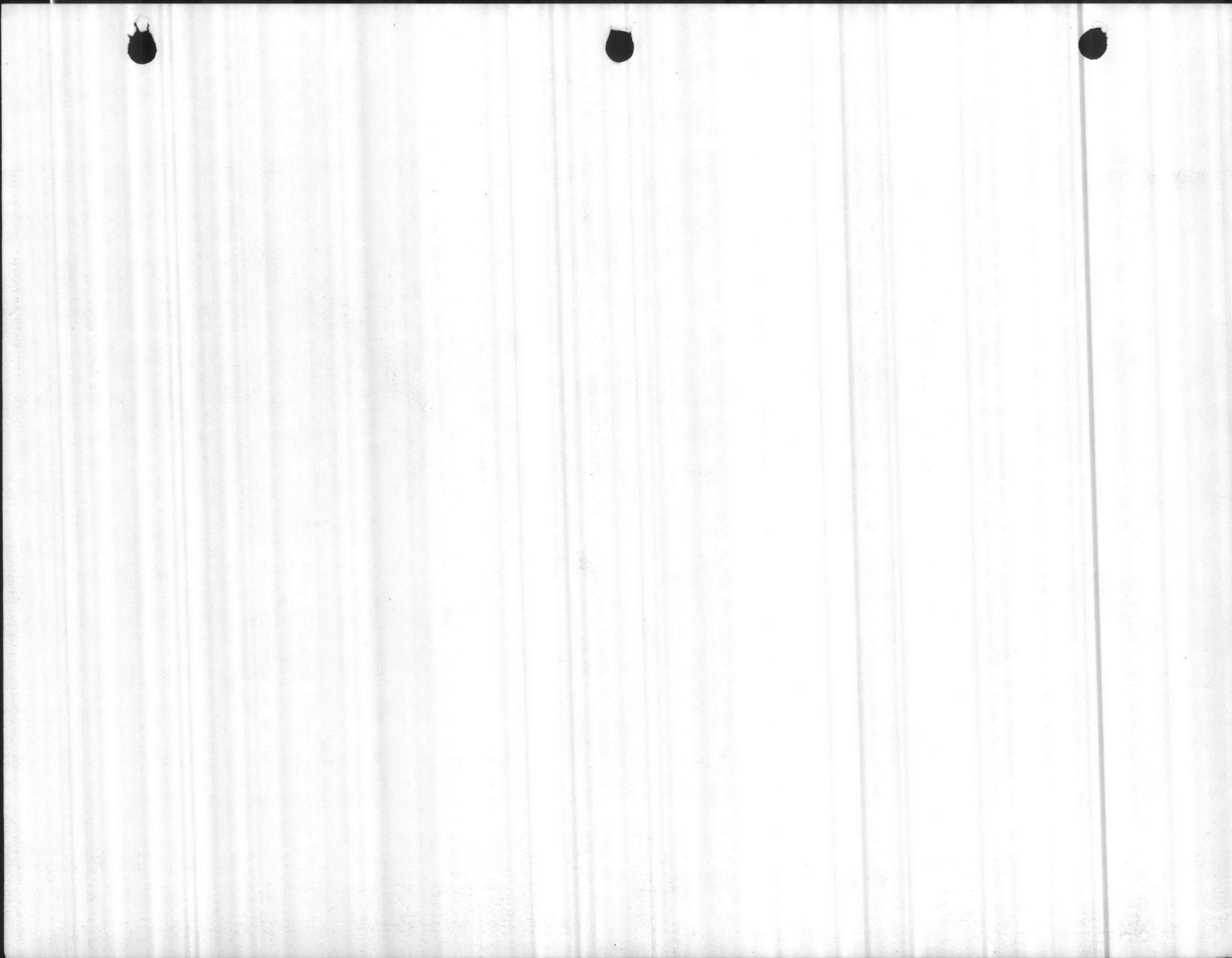
Another normally opened CR11 contact in series with a normally open CR4B contact completes a circuit to the open input of the Surface Wash Valve #1 operator. When this valve has reached the fully opened position, a limit switch transfers energizing relay CR13.

Referring to Page 6 of the Wiring Diagram, a normally open CR13 contact in series with a normally open CR4C contact will energize either of the surface wash pump control relays depending upon which position the selectors are in. For instance, if the Surface Wash Pump selector is in the #1 position and the Surface Wash Pumps H-0-A selector is in the AUTO position, relay CR29 will be energized, lighting the Surface Wash Pump #1 Required light and starting Surface Wash Pump #1. Referring to Page 3 of the Wiring Diagram,

See NOTE #1 → SEE NOTES #2 + #3

TITLE	DESCRIPTION OF OPERATION	DESIGNED	DRAWN	CHECKED	REVISION
	JACKSONVILLE, N.C. S.O. 15726, ITEM K	TWM		3-9-76	C
	Consolidated Electric Company 141 SOUTH LAFAYETTE FREEWAY SAINT PAUL, MINNESOTA 55107	PAGE 3 OF 6	DRAWING NO IM01083		

TITLE	DESCRIPTION OF OPERATION	DESIGNED	DRAWN	CHECKED	REVISION
	JACKSONVILLE, N.C. S.O. 15726, ITEM K	TWM		3-9-76	C
	Consolidated Electric Company 141 SOUTH LAFAYETTE FREEWAY SAINT PAUL, MINNESOTA 55107	PAGE 4 OF 6	DRAWING NO IM01083		



another normally open CR13 contact energizes timer TMI, which will establish the duration time of the backwash operation. This timer can be set for up to 30 minutes of backwashing time.

Note that relay CR3 is the relay that causes the filter to stop backwashing and sequence its valves to the in-service position. This "backwash stop" relay can be activated by timer TMI when it times out at the end of the automatic backwash. Or, CR3 can be energized manually by the operator turning the Backwash Control switch momentarily to STOP. This "backwash stop" relay can also be activated by a momentary closing of the contacts connected between terminals 21 and 22, so that if there is inadequate suction for the backwash pumps or inadequate volume available for their discharge, the filter will be sequenced out of backwash.

When Timer TMI times out, its contacts 6 and 5 close, energizing relay CR3 and applying power through the CR4B normally open contact to the close input to the Surface Wash Valve #1 operator. As soon as the valve begins to close, relay CR13 is de-energized, stopping the surface wash pump. Relay CR3 on Page 3 of the Wiring Diagram seals itself in through its normally open contact and a normally open CR4C contact.

Referring back to Page 4 of the Wiring Diagram, when the Surface Wash Valve #1 reaches the fully closed position, relay CR14 is energized, and the Surface Wash Valve #1 Closed light comes on. A normally open CR14 contact applies an input to the close terminal of the Backwash Valve #1 positioner. As soon as this valve begins to close, relay CR11 is de-energized, and the backwash pump is stopped. When the Backwash Valve #1 reaches the fully closed position, relay CR12 is energized. The valve position meter should then read approximately 0% opened.

A normally open CR12 contact applies power thru a N.O. CR4A contact, to the open input of the Filter Effluent Valve #1 positioner. When this valve begins to open, relay CR8 will be de-energized. The position meter for the Filter Effluent Valve #1 should then read approximately 100% opened.

*Re-arrange
Auto
Sequence*

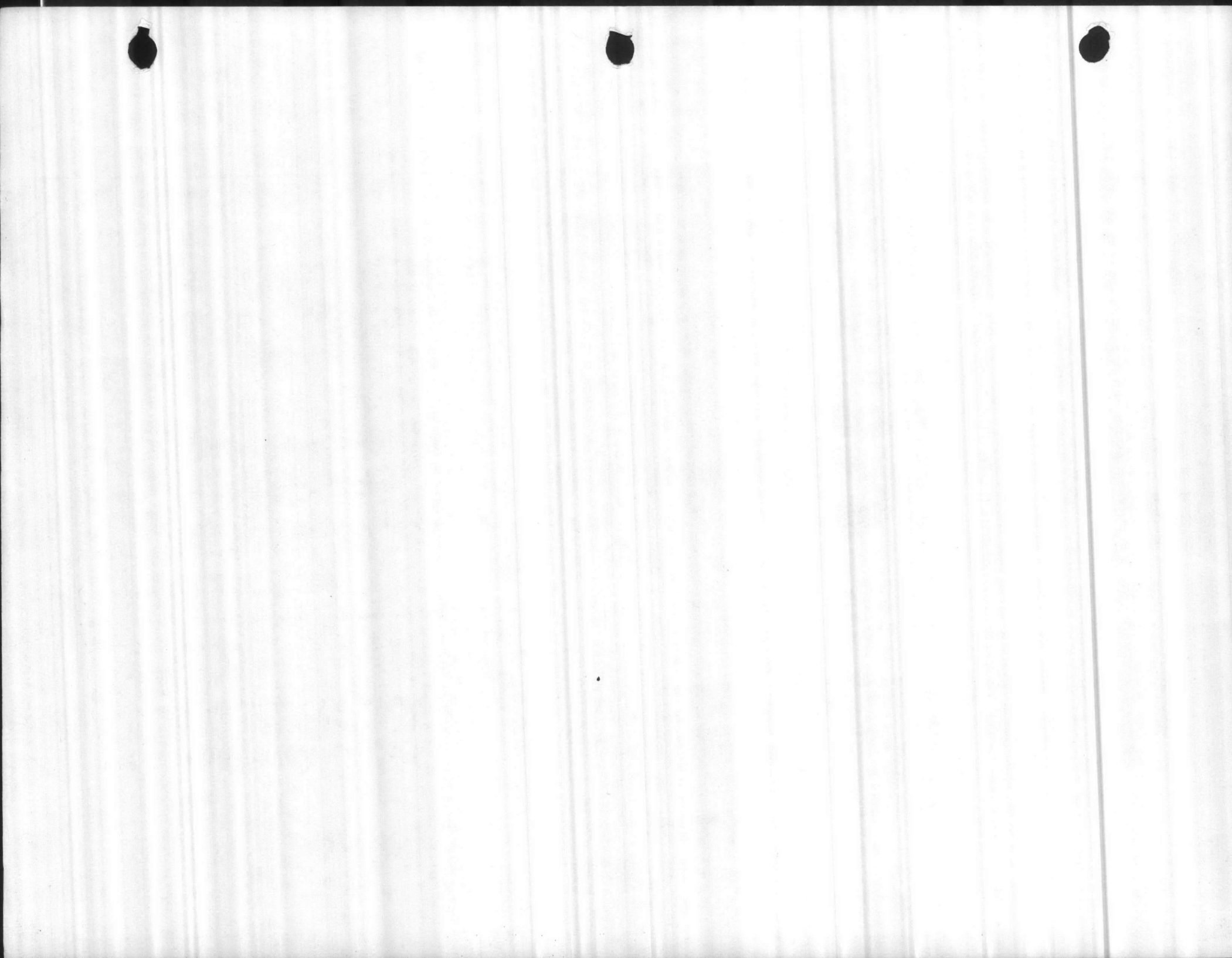
In the upper left hand corner of Page 3, a normally open CR3 contact in series with a normally closed CR8 contact now applies power to the reset input of latch relay CL1, resetting it and placing Filter #1 back in service. The in-service light is now turned on and the backwash light is turned off. The effluent valve will be re-positioned, under command from position controller VPC1 on Page 3, until the water level setpoint is reached in Filter #1.

The 96-pin timers TC1 and TC2 on Page 6 of the Wiring Diagram control the operation of the remote solenoid valves controlling the two sludge draw-off valves. The dial on each timer revolves once every 24 hours. The time and duration of each valve operation is easily programmed in 15 minute increments.

1. - Filter Eff. Pump. must be W.T. off for backwash sequence and returned to service at end of Backwash sequence
2. - Surface wash Valves (and Pumps) are to have a time for 0-30 minute setting
3. - Surface wash Valves (and Pumps) open before backwash Valves and Pumps.
 - 1 - Filter Eff. pump (off)
 - 2 - Surface wash pumps (on)
 - 3 - Backwash Pump (on)
 - 4 - Surface wash Pumps (off)
 - 5 - Backwash Pumps (off)
 - 6 - Filter Eff. Pumps (on)

TITLE DESCRIPTION OF OPERATION	DESIGNED	DRAWN	CHECKED	REVISION
JACKSONVILLE, N.C. S.O. 15726, ITEM K	TWM		3-1-74	C
 Consolidated Electric Company 141 SOUTH LAFAYETTE FREEWAY SAINT PAUL, MINNESOTA 55107	PAGE 5 OF 6	DRAWING NO IM01083		

TITLE DESCRIPTION OF OPERATION	DESIGNED	DRAWN	CHECKED	REVISION
JACKSONVILLE, N.C. S.O. 15726, ITEM K	TWM		3-1-74	C
 Consolidated Electric Company 141 SOUTH LAFAYETTE FREEWAY SAINT PAUL, MINNESOTA 55107	PAGE 6 OF 6	DRAWING NO IM01083		



ITEM NO.	CECO PART NUMBER	SUB-VARIATION			DESCRIPTION	PL	PAGE OF	DWG. NO.	COMPONENT DESIGNATION
		01	02	03					
		QUANTITY							
1	DL01382	REF	REF	REF	Document List				
2	902070-01	REF	REF	REF	Wiring Diagram				
3		1	1	1	40Hx24Wx20D Console, NEMA Hoffman	C-10B			
4									
5		1	1	1	Type 185 Vertical Meter, 0-100% Scale G.E.			VM 3	
6		60	60	60	Term. Section Buchanan	625		TB 1	
7		3	3	3	End Piece Buchanan	630		TB 1	
8	800073-02	1	1	1	120/12 @ 1.5 Amp. Pwr. Supply CECO			PWR 2	
9		1	1	1	Fuseholder Marathon	F30A1SP		F 1	
10		1	1	1	Fuse, 1 Amp. Buss	NON-1		F 1	
11	600496-01	6	6	6	Signal Adjust Pot CECO	CMZ-01		MCU 1-3	
12		3	3	3	Ctr. Off-Momentary Sel. Sw. A-B	800T-J91A		SS 1,2,4	
13		2	2	2	2 pos. Maintained Sel. Sw. A-B	800T-H2A		SS 3,5	
14		4	4	4	Lamp, 155V. G.E.	6S6-155V.		LT 1-4	
15	800195-01	4	4	4	Lamp Base CECO			LT 1-4	
16	800196-02	2	2	2	Lens, Green CECO			LT 1,3	
17	800196-05	2	2	2	Lens, White CECO			LT 2,4	
18		2	2	2	Type 185, Vertical Meter, 0-100% G.E.	185014NDND1J		VM 1-2 X	
19		3	3	3	Bezel Kit G.E.	4149K16G778		VM 1-3	
20		1	1	1	Circuit Bkr. West.	HQCL-1015		CB 1	
21		1	1	1	CB Mtg. Plate West.	1258C07G01		CB 1	
22		4	4	4	Stop P.B. Sw. Norm. Closed Salinger	MPIR		PB 1,3,5,7	
23		4	4	4	Start P.B. Sw. Norm. Open Salinger	MPIB		PB 2,4,6,8	
24		1	1	1	Cem Case & Pwr Supply Bristol	MY814MY		X	
25		1	1	1	Sq. Root Card Bristol	374471-01-0		X	
26		1	1	1	Subtractor Card Bristol	383654-01-7		X	
27		1	1	1	Pwr. Supply Bristol	2007-40B		PWR 1 X	
28		1	1	1	Indicator Bristol	2751-10C-110 -001-000		X	

NOTE: ITEMS 24-28 FURNISHED TO CECO BY McMAHAN CO.



DESCRIPTION OF OPERATION
 WATER TREATMENT PLANT FILTER CONSOLES
 JACKSONVILLE, NORTH CAROLINA
 S.O. 15726, ITEM L

Reference Wiring Diagram 902070-01.

Each of the three filters has its individual filter control console containing a filter flow indicator with associated circuit cards and power supplies, as well as manual control switches and indication for the five valves. Start and stop push buttons are provided for manual control of the two backwash pumps and the two surface wash pumps.

Each of the first three pages of the wiring diagram is devoted to the flow indicator circuitry for an individual filter. This is necessary because the filter flow circuitry is somewhat different for each filter. In the case of Filter No. 1, shown on Page 1 of the diagram, the flow indicator circuitry is quite simple, in that only a square root extractor card is needed to condition the signal from the flow transmitter to the Bristol Indicator.

On Page 2 of the Wiring Diagram, a subtractor card is employed in the flow indication circuitry for Filter No. 2, since the transmitter sends a signal proportional to total flow for both Filters 1 and 2. The output from the square root extractor card is applied to the subtractor card and then the signal representing Filter No. 1 flow is subtracted from the total signal output from the square root extractor. The resultant analog signal represents the flow for just Filter No. 2, and this is applied to the flow indicator.

Referring to Page 3 of the Wiring Diagram, for the flow circuitry for Filter No. 3, the transmitter input signal, representing total flow for all three filters, is applied to the square root extractor card. The output from the square root extractor, proportional to flow, is applied to the subtractor card as is the signal from the Filter No. 2 control console, which represents the total flow of Filters 1 and 2. The subtractor output then represents the difference between the Filter No. 3 transmitter signal and the flow for Filters 1 and 2 which results in a signal proportional to the flow from just Filter No. 3. This output is then applied to the Filter No. 3 flow indicator.

TITLE DESCRIPTION OF OPERATION JACKSONVILLE, N.C. S.O. 15726, ITEM L	DESIGNED TWM	DRAWN	CHECKED <i>W. S.</i>	REVISION B
 Consolidated Electric Company 141 SOUTH LAFAYETTE FREEWAY SAINT PAUL, MINNESOTA 55107	PAGE 1 OF 2	DRAWING NO IM01084		


MANUAL BACKWASHING

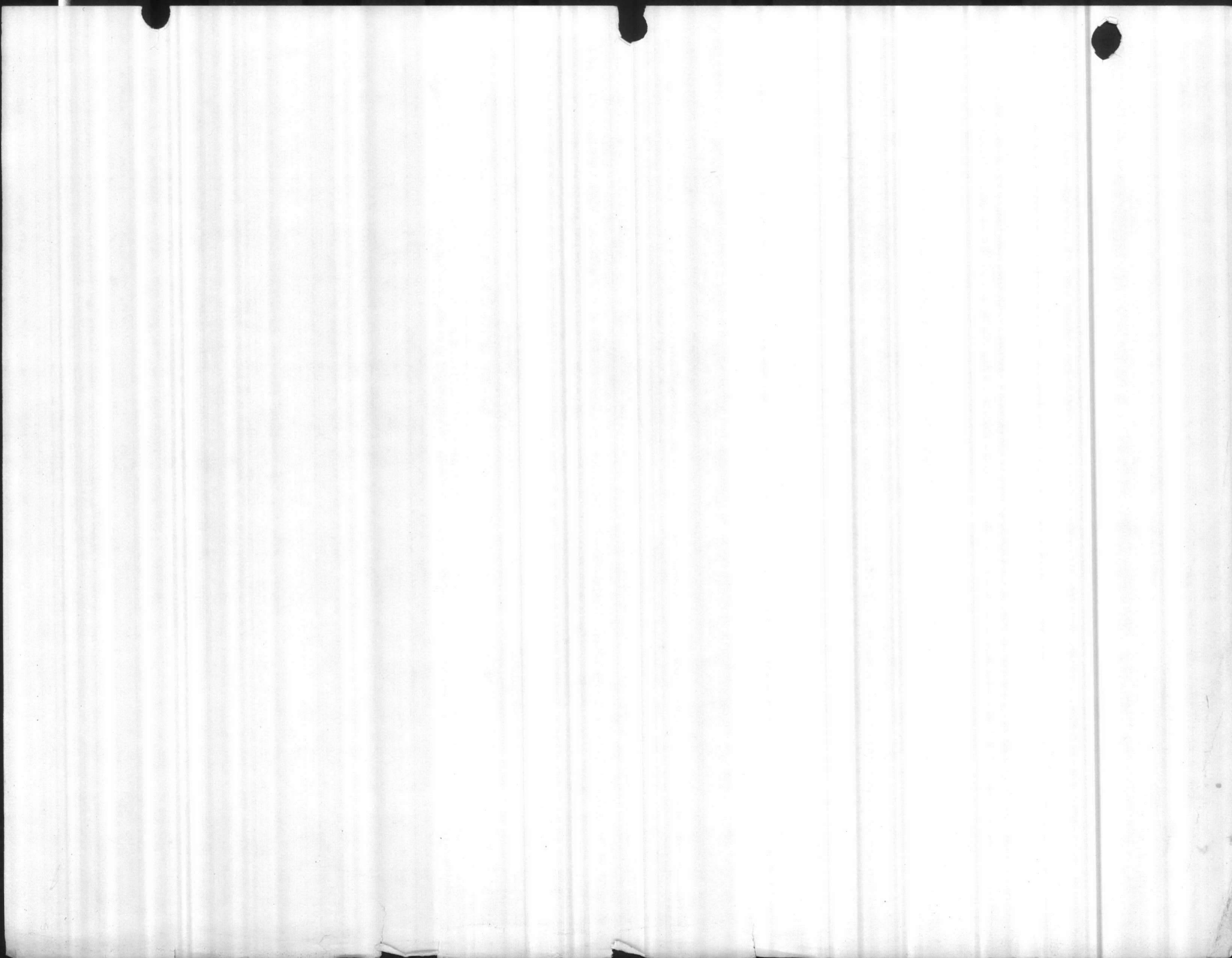
The valve positioner for the filter influent, filter effluent and the backwash influent valves are to be furnished with 1000 ohm potentiometer outputs, which will control a valve position meter for each of these valves on the control console. These valves will be manually modulated to adjust flow rates. The backwash effluent valve and the surface wash valve merely operate in the fully opened or fully closed positions, and lights are furnished to indicate which position these valves are in. The selector switches for these valves are simply maintained 2-position switches placed in either the open or close position. The selector switches for the manually modulated valves are 3-position center-off switches with momentary open and close positions.

To place the filter in backwash, the operator must first turn SS1 to close until the Filter Influent Valve meter indicates that the valve is 0% opened. The operator should then move the selector switch for the Filter Effluent Valve to close and hold it until the position meter indicates 0% opened. The operator should next press the open side of selector switch SS5, and when the opened light comes on for the Surface Wash Valve he should press the start button for the desired Surface Wash Pump.

The operator then turns selector switch SS3 to the open position opening the Backwash Effluent Valve. When the opened light comes on, the operator then turns selector switch SS4 to open until the Backwash Influent Valve indicates 100% opened, or the desired opening. The operator should then press the start button for Backwash Pump #1 or Backwash Pump #2 or both depending on how much backwash flow is desired. The backwash flow rate will be indicated on the large backwash flow indicator separately mounted. Note that by use of the "Open-Off-Close" Backwash Influent Valve selector switch, the operator can modulate the backwash flow, to obtain virtually any desired rate.

When the filter has been backwashed for a sufficient period of time the operator reverses the backwash procedure and returns the filter to the in service mode.

TITLE DESCRIPTION OF OPERATION JACKSONVILLE, N.C. S.O. 15726, ITEM L	DESIGNED TWM	DRAWN	CHECKED <i>W. S.</i>	REVISION B
 Consolidated Electric Company 141 SOUTH LAFAYETTE FREEWAY SAINT PAUL, MINNESOTA 55107	PAGE 2 OF 2	DRAWING NO IM01084		



A B C D E F G H I J K L M N O P

REV.	CO. NO.	DATE	DESCRIPTION	CHK.	APP.
A	3723	8-8-75	RELEASED		
B	HJG	2-20-76	CUST'S. CHANGES		

CAMP GEIGER WELLS

1. FUTURE
2. WELL J
3. WELL K
4. WELL L
5. WELL H
6. WELL M
7. WELL N
8. WELL O
9. WELL P
10. WELL B
11. WELL D
12. WELL E
13. WELL F
14. WELL G
15. WELL Q
16. WELL R

CURTIS ROAD PUMPS

17. BOOSTER NO. 1
18. BOOSTER NO. 2

NEW RIVER PUMPS *Wells*

19. PUMP 2 *Well*
20. PUMP 4 *"*
21. PUMP 3 *"*
22. PUMP 5 *"*
23. PUMP 10 *"*
24. PUMP 11 *"*
25. PUMP 7 *"*
26. PUMP 8 *"*

PLANT PUMPS

27. BOOSTER NO. 1
28. BOOSTER NO. 2

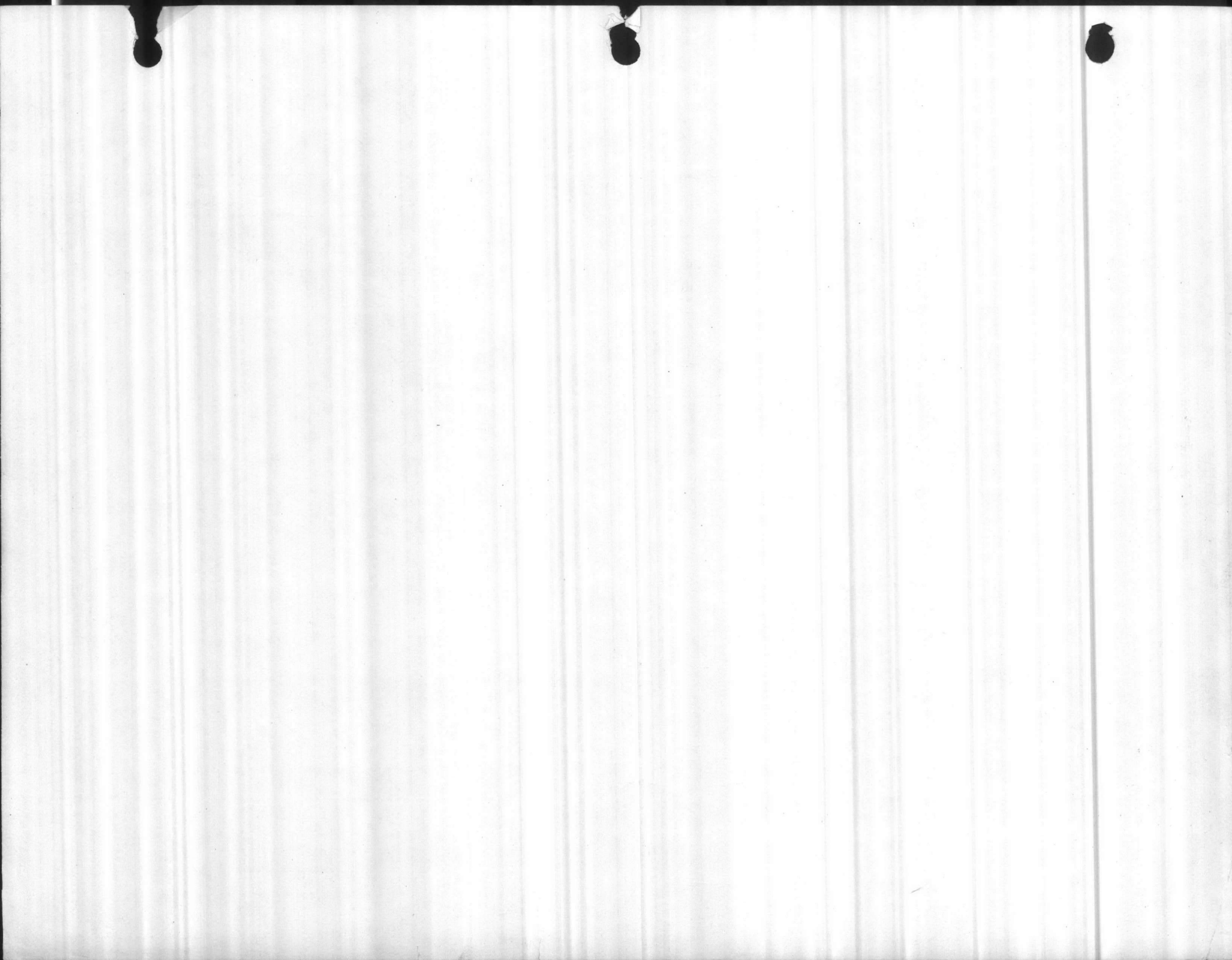
CAMP GEIGER INDICATORS/ALARMS

29. GROUND RESERVOIR LEVEL
30. SIGNAL FAILURE & ABNORMAL LEVEL
31. ELEVATED TANK LEVEL
32. SIGNAL FAILURE & ABNORMAL LEVEL

NEW RIVER INDICATORS/ALARMS

33. ~~LOW TANK LEVEL~~ *Ground Reservoir Level*
34. SIGNAL FAILURE & ABNORMAL LEVEL
35. CAMPBELL ST. ELEV. TANK LEVEL
36. SIGNAL FAILURE & ABNORMAL LEVEL
37. WHITE ST. ELEV. TANK LEVEL
38. SIGNAL FAILURE & ABNORMAL LEVEL
39. FINISHED WATER PUMP - 5 H.P.
40. FINISHED WATER PUMP - 7.5 H.P.
41. FINISHED WATER PUMP - 15 H.P.
42. NEW RIVER PUMP - 60 H.P.
43. NEW RIVER PUMP - 50 H.P.
44. NEW RIVER PUMP - 100 H.P.
45. CLEARWELL HIGH LEVEL ALARM LIGHT
46. CLEARWELL LOW LEVEL ALARM LIGHT
47. SLAKER ALARM LIGHT

TITLE: DIMENSIONS & ARRANGEMENT MAIN CONTROL ENCLOSURE - NEMA 1 NEW RIVER WATER TREATMENT PLANT		ITEM "M" PAGE 2 OF 2					
SHOP ORDER 15726	JOB NAME JACKSONVILLE, N.C.	MATERIAL 12 GA. C.R.S.					
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		FINISH GRAY HAMMERTONE					
<small>TOLERANCES: UNLESS OTHERWISE SPECIFIED. TWO PLACE DEC. ± .010. THREE PLACE DEC. ± .005. FRACTIONS ± 1/64.</small>		DO NOT SCALE	<table border="1"> <tr> <td>DESIGNED TVVM</td> <td>DRAWN HJG 8/6/76</td> </tr> <tr> <td>DATE</td> <td>CHECKED</td> </tr> </table>	DESIGNED TVVM	DRAWN HJG 8/6/76	DATE	CHECKED
DESIGNED TVVM	DRAWN HJG 8/6/76						
DATE	CHECKED						
DRAWING NO. IM01121			REV. B				



ITEM NO.	CECO PART NUMBER	SUB-VARIATION				DESCRIPTION	PL	PAGE 1 OF 2	DWG. NO. 201901-01	COMPONENT DESIGNATION
		01								
		QUANTITY				SPECS. OR MFGS. P/N				
1	DL01382	REF				Document List				
2	902071-01	REF				Wiring Diagram				
3	SK01026	2				Encl., NEMA 1 90x20x20				
4	SK01027	1				Encl., NEMA 1 90x25x20				
5	GB6608210-5	2				L.H. Hinged Rear Door 80x20	103G-8AP			
6	GB6608210-5	1				L.H. Hinged Rear Door 80x25	103G-8BP			
7	SK01028-01	2				Fixed Door, 20x10 high	103G-7AB			
8	SK01029-01	1				Fixed Door, 25x10 high	103G-7BB			
9	SK01028-02	2				Fixed Door, 20x10 high			No Holes-w/Studs	
10	SK01029-02	1				Fixed Door, 25x10 high			No Holes-w/Studs	
11	SK01030,31	2				Fixed Door, 20x80 high			No Holes-w/Studs	
12	SK01032	1				Fixed Door, 25x80 high			No Holes-w/Studs	
13	SK01033	1				Inner Panel, 18-3/4x70 high			X	
14		2				Channel Iron, 1 1/2"x3"x65" long				
15	700272-01	1				Swing Out Bay Frame				
16	700201-01	2				Frame Angle Rack | -RH | -LH				
17	700210-01	2				Frame Angle Rack | -RH | -LH				
18	700273-01	2				Hinge, Fixed Bracket				
19	700274-01	2				Hinge, Swinging Bkt.				
20		2				Flat Washer, 3/8"	Cad. Pltd.			
21		2				Nut, Hex 3/8"-16	Cad. Pltd.			
22	700275-01	2				Bkt., Bay Latch				
23	700276-01	2				Bkt., Latch Mounting				
24		10				Screw, P.H., 1/4"-20x3/8"	Cad. Pltd.			
25		2				Screw Fastener Southco	17-13-304-11			
26		2				Retaining Washer Southco	17-10014-11			
27		1				1-pole, 15A. Circuit Bkr. West.	HQCL-1015	CB 1		
28		1				CB Mtg. Bkt., West.	1258C07G01	CB 1		
29	201999-01	5				Cecotronic Receiver CECO				
30		3				Type 180-vertical-6" Meter, 0-30 Ft. G.E.	(Control Assy. Inc.) 100-0-100uA	LM 2,3,5		
31		2				Type 180-vertical-6" Meter, 0-15 Ft. G.E.	(Control Assy. Ind.) 100-0-100uA	LM 1,4		
32		1				4" 120V. Alarm Bell Faraday	346-4			
33	800195-01	75				Light Base		LT 1-75		
34	800196-01	13				Lens, Round-Red		LT 1-10, 46-48,		
35	800196-02	33				Lens, Round-Green		LT 11-43		
36	800196-03	29				Lens, Round-Amber		LT 44, 45, 49-75		
37		40				Lamp, 155V. G.E.	6S6-155V.	LT 1-10, 46-75		
38		35				Lamp, 60V. G.E.	6S6-60V.	LT 11-45		
39		3				Screw terminal - 11 unit Fuseholder Block Buss	3833-11	F 1-33		
40		33				Fuse, 1 Amp. 1x1 1/4 Buss	AGC-1	F 1-33		
41	600566-06	3				Alarm Module 120V.		AM 1-3		
42	800156-03	27				Sel. Switch On/Off		SS 1-27		
43		170				Term. Block Buchanan	625	TB 1		
44		8				End Piece Buchanan	630	TB 1		
45		33				P.B. Switch Salinger	MP1B	START		
46		33				P.B. Switch Salinger	MP1R	STOP		

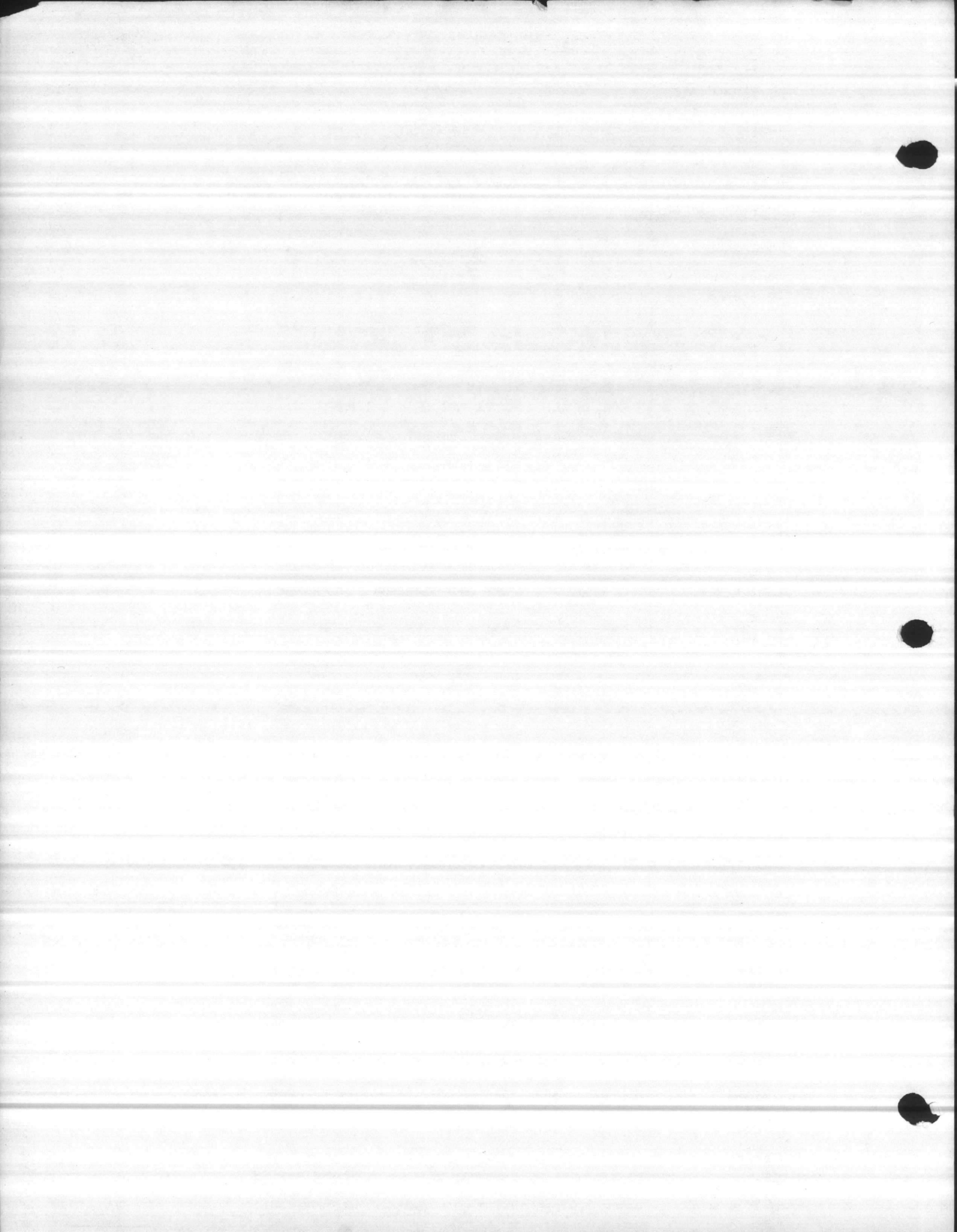
201901-01
PAGE OF 1 2
REV B
DRAWING NO. 201901-01

TITLE: NEW RIVER WATER TREATMENT PLANT MAIN CONTROL CENTER S.O. 15726, ITEM "M"

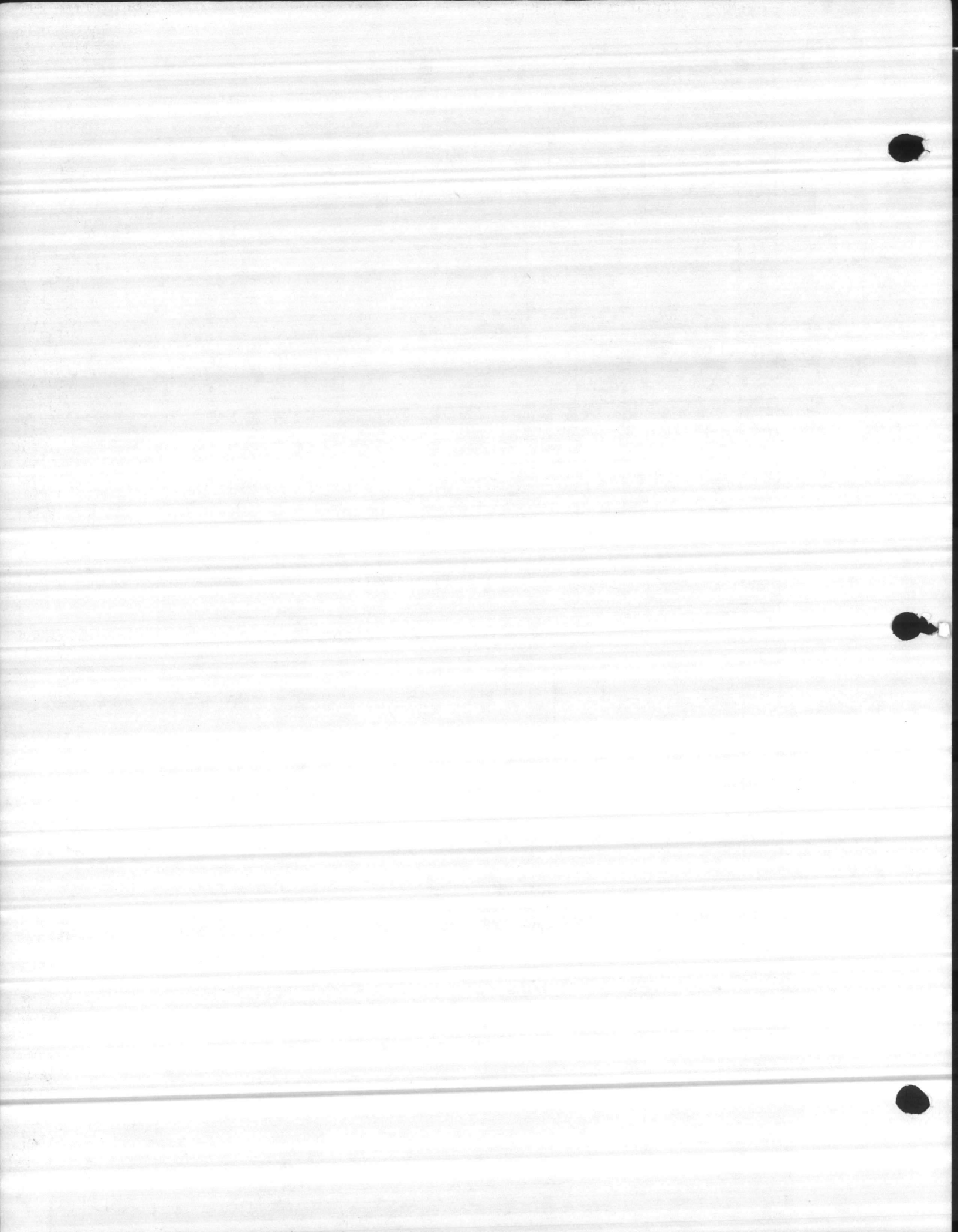


CONSOLIDATED ELECTRIC CO.
141 SO. LAFAYETTE FREEWAY • ST. PAUL, MINN. 55107

DFT	8/6/75	HJG
CHK	8/8/75	TWM
ENG		
APP	7/2/75	



ITEM NO.	CECO PART NUMBER	SUB-VARIATION				DESCRIPTION	PL	PAGE 2	OF 2	DWG. NO. 201901-01
		01								
		QUANTITY								
47		28				Telph. Jack Newark Switchcraft	39F656 111			
48		8				P.B. Opr. C-H	10250T-101		PB 1-5, 72-74	
49		8				Contact Block C-H	10250T-53		PB 1-5, 72-74	
50										
51										
52										
53										
54										
55										
56		1				120V/24V Power Supply Bristol	2007-40B		X	
57		1				Cem Case & Power Supply Bristol	MY814MY		X	
58		1				Sq. Root Card Bristol	374471-01-0		For Cem Case X	
59		1				Single Pen, 120V. Recorder/Ind. Bristol	2711-10A-200-104-010-00N-00R-100		Raw Water Flow X	
60		1				Single Pen, 120V. Recorder/Ind. Bristol	2711-10A-200-104-010-00N-00R-100		Finished Water Flow X	
X - ITEMS 56-60 TO BE FURNISHED TO CECO BY McMAHAN COMPANY.										



DESCRIPTION OF OPERATION

NEW RIVER WATER TREATMENT PLANT MAIN CONTROL PANEL

JACKSONVILLE, NORTH CAROLINA

S.O. 15726, ITEM M

Reference Wiring Diagrams 902071-01 and 902104-01.

This Main Control Panel includes programming lights for all the raw water pumps, which are operated by ~~toggle~~ ^{Selector} switches. The operator can position these ON/OFF ~~toggle~~ ^{Selector} switches to indicate which pumps are to be run. The Pump Required lights that are thus turned on, maintain a record of which pumps are to be used. The remote control of these raw water pumps, both wells and boosters, is achieved by the use of push buttons, momentarily operating 48 volt DC relays at the receiving locations. Indicator lights are furnished for each of these remote pumps, operated by contacts from the remote location. Each remote location has a call button and a phone jack to permit communication with the main panel. Individual fuses are furnished for each of the remote pumps, to provide maximum integrity of the system.

Manual control of the finished water pumps and the distribution pumps is also furnished in the same manner along with running indication lights. A call light and phone jack is provided for communication from these pump locations also.

Five Cecotronic Receiver frames are provided, one for each of the water storage tanks, along with vertical-scale tank level meters. The pulse width modulated signal received from each of the water tanks is converted to an analog signal that drives the level indicator. Setpoints are furnished in the receiver frame which operate output relays to operate an alarm when there is an abnormal level in the tank and also to indicate an alarm when there is a signal failure. Another output contact from the control frame operates an alarm bell when either of these alarm conditions occurs at any of the five tank locations. Pressing the silence button for the appropriate water tank will silence the alarm bell when an alarm condition occurs. The alarm light will stay on until the alarm condition has been eliminated.

Tie into Common Series

Flow recorders are mounted in this panel, to indicate and record the raw water flow rate and the finished water flow rate. The circuitry for these recorders and associated circuit cards and power supplies are shown on the right hand side of Page 2 of the Wiring Diagram.

Referring to Page 3 of the Wiring Diagram, the remote control circuitry for each of the remote pumps is essentially identical, therefore it is only necessary to describe one of them. If the operator presses the start button for Well B, a signal is transmitted to Item "N1" panel at Well B which momentarily energizes a 48 volt DC relay, closing a contact around the start push button at the motor starter, energizing that starter which seals itself in. When the operator wishes to stop the pump at Well B, he presses the stop push button, again momentarily energizing a 48 volt DC relay, which breaks the circuit in series with the stop button at the motor starter, dropping out the starter and stopping the pump. While the pump is running at Well B, an auxiliary contact of the starter completes the circuit to the Well B running light, turning that light on.

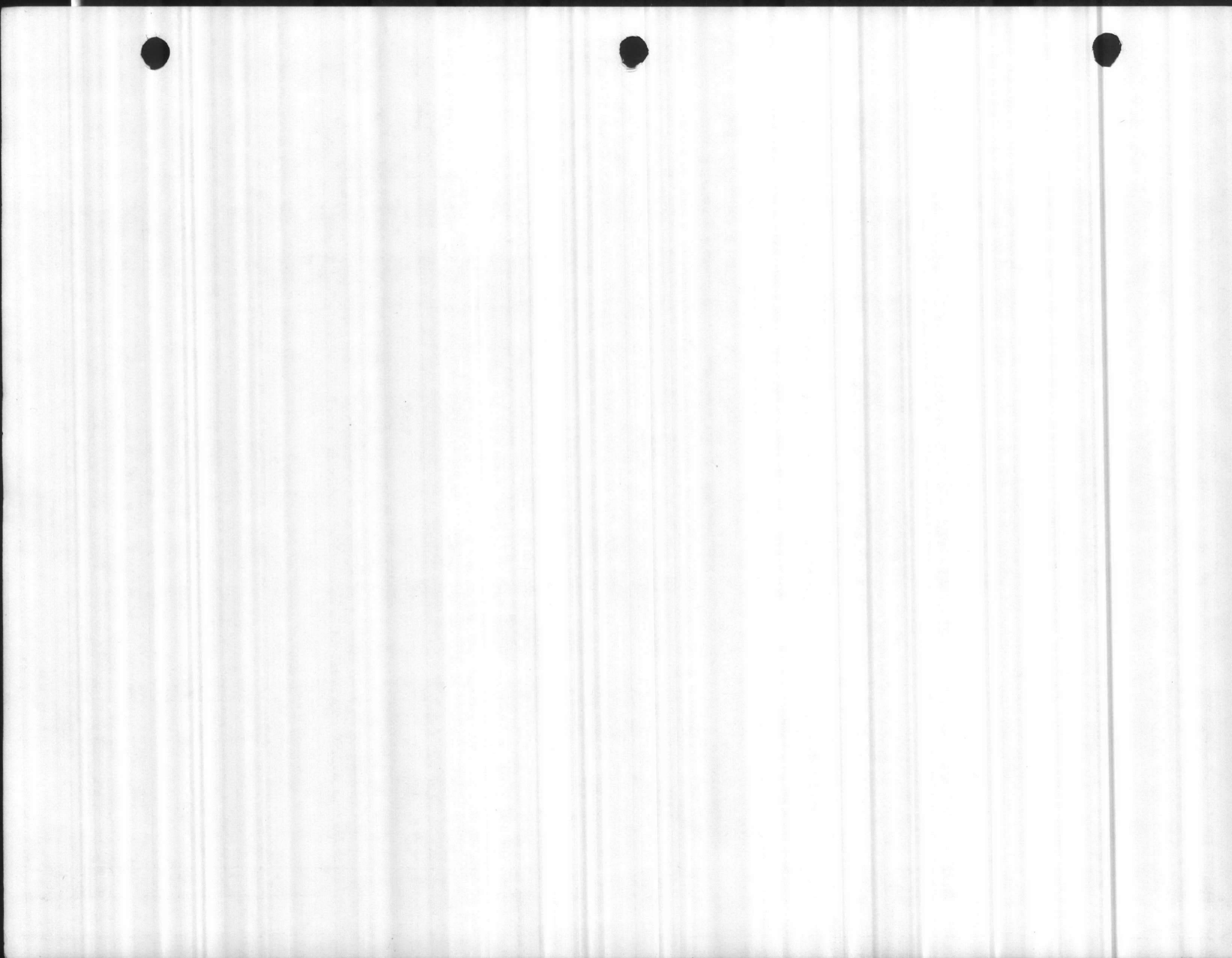
Referring to Page 6 of the Wiring Diagram, contact closures in the panel at the clearwell, Shop Order Item "F", will operate alarm modules for high level and low level in the clearwell. For instance if a high level condition occurs at the clearwell, a contact closure will energize relay CR2 in Alarm Module AM1. This lights the High Level in Clearwell light, and energizes the alarm bell shown on Page 1 of the Wiring Diagram. Pressing the silence button for the high level alarm, will energize relay CR1 in Alarm Module AM1, deactivating the alarm bell. The high level light stays on until the level subsides in the clearwell. Similar alarm modules are furnished for Clearwell Low Level and for a Slaker Alarm. A contact is furnished by others to activate the slaker alarm.

CECOTRONIC ELEVATED TANK RECEIVER

Referring to Wiring Diagram 902104-01 and Assembly Drawing 201999-01, the pulse width modulated DC signal on the signal pair from the transmitter is applied to terminals T1 and T2 of the DC Receiver in slot A-25. This pulse width modulated signal is converted to a logic level pulse width modulated signal and applied to the inputs of the XPW-18 Signal Failure Detector card in slot A-03.

TITLE	DESIGNED	DRAWN	CHECKED	REVISION
DESCRIPTION OF OPERATION JACKSONVILLE, N.C. S.O. 15726, ITEM M	TWM		<i>Chen</i> 8-12-75	A
 Consolidated Electric Company 141 SOUTH LAFAYETTE FREEWAY SAINT PAUL, MINNESOTA 55107	PAGE 1 OF 4	DRAWING NO IM01085		

TITLE	DESIGNED	DRAWN	CHECKED	REVISION
DESCRIPTION OF OPERATION JACKSONVILLE, N.C. S.O. 15726, ITEM M	TWM		<i>Chen</i> 8/12/75	A
 Consolidated Electric Company 141 SOUTH LAFAYETTE FREEWAY SAINT PAUL, MINNESOTA 55107	PAGE 2 OF 4	DRAWING NO IM01085		



The XPW-18 card detects when a monitor signal from the water tank transmitter has been lost, indicating a failure at the transmitter or a failure of the signal lines. This condition will apply a zero input to Pin 17 of the alarm silence gate in slot A-15. The output at terminal 16 of the DSG-03 card energizes relay K2 in the QRM-01 Module in slot A-44. This operates relay K2 which activates the Signal Failure light. The output at terminal 12 of the DSG-03 card energizes relay K3 which operates the alarm bell. When the operator presses the silence button for this water tank, the 12 volt input applied to the Pin 18 of the QFG-02 Buffer in card slot A-17 pulls down the silence input Pin 11 of the DSG-03. This de-energizes relay K3 and de-activates the alarm bell.

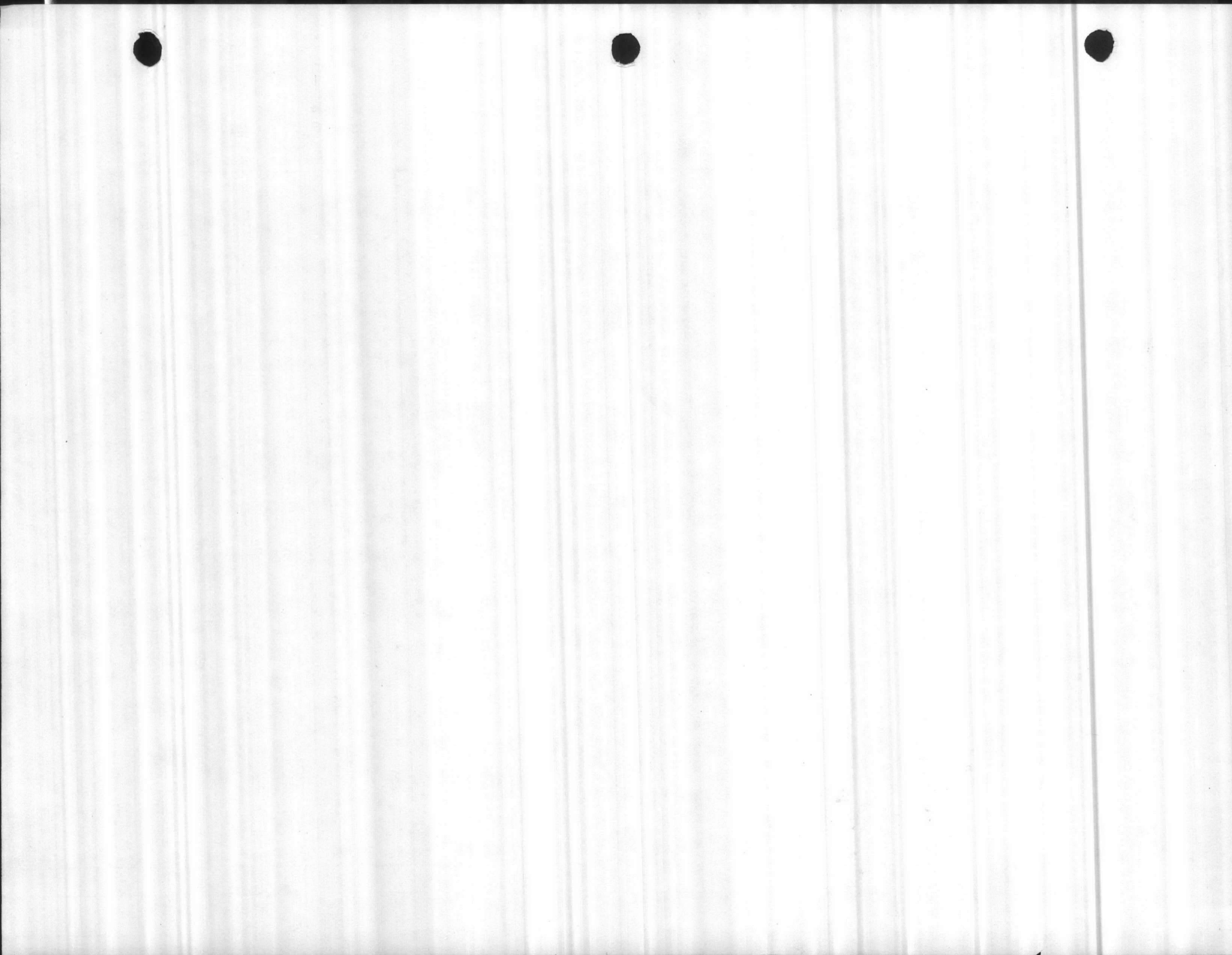
The signal output from the XPW-18 card is applied to the input terminals of the XPW-15 Pulse Width Demodulator card in slot A-05. This card converts the pulse width signals, which are logic level signals varying between 100 milliseconds and 900 milliseconds in duration, proportional to the level of water in the tank, to an analog signal varying between -5 and +5 volts DC. This signal is then applied to the input of the Simulator/Queller card in slot A-07. The pulse width modulation system is further described in IM00290.

The SES-06 Simulator/Queller card in slot A-07 performs two functions. The quelling function is one of delaying the system response to variations in the level signal received from the transmitter. The input signal is integrated such that the changes in level are caused to occur slower in the output than they are at the input. This rate of quelling is adjustable by a trimpot on the upper front face of the card. The simulator function is one of permitting the operator to move a switch on the front face of the card to the manual position and adjust a trimpot at the lower front face of the card to simulate variations in the level signal. The operator must always remember after using the manual mode, to move the switch back to the AUTO position so that the system will respond to variations in the actual level signal. The simulation function is very helpful in facilitating trouble shooting, and to help the operator in making adjustments to the system. A buffered level signal is provided at terminal 17 and this is used to drive a vertical scale meter on the front panel. The 100K pot on the ZOM-02 Connector Board in slot A-50 is used to adjust the meter output for proper deflection. The normal analog output signal from terminal 11 of the SES-06 card is applied to the input terminal 18 of the QEC-01 Voltage Comparator or Setpoint Card in slot A-13. The Simulator/Queller card is further described in ES50070.

The QEC-01 Voltage Comparator card is used to compare the varying analog level signal to pre-adjusted voltage setpoints and provide logic level outputs which change abruptly between logic 1 and logic 0 (plus 5 volts and 0 volts approximately). In this system, the high alarm setpoint and the low alarm setpoint are wired together and connected to the input Pin 6 of the DSG-03 alarm silencing gate. This means that whenever there is either a high level condition or a low level condition in the tank, this alarm input will be pulled down which will cause the alarm gate to energize relay K1 in the QRM-01 Module in slot A-44. The output contact of relay K1 lights the abnormal level alarm light. As in the case of the signal failure alarm, the output from terminal 12 of the DSG-03 card will energize relay K3 activating the alarm bell. In the same manner, if the operator presses the silence button for this water tank, it will silence the alarm bell by de-energizing relay K3. The operation of the voltage comparator card is further described in ES50065. The operation of the QRM-01 Relay Module is further described in ES50067. The DTC-02 DC Receiver module includes lightning protection for the input signal, which is further described in ES50061.

TITLE	DESIGNED	DRAWN	CHECKED	REVISION
DESCRIPTION OF OPERATION JACKSONVILLE, N.C. S.O. 15726, ITEM M	TWM		<i>Chapman</i> 8/12/75	A
 Consolidated Electric Company 141 SOUTH LAFAYETTE FREEWAY SAINT PAUL, MINNESOTA 55107	PAGE	DRAWING NO		
	3 OF 4	IM01085		

TITLE	DESIGNED	DRAWN	CHECKED	REVISION
DESCRIPTION OF OPERATION JACKSONVILLE, N.C. S.O. 15726, ITEM M	TWM		<i>Chapman</i> 8-12-75	A
 Consolidated Electric Company 141 SOUTH LAFAYETTE FREEWAY SAINT PAUL, MINNESOTA 55107	PAGE	DRAWING NO		
	4 OF 4	IM01085		



INSTRUCTIONS FOR TESTING
TELEPHONE CIRCUITS

A leased circuit consists of two wires running from one point to another. The run is never continuous, but rather is made in several segments (See Fig. 1).

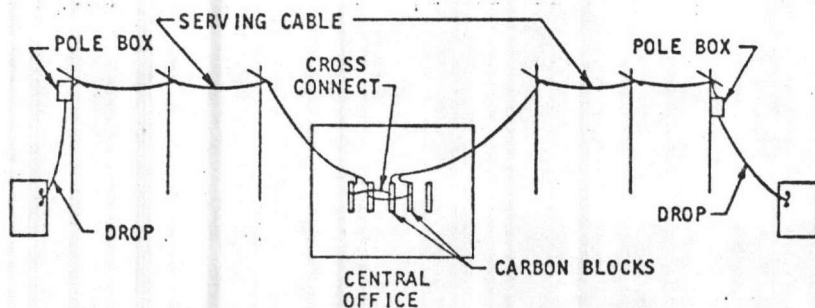


FIG. 1 TYPICAL LEASED CIRCUIT

Tracing the circuit from one end to another, we start with the DROP—the single pair which runs from the end of the circuit to the nearest POLE BOX—where access to a cable is available. The pole box may or may not be mounted on a pole. It is a terminal box where a large cable is opened. This large cable follows a rather direct route to the serving Central Office. In the central office, this cable is fanned onto Carbon Blocks and mounted on the central office Distribution Frame. These carbon blocks provide over-current protection and lightning protection for the central office. A Cross Connect extends the circuit to another serving cable. It also is equipped with carbon blocks. This cable brings the circuit to a pole box near the far end of the circuit where another Drop extends it to the end.

Common trouble spots in a circuit of this type are between the end of the circuit to the Pole Box - the Drop, and the Carbon Blocks. In the drop, one or both of the wires of the circuit can become broken (open), they can short together, or one or both can become grounded.

IA7108426

To check a pair of lines, disconnect from equipment at both ends, and make sure that wires cannot touch any metal object (tape ends, etc.). First, using a voltmeter, check to be sure that there are no induced voltages across the lines or from line to ground. Now, using an ohmmeter on the high resistance scale, check the resistances shown in Figure 2 at one end of the line.

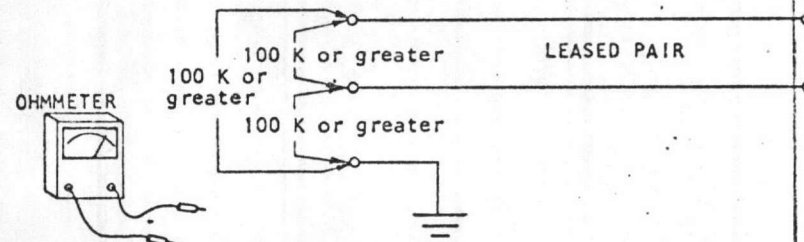


FIG. 2 Checking for Shorts and Grounds

For the ground checks, use any good water pipe ground or the ground in the control panel. If any of the readings between lines or to ground measure less than 100,000 ohms, notify the telephone company and have them repair the line.

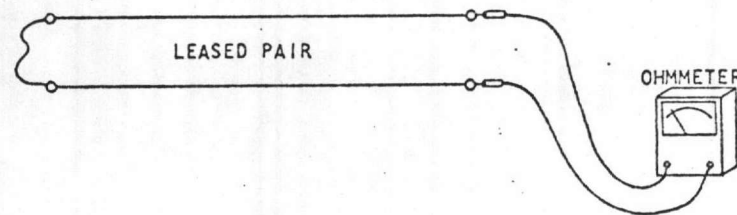
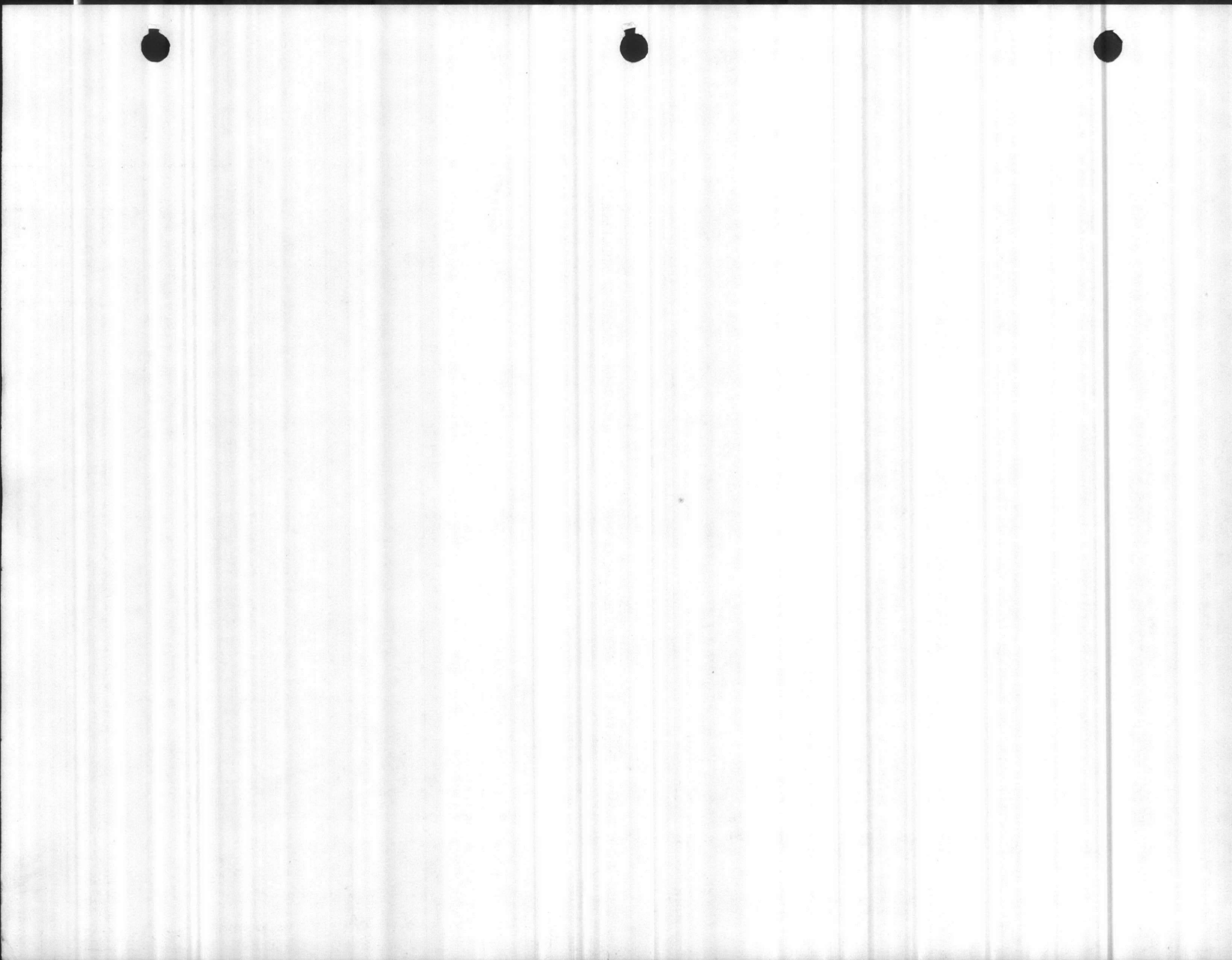


FIG. 3 Checking Line Resistance

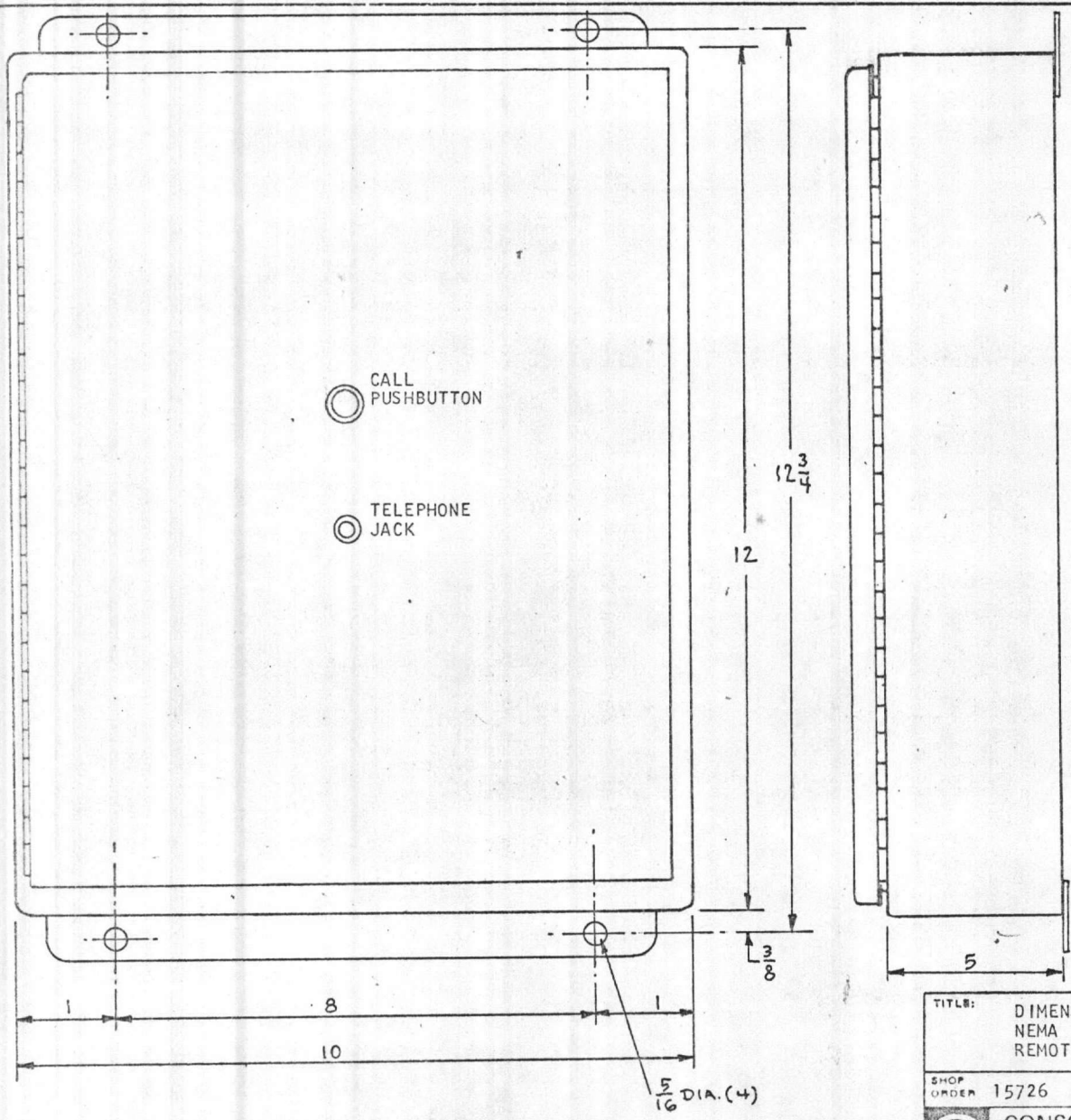
Referring to Figure 3, connect the two lines together, but do not allow them to touch any metal. Now go to the other end of the line and measure the resistance between the two lines.

Check this reading against the maximum permissible line resistance listed in the Trouble Shooting Guide for the transmitter used.

IA7108426

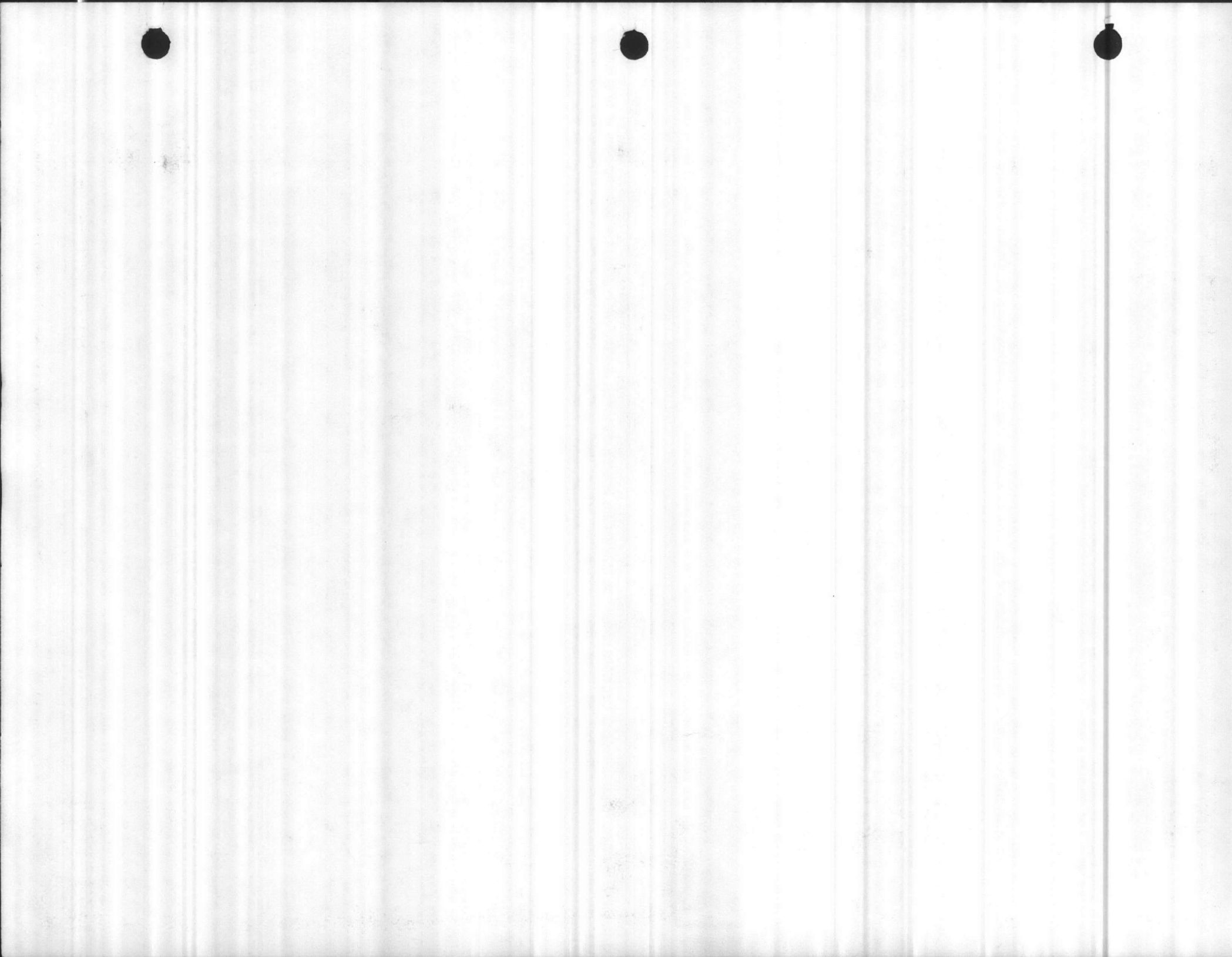


A B C D E F G H I J K L M N O

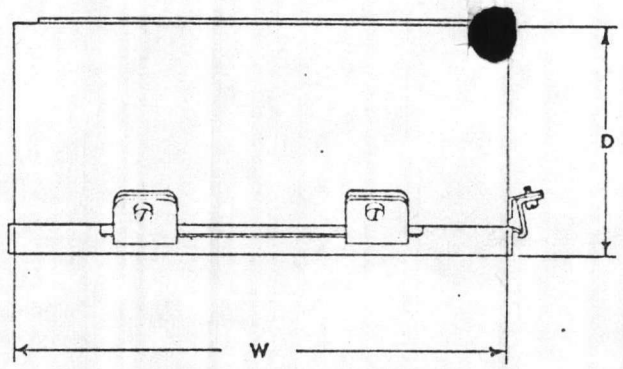


REV.	CO. NO.	DATE	DESCRIPTION	CHK	APP.
A	3723	8/7/75	RELEASED		<i>[Signature]</i>

TITLE: DIMENSIONS & ARRANGEMENT NEMA 1 ENCLOSURE REMOTE PUMP RELAY PANEL		ITEM "N"
SHOP ORDER 15726	JOB NAME JACKSONVILLE, N.C.	MATERIAL 14GA. (.075) C.R.S.
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN.		GRAY HAMMERTONE
TOLERANCES UNLESS OTHERWISE SPECIFIED: TWO PLACE DEC : .010 THREE PLACE DEC : .005 FRACTIONS : 1/64 ANGULAR	DO NOT SCALE	DESIGNED TWM DATE 8-5-75 DRAWN HJA 8/75 CHECKED <i>[Signature]</i>
		IM01122
		REV. A

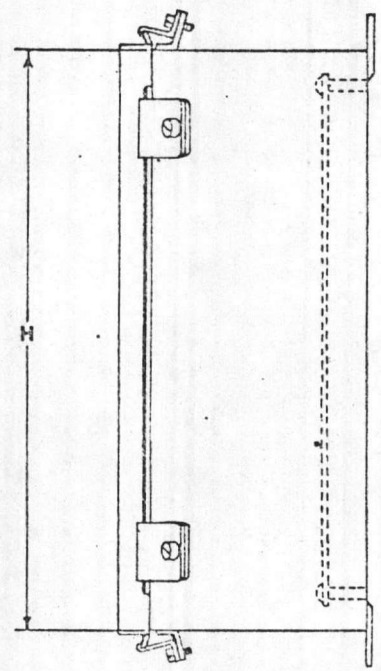
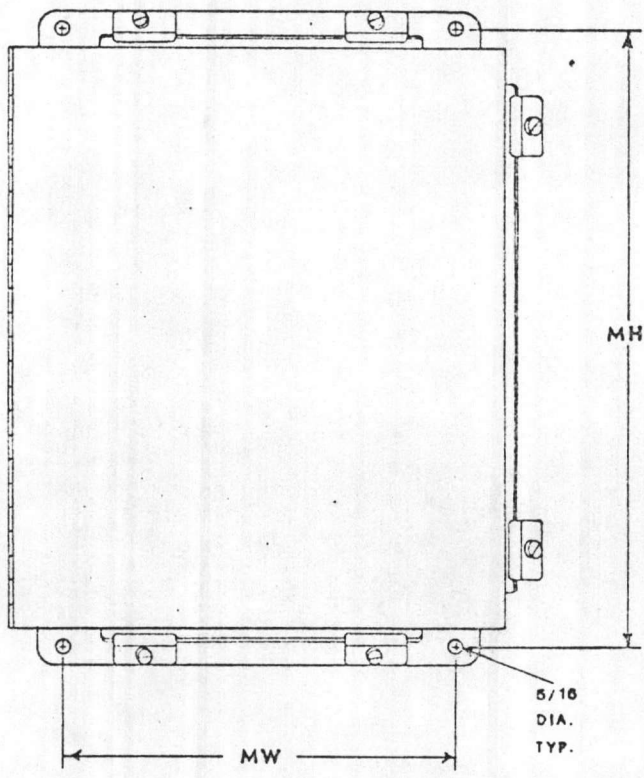


REV.	CO. NO.	DATE	FUNCTION	CHK. APP.
A	2807	12-28-75	RELEASE	CM



DIMENSIONS (INCHES)

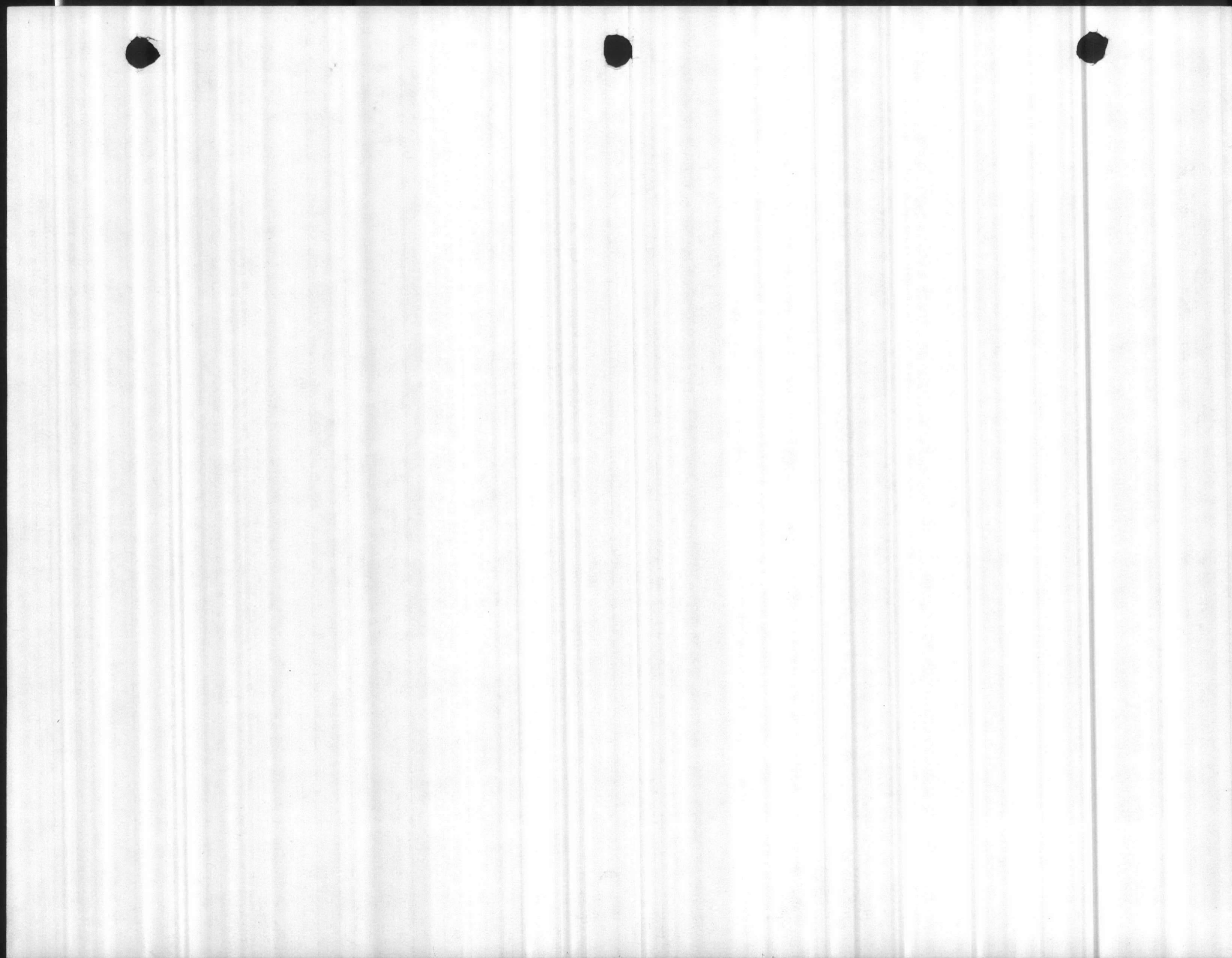
W	H	D	MW	MH
8	10	4	6	10 3/4
10	12	5	8	12 3/4
12	14	6	10	14 3/4
14	16	6	12	16 3/4
20	20	6	14	21 1/4

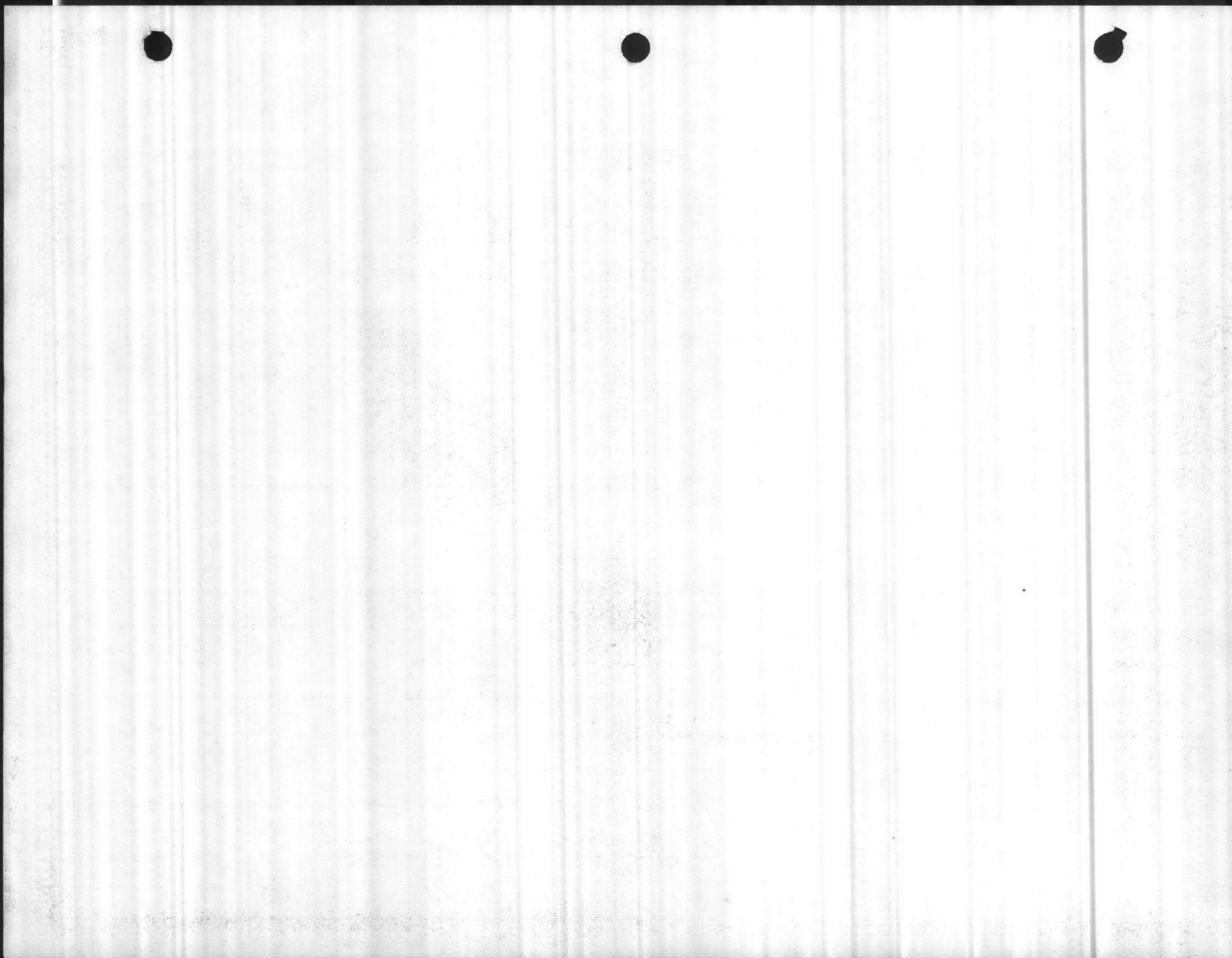



NOTE: THIS DRAWING IS INTENDED TO GIVE ENCLOSURE OUTLINE AND MOUNTING DIMENSIONS ONLY. COMPONENT LAYOUTS WILL VARY, DEPENDENT UPON SPECIFIC JOB REQUIREMENTS.

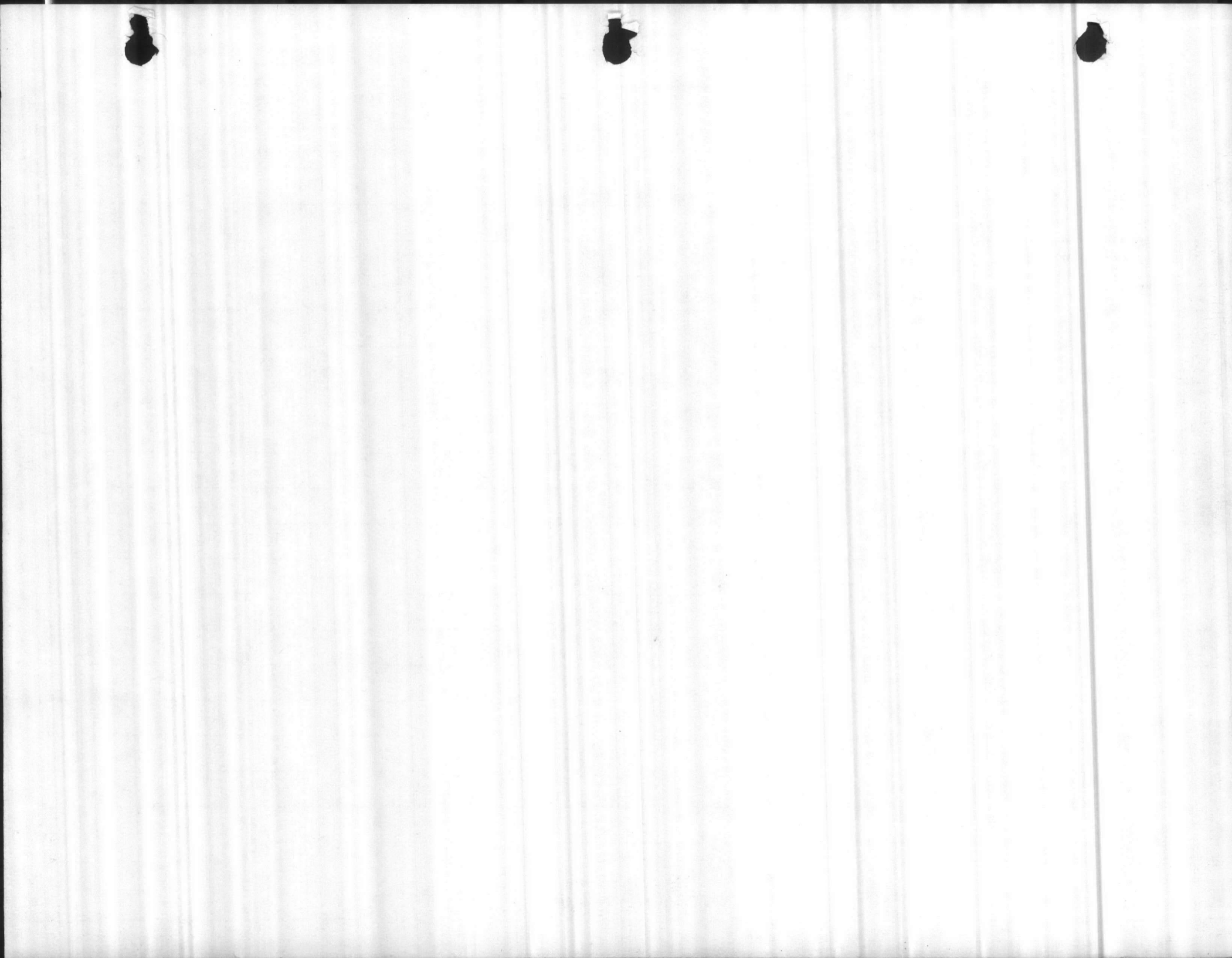
DESCRIPTION: NEMA TYPE 4 ENCLOSURE. FOR USE IN AREAS WHICH MAY BE REGULARLY HOSED DOWN OR OTHERWISE VERY DAMP. IT IS SUITABLE FOR OUTDOORS OR IN DAIRIES, BREWERIES, AND SIMILAR INSTALLATIONS.

TITLE: ENCLOSURE DIMENSIONS NEMA 4		S.O. ITEMS "O.P.G. & R"	
SHOP ORDER: 5722	JOB NAME: JACKSONVILLE, I.L.C.	MATERIAL: S.A. C.P.S.	
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		FINISH: GRAY HAMMERTONE	
DO NOT SCALE		DRAWING NO.: 1M00432	A





ITEM NO.	CECO PART NUMBER	SUB-VARIATION				K	DESCRIPTION	PL	PAGE 1	OF 1	DRAWING NO. 202000-01	COMONENT DESIGNATION
		01										
1	DL01382	REF					Document List					
2	902105-01	REF					Wiring Diagram					
3		1					Encl., NEMA ^{20x20x6} ₄ Hoffman			A20H20ALP		
4		1					Inner Panel ^{17x17} Hoffman			A20P20		
5	600463-01	1					Cecotronic Assembly					
6	600078-01	1					Transducer Assembly					
7		1					Term. Block Marathon			302	TB 1	
8		1					Ltng. Arrestor G.E.			9L15DCB002	LA (1Ø)	
9		1					Thermoswitch CECO			2G-91	TH	
10		1					Heater, 120V. ^{75 Watts} Chromalox			SCB-75	HTR	
11		1					Receptacle Leviton			9063		
12		1					Circuit Bkr. West.			HQCL-1010	CB 1	
13		2					C.B. Surface Mtg. Clip West.			K82216		
14		1					Gauge, 3 ¹ / ₂ " ^{0-15 lbs.} US Gauge			P844U		
15		1					Mtg. Flange Monnier			11520		
16		2					Valve, ¹ / ₄ " Generant			3000-4		
PL		PAGE 1	OF 1	REV. A	TITLE BULL. E800, MODEL 121-RST S.O. 15726, ITEMS "O,P,Q,R"			DRFT	8/6/75	HJG		
DRAWING NUMBER 202000-01					CONSOLIDATED ELECTRIC CO. 141 SO. LAFAYETTE FREEWAY • ST. PAUL, MINN. 55107			CHKD	8-6-75	Jen		
								ENG		TWM		
								APP				



QRM-01, QUAD RELAY MODULE

Schematic Assembly
 QRM-01 900440-01 600186-01

The QRM-01 is a quad Relay Assembly for interfacing between Electronic on-off signals and AC control circuits, such as industrial control relay circuits. The output is a Form C mechanical relay. It, therefore, will operate properly in most low power circuits.

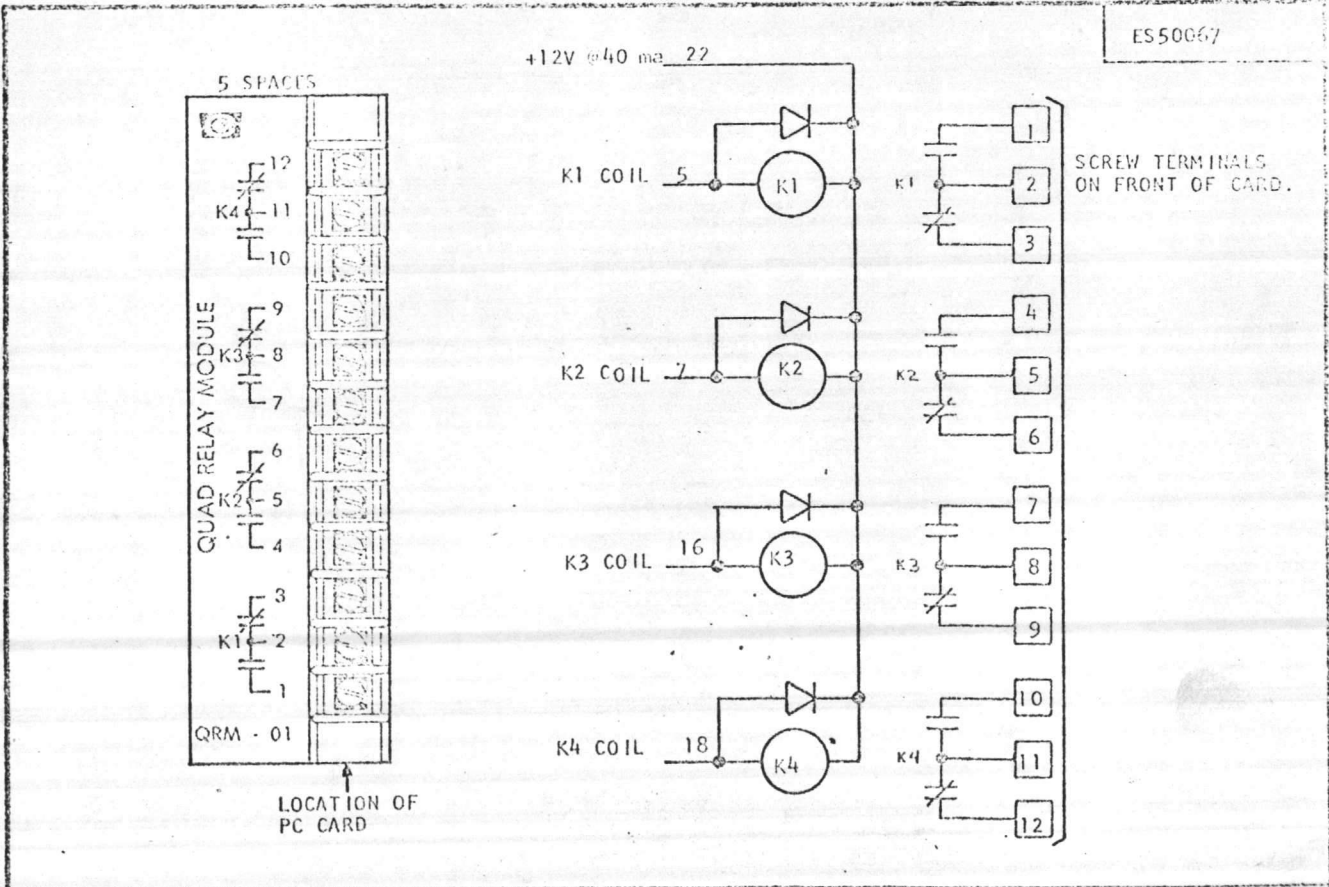
When the Input is held at a logic 0, the relay will energize. When the input is at a logic 1, the relay will release.

Contact Ratings: 2 Amp. continuous
 For non-inductive loads only, AC or DC
 150 Volts maximum.

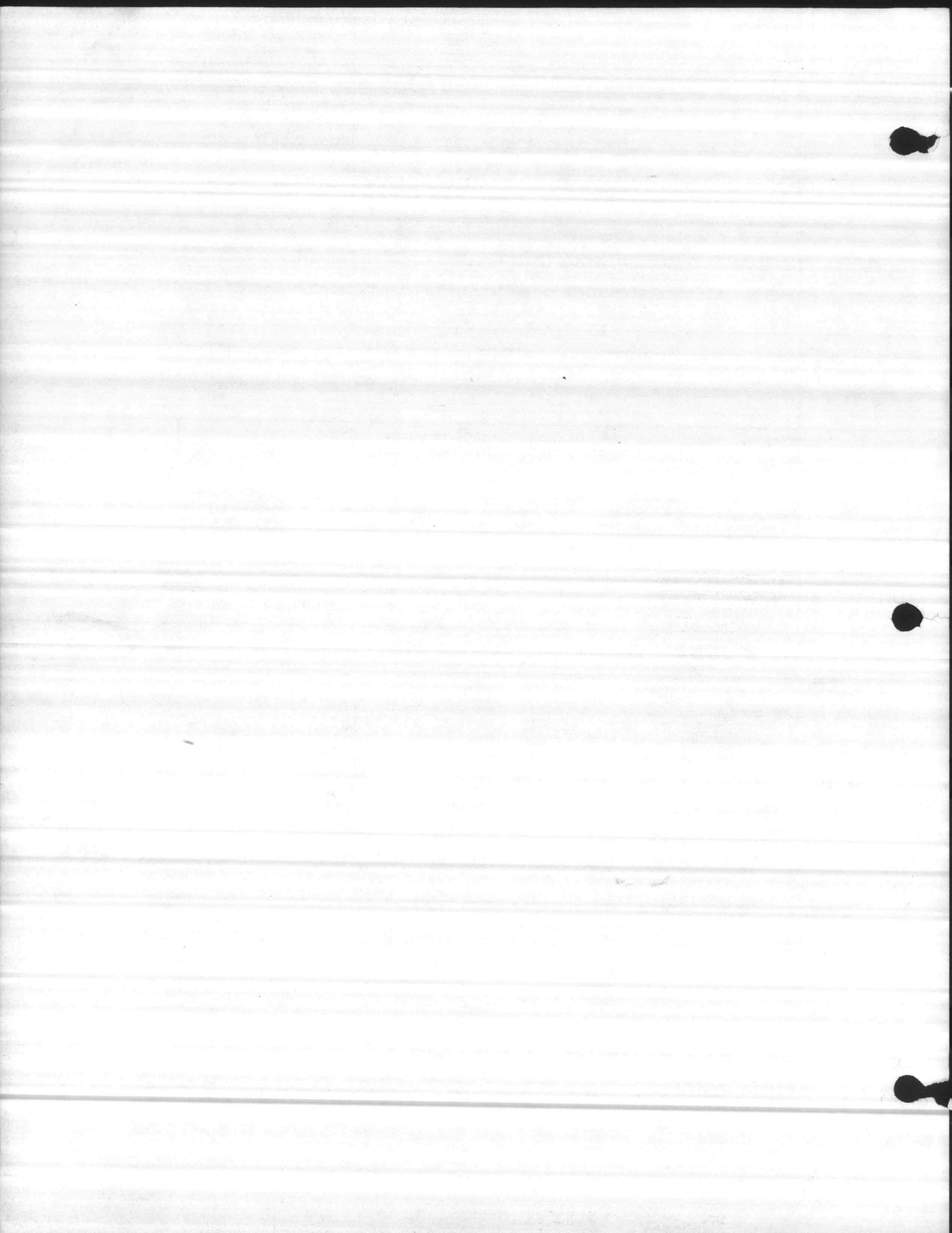
Load contacts are completely isolated from Ground and each other.

Contacts are not suitable for dry circuit loads.

TITLE: TECHNICAL DATA QRM-01 P/N 600186-01		DRAWN	DESIGNED DGL	
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED	PAGE 1 OF 2	DRAWING NO ES50067
				REV B



TITLE: TECHNICAL DATA QRM-01 P/N 600186-01		DRAWN	DESIGNED DGL	
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED	PAGE 2 OF 2	DRAWING NO ES50067
				REV B



I. INTRODUCTION

CECOTRONIC BASIC ANALOG TRANSMITTER

The Basic Analog Transmitter is a versatile, solid-state system, designed for municipal applications requiring continuous, automatic transmission of a measured variable over a DC circuit.

The system is designed to provide flexibility of configuration to meet application needs and provide convenient future on-line modification.


This Manual is not intended to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to Consolidated Electric Company, Saint Paul, Minnesota, 55107.

MAINTENANCE FEATURES

All printed circuit cards and modules plug in to convenient receptacles within the card frames. The receptacles are individually keyed for specific card types, to minimize operator error in changing cards.

Card adjustments, switches, and test points are located at the front edge of the cards where they can be easily reached.

Trouble-shooting the system is simplified by the use of test points, placed strategically throughout the circuitry. The compact logic probe, which plugs into a regulator card for power, indicates ON or OFF status of logic signals present at any test point.


TITLE	DESCRIPTION OF OPERATION CECOTRONIC BASIC ANALOG TRANSMITTER	DRAWN	DESIGNED DGL	ASSEMBLY NO. 600463-XX
	CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107	CHECKED DGL	PAGE 1 OF 9	DRAWING NO 1M00402
				REV A

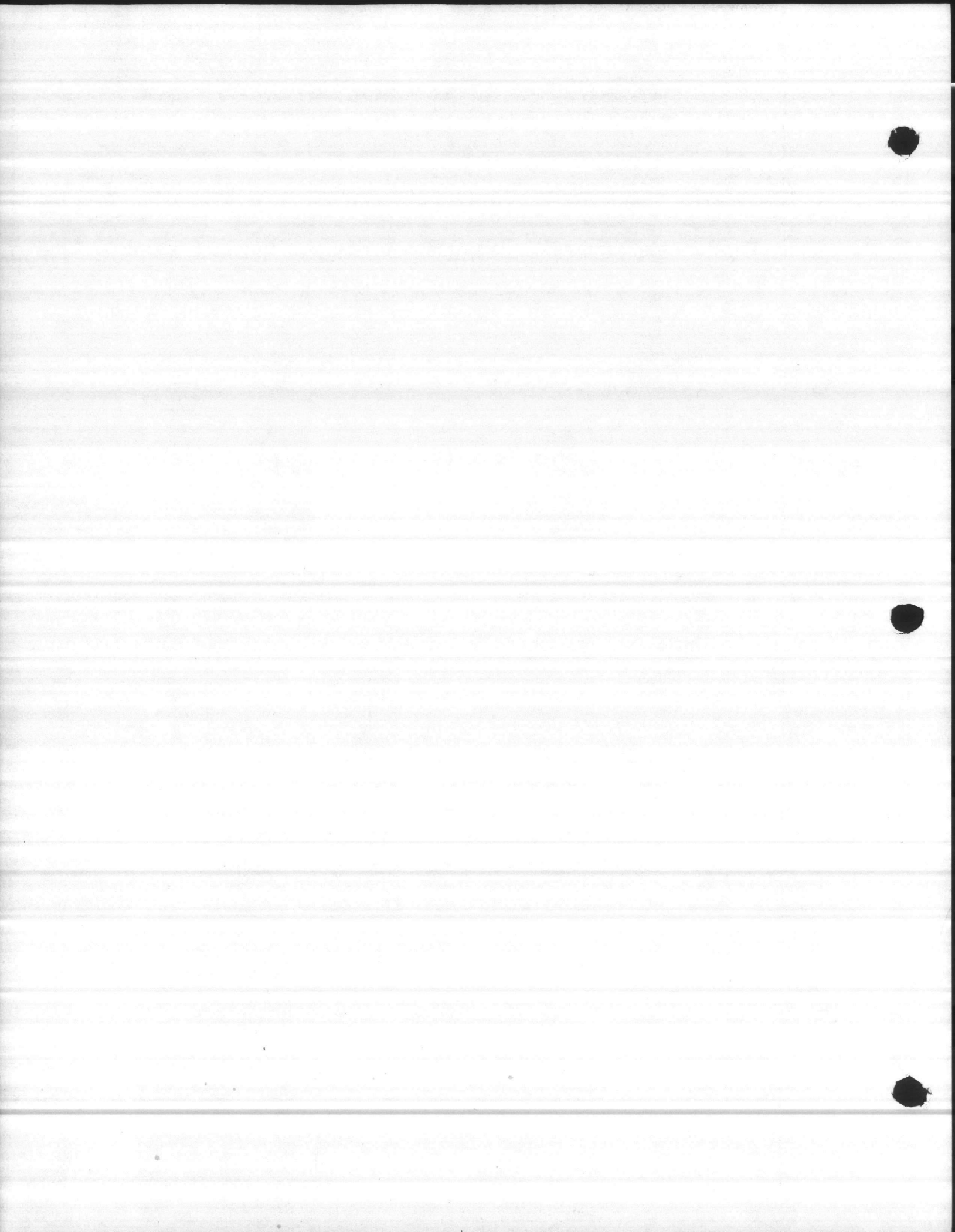
Card-edge connectors within the card frame assemblies are back-wired and normally do not require attention. However, should it become necessary for field service personnel to repair or modify this wiring, the entire electronics frame is removable for easy access to the connectors.

A well-designed solid-state system is extremely reliable. Component failures can occur however, and for this reason, the System has been made for easy servicing.

DESCRIPTION OF OPERATION

The Cecotronic Pulse Width Modulation, P.W.M. System is designed for applications where an analog signal must be sent from a remote location to a central location. The distance involved which constitutes the use of a P.W.M. System is normally a couple hundred feet up to approximately five miles. In order to accurately transfer analog information, the data must be transformed into data which is not adversely affected by phone line resistance. The analog data is in the form of a small D.C. voltage which is continuously variable from minus 5 volts D.C. to plus 5 volts D.C. The Pulse Width Modulation System transforms this small D.C. voltage into a continuously variable pulse duration signal which makes it possible to transmit the information accurately. When the data is received the pulse duration signal is then transformed back into a D.C. analog signal. An accuracy loss of less than .1 percent of span is easily obtained with this system.

TITLE	DESCRIPTION OF OPERATION CECOTRONIC BASIC ANALOG TRANSMITTER	DRAWN	DESIGNED DGL	ASSEMBLY NO. 600463-XX
	CONSOLIDATED ELECTRIC COMPANY	CHECKED DGL	PAGE 1 OF 9	DRAWING NO 1M00402
				REV A



The Basic Analog Transmitter is designed for use with differential voltage inputs or 4 to 20 mA process current loop inputs. An appropriately calibrated input amplifier is supplied.

An SEA-04 amplifier is used for differential voltage inputs. Its maximum differential input voltage is 8 volts, and its maximum common mode input voltage is 8 volts.

An SIR-01 amplifier is used for 4 to 20 mA current loop inputs. It requires no calibration (factory calibrated) and has a maximum common mode input voltage of 50 volts. Accidental, short duration, connection to voltages up to 250 VAC will not damage the SIR-01 amplifier.

LEVEL SIMULATION

The output signal from the input amplifier is a DC voltage which varies between -5 and +5 volts DC. This signal is applied to the Simulator/Queller. A switch in the Simulator/Queller circuit permits the operator to switch from AUTO mode to MANUAL mode. To make adjustments on the system, the operator need only position the level simulation pot on the SES-06 to simulate the desired level signal. Once the adjustments are made, the operator switches back to the AUTO mode.

The Simulator/Queller circuit also provides an integration or quelling function. In the AUTO mode the system responds slowly to the instantaneous level input signal, due to the integrating function. This controlled response eliminates sporadic operation of the level set-points due to sudden changes in the level, or due to noise induced in the line carrying the level signal. The rate of integration of "Quelling" is adjustable on the SES-06. The quelling rate potentiometer is a 20 turn potentiometer, in as much as it will take 20 turns to go from one limit of travel to the other. A very small clicking sound will be heard when the limit is reached. By turning

TITLE: DESCRIPTION OF OPERATION CECOTRONIC BASIC ANALOG TRANSMITTER		DRAWN	DESIGNED DGL	ASSEMBLY NO. 600463-XX
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED DGL	PAGE 3 OF 9	DRAWING NO IM00402 REV A

this potentiometer clockwise, system response to instantaneous level changes is decreased. Inversely, by turning it counter-clockwise, system response to instantaneous level changes is increased. Best adjustment is obtained by observing system operation and adjusting accordingly.

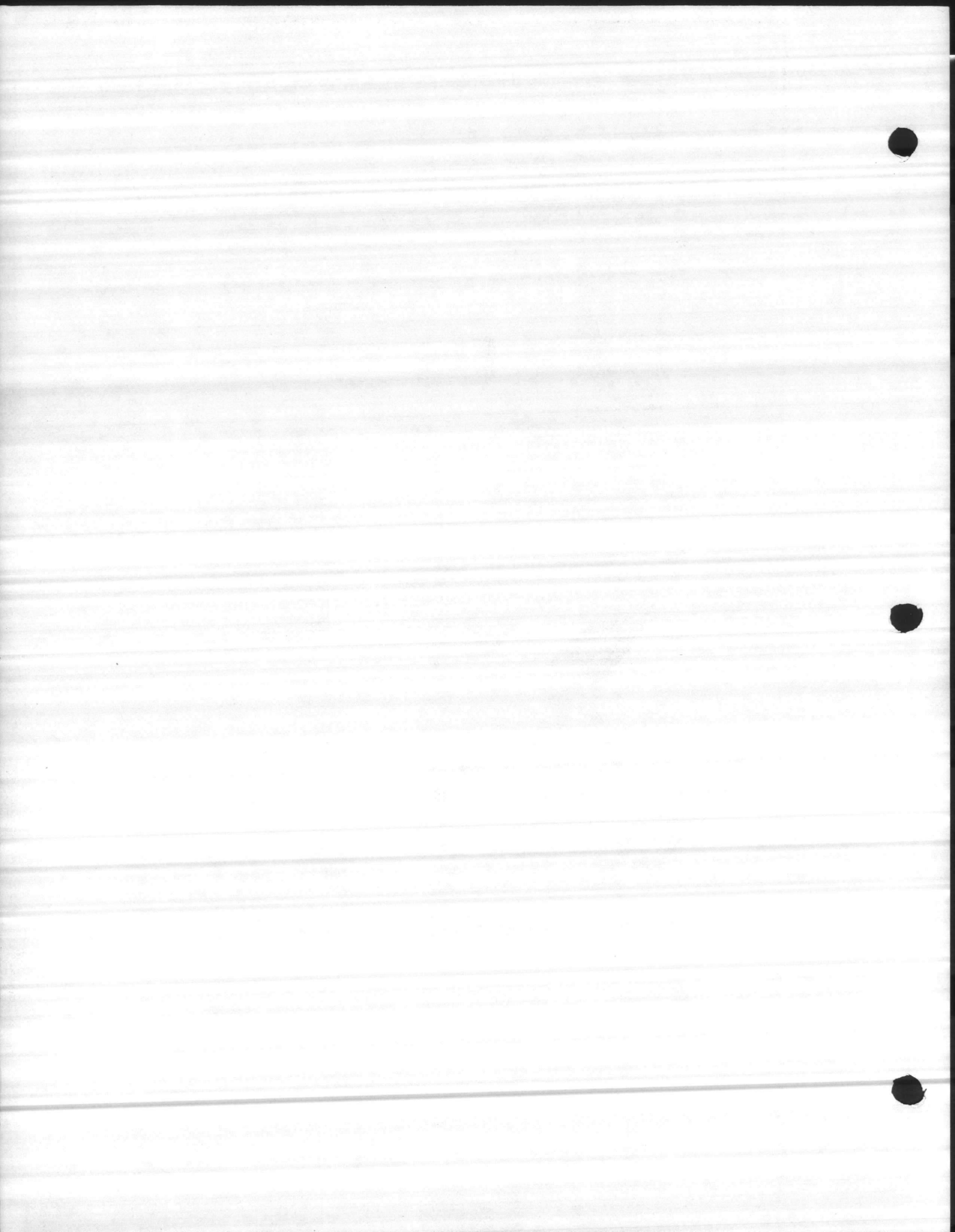
Refer to Figure 1. The analog signal is sent to the XPW-14 card titled Modulator. This card transforms the variable analog signal into a pulse train whose duration is continuously variable from .1 second to .9 seconds. (These durations refer to the positive pulse). The output of the XPW-14 card is a pulse train whose repetition rate is approximately one cycle per second and whose positive duration is dependent on the analog signal applied to the input. The XPW-14 card also contains provisions for placing it in a calibration mode. The small button switch located on the bottom of the XPW-14 card enables the operator to place the system in the calibrate mode. The calibration switch directly above the calibration mode switch allows the operator to send any of three accurate calibration signals.

The logic level PWM signal is then applied to the DC Transmitter module. The D.C. Transmitter conditions the PWM signal for transmission onto the phone line. The conditioning in the D.C. Transmitter includes increasing of the amplitude, isolation, and allowing its excursion to be both a negative and a positive voltage. The duration of the pulse is unchanged. Also applied to the D.C. Transmitter module is the equipment failure input. When an equipment failure has occurred, the D.C. Transmitter inhibits the negative portion of the pulse. With this situation, the analog signal is still received as the analog information is contained in the positive portion of the pulse. Also contained in the D.C. Transmitter module is the phone line protection circuitry.

PHONE LINE PROTECTOR CIRCUIT

The D.C. Transmitter module contains a transient voltage protection circuit. These circuits protect the electronic components from high voltage transients induced onto the phone lines. These protectors contain a surge voltage

TITLE: DESCRIPTION OF OPERATION CECOTRONIC BASIC ANALOG TRANSMITTER		DRAWN	DESIGNED DGL	ASSEMBLY NO. 600463-XX
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED DGL	PAGE 4 OF 9	DRAWING NO IM00402 REV A



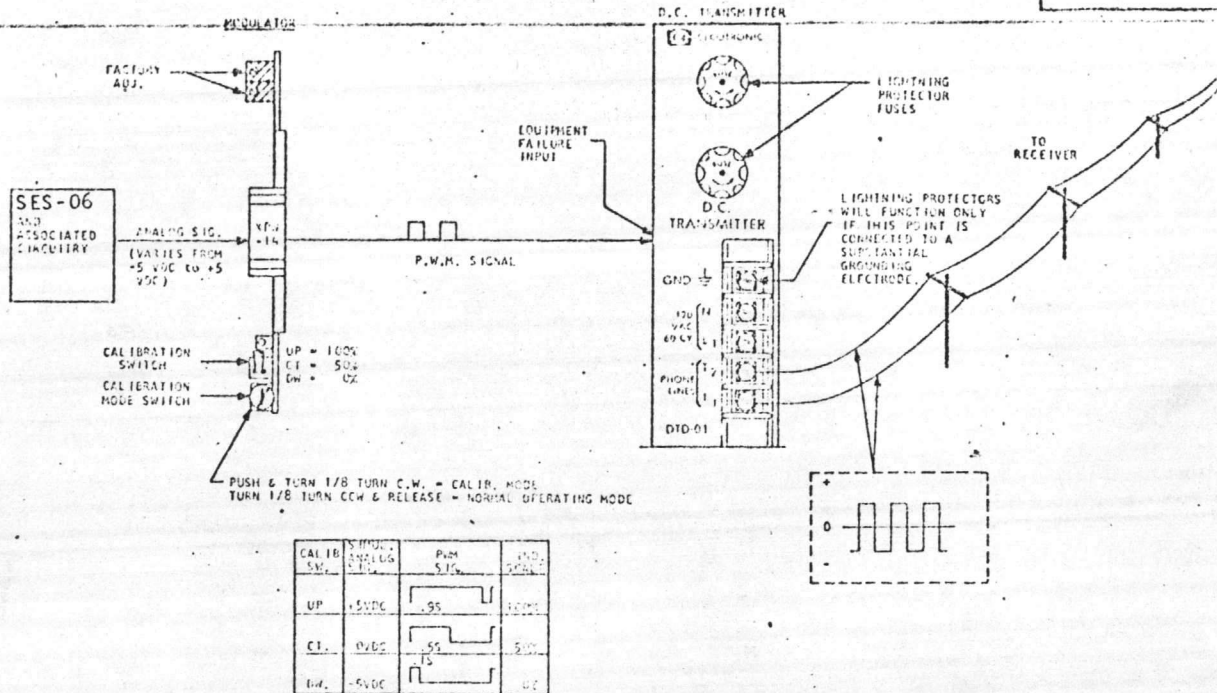


FIGURE 1

TITLE	DESCRIPTION OF OPERATION CECOTRONIC BASIC ANALOG TRANSMITTER	DRAWN	DESIGNED DGL	ASSEMBLY NO. 600463-XX
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED DGL	PAGE 5 OF 9	DRAWING NO 1M00402 REV A

protector (SVP) and a fuse. If a transient of approximately 90 volts or more is induced onto either phone line, the SVP will become a very low impedance to ground. If the transient is of ample duration and power, the phone line fuse will open.

The most common source of transients is lightning. If lightning occurs close enough to the phone line system it will induce a voltage transient of ample amplitude and duration to open the phone line fuses. Therefore, it is common for the phone line fuses both on the D.C. Transmitter and D.C. Receiver to open during an electrical storm. The four major factors that determine the likelihood of opening a phone line fuse during an electrical storm are as follows:

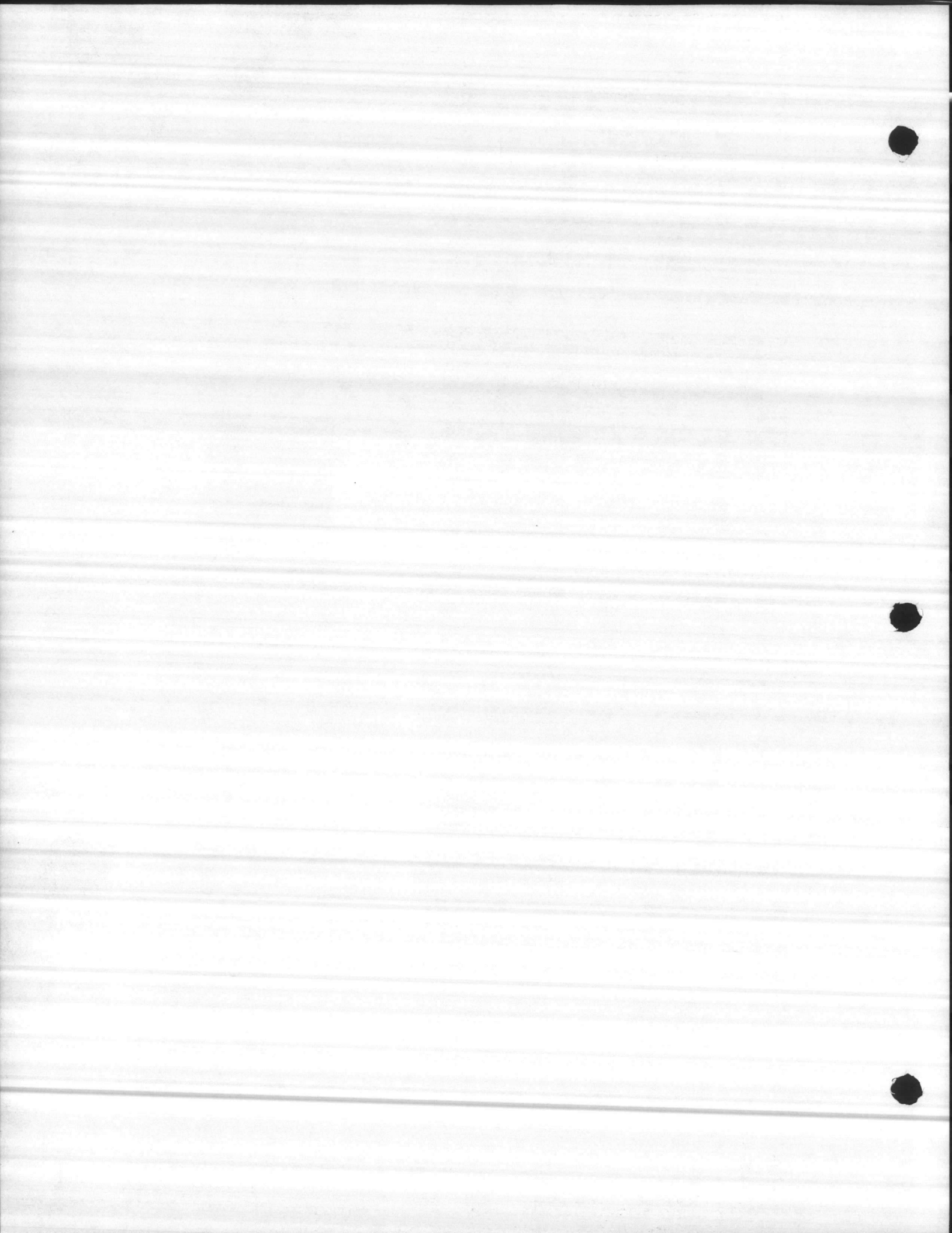
1. Proximity of lightning occurrence to the phone line.
2. Type of phone line (overhead, shielded, buried, etc.)
3. Length of phone line.
4. Geographical location of phone line.

Having only partial control over one of these factors, (type of line) makes it difficult to accurately predict the occurrence rate of opening the phone line fuses.

PWM SYSTEM FUNCTIONAL AND CALIBRATION CHECK

At the Remote Transmitter, locate the XPW-14 under blue R.F. cover. On the bottom edge of the XPW card locate the small button switch. By pushing and turning 1/8 turn clockwise, the system is placed in the calibrate mode. Directly above the button switch locate a small toggle switch. With the toggle switch in the UP position the Transmitter will transmit a signal equal to 100% scale or full scale. Observe and record the reading on the indicator at the Receiver. With

TITLE	DESCRIPTION OF OPERATION CECOTRONIC BASIC ANALOG TRANSMITTER	DRAWN	DESIGNED DGL	ASSEMBLY NO. 600463-XX
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED DGL	PAGE 6 OF 9	DRAWING NO 1M00402 REV A



the toggle switch in the CENTER position the Transmitter will transmit a signal equal to 50% scale or half scale on the indicator at the Receiver. Observe and record this reading. With the toggle switch in the DOWN position the Transmitter will transmit a signal equal to 0% scale or zero scale on the indicator at the Receiver. Observe and record this reading.

If the readings obtained fall outside the required system accuracy, the system will require re-calibration by a factory serviceman or a CECO representative.

Find the D.C. Receiver Module at the Receiver. Find two lights on the front of the module labeled MARK and SPACE. The following relationships apply to the three calibrate positions:


CALIBRATE SW. POSITION	INDICATOR SCALE	(SEC) MARK	(SEC) SPACE
UP	100%	9/10	1/10
CENTER	50%	1/2	1/2
DOWN	0%	1/10	9/10

Turn small button switch counter clockwise 1/8 turn and release. This places the system back in the normal operation mode. Note: With the calibration mode switch in the "Normal Operating Mode", the calibration switch has no effect on the system operation.

POWER SERVICE REQUIREMENTS AND CHARACTERISTICS


Power Service Requirements.

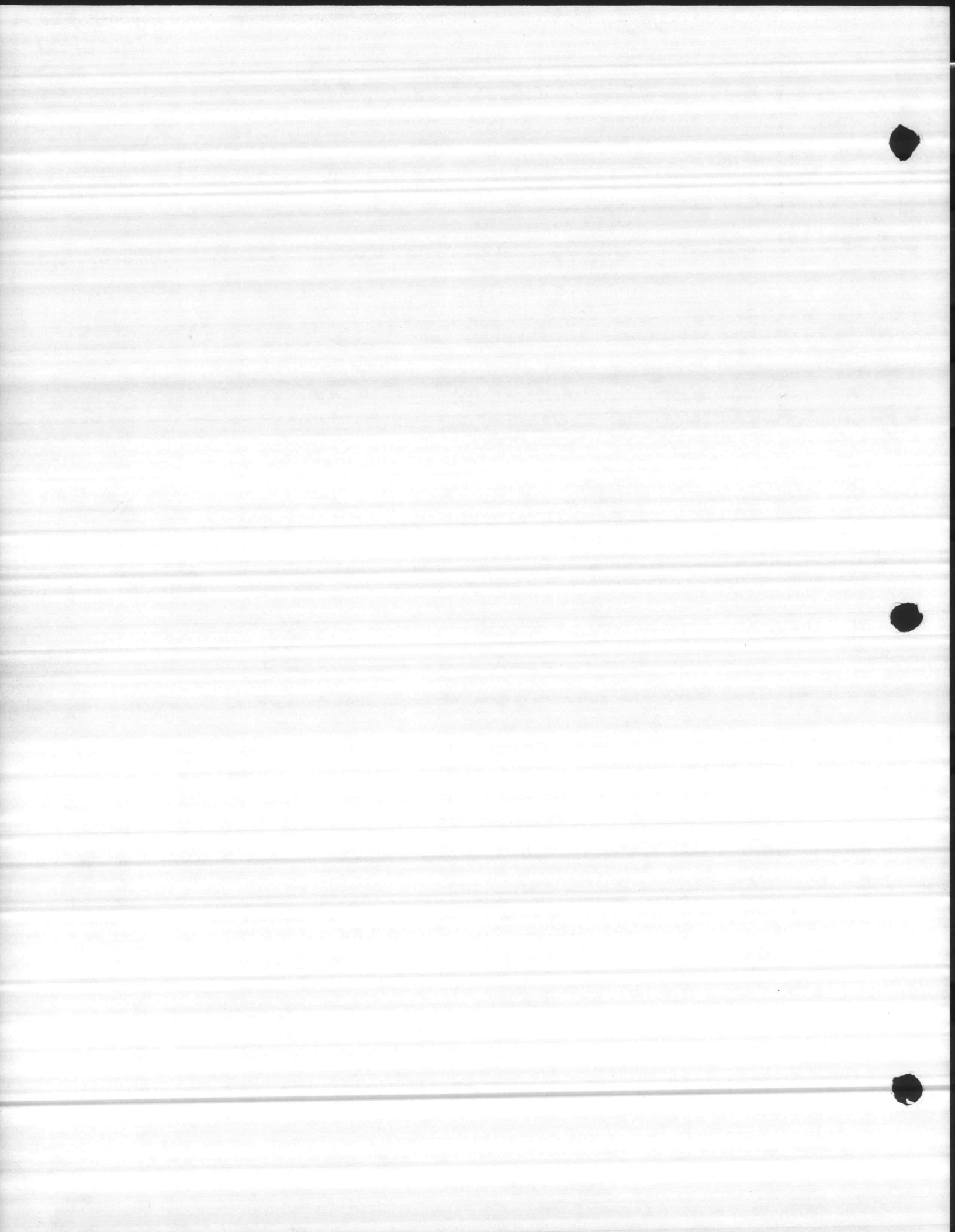
- The SCC, RST, and PCS are designed for direct wire connection to a 115 volt, 15/20 A., 2 wire service.

TITLE: DESCRIPTION OF OPERATION CECOTRONIC BASIC ANALOG TRANSMITTER		DRAWN	DESIGNED DGL	ASSEMBLY NO. 600463-XX
 CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107	CHECKED DGL	PAGE 7 OF 9	DRAWING NO 1M00402	REV A

Power Service Characteristics

- The normal incoming power service voltage shall be maintained at 115 V., ± 10%, (RMS) for normal system operation.
- The system shall not malfunction when subjected to non-repetitive, transient line voltage conditions between 95-132V. (RMS) for transient line durations not exceeding 20 milliseconds. The transient duration shall be that time in which the incoming service voltage is outside the normal operating range of 115V., ±10% (RMS).
- System malfunction can be anticipated for incoming service transient voltages lower than 95V. (RMS) or for transient durations longer than 20 milliseconds, when the incoming service voltage is below the normal operating range.
- System malfunction and possible component damage can be anticipated when the system is operated on incoming service voltages in excess of 132V. (RMS).
- The incoming power service frequency shall be maintained between 58-62 hertz for normal system operation. Frequency durations outside this range shall be limited to a duration of 20 milliseconds or less.
- All supplied power services shall be single phase, two-wire with ground. The ground wire shall be connected to earth ground bar per NEC requirements to insure proper operation of lightning protective devices in the system. The resistance of the supplied ground line shall not exceed 3 ohms to earth ground.



TITLE: DESCRIPTION OF OPERATION CECOTRONIC BASIC ANALOG TRANSMITTER		DRAWN	DESIGNED DGL	ASSEMBLY NO. 600463-XX
 CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107	CHECKED DGL	PAGE 8 OF 9	DRAWING NO 1M00402	REV A

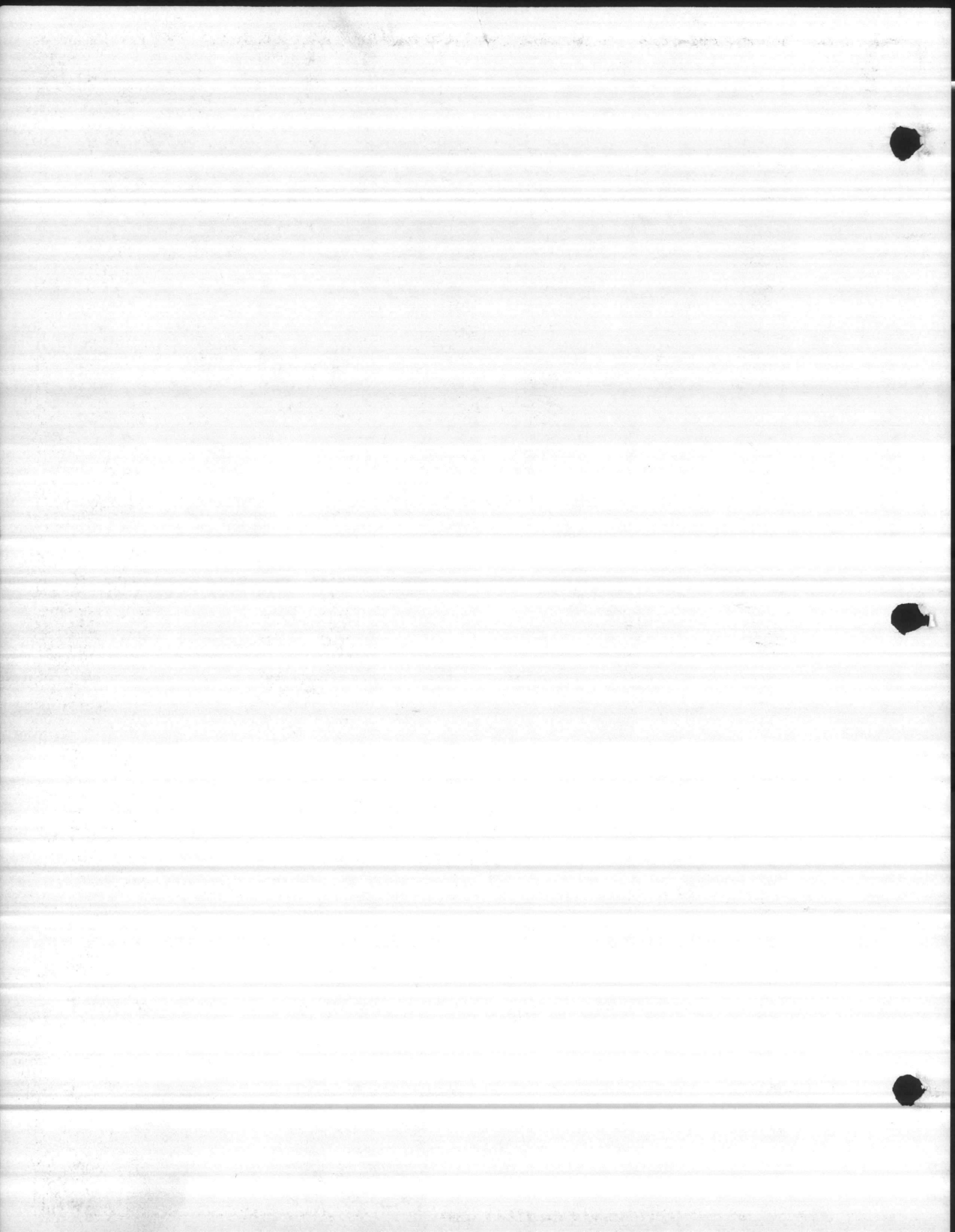


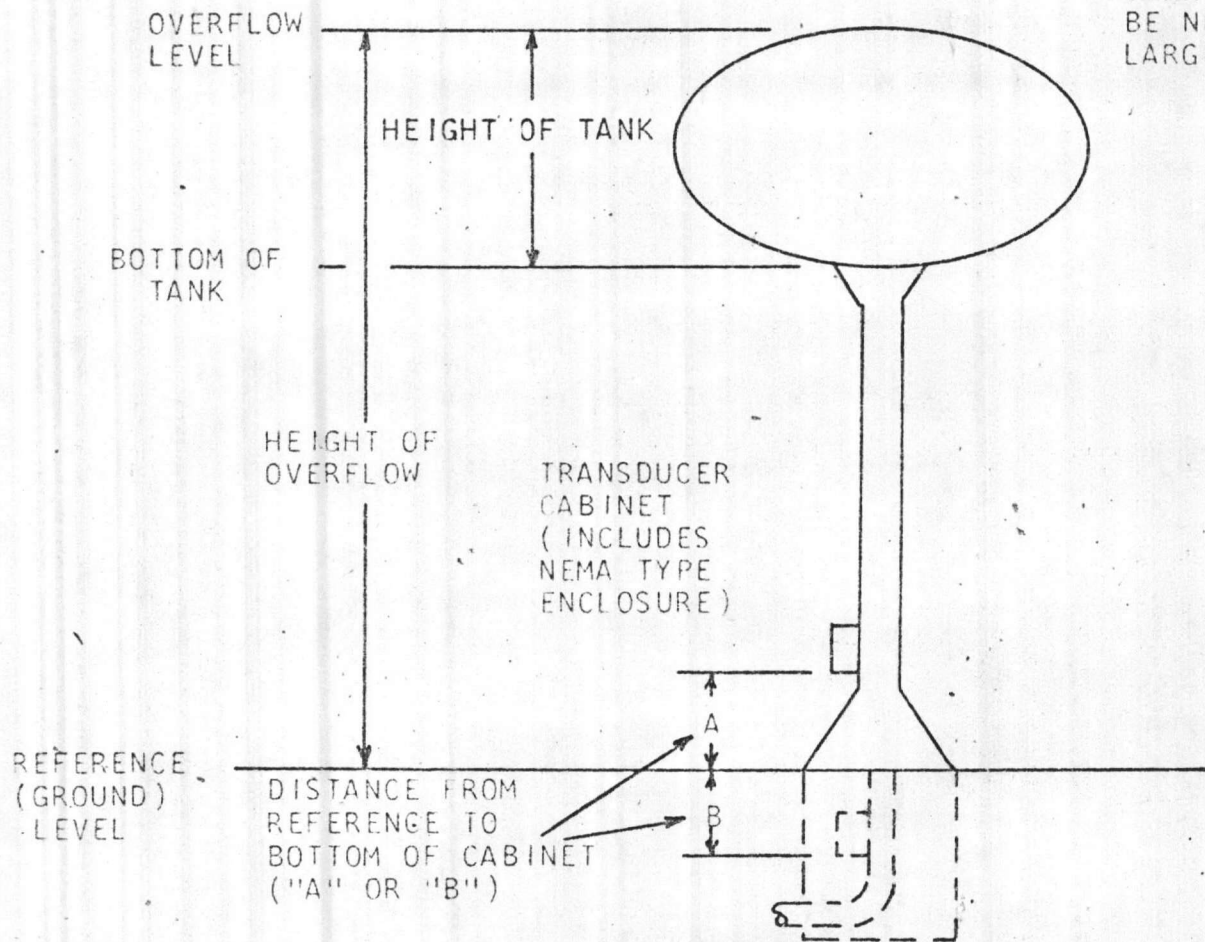
OPERATING ENVIRONMENT

Environmental Limitations.

- Ambient operating temperatures must not exceed the range of +40°F to +120 F. In the case of a heated enclosure, this temperature range refers to the temperature within the enclosure.
- The equipment must not be subjected to any humidity condition causing condensation to form.
- The equipment must not be subjected to any corrosive atmosphere that will cause physical damage to circuit cards, connectors, switch contacts, etc. Such atmospheres are often found near chlorinator and flouridator systems.
- The equipment must not be subjected to any abnormal vibration levels.

TITLE DESCRIPTION OF OPERATION CECOTRONIC BASIC ANALOG TRANSMITTER		DEAWN	DESIGNED DGL	ASSEMBLY NO. 600463-XX	
 CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107	 CHECKED <i>DGL</i>	PAGE 9 OF 9		DRAWING NO IM00402	REV A





RECORDER (OR METER) WILL INDICATE HEIGHT OF WATER ABOVE "BOTTOM OF TANK". FULL SCALE INDICATION WILL BE NEAREST STANDARD SCALE WHICH IS LARGER THAN "HEIGHT OF TANK".

NOTE: IF PRECISE FIGURES ARE NOT AVAILABLE, GIVE BEST ESTIMATE.

FIGURES SHOWN ARE PRECISE.
SIGNED: GARY HOME

FIGURES SHOWN ARE ESTIMATED.

HEIGHT OF TANK (SPAN) 30 FT.

HEIGHT OF OVERFLOW 148.5 FT.

DISTANCE FROM REFERENCE TO BOTTOM OF CABINET -
DIMENSION "A" 5 FT.
OR
DIMENSION "B" _____

TITLE TECHNICAL SPECIFICATION CAMP GEIGER
ELEVATED TANK TRANSDUCER CALIBRATION

DRAWN
HJG
7-30-75

DESIGNED
TWM

S.O. 15726 ITEM "0"

JOB NAME: JACKSONVILLE, N.C.

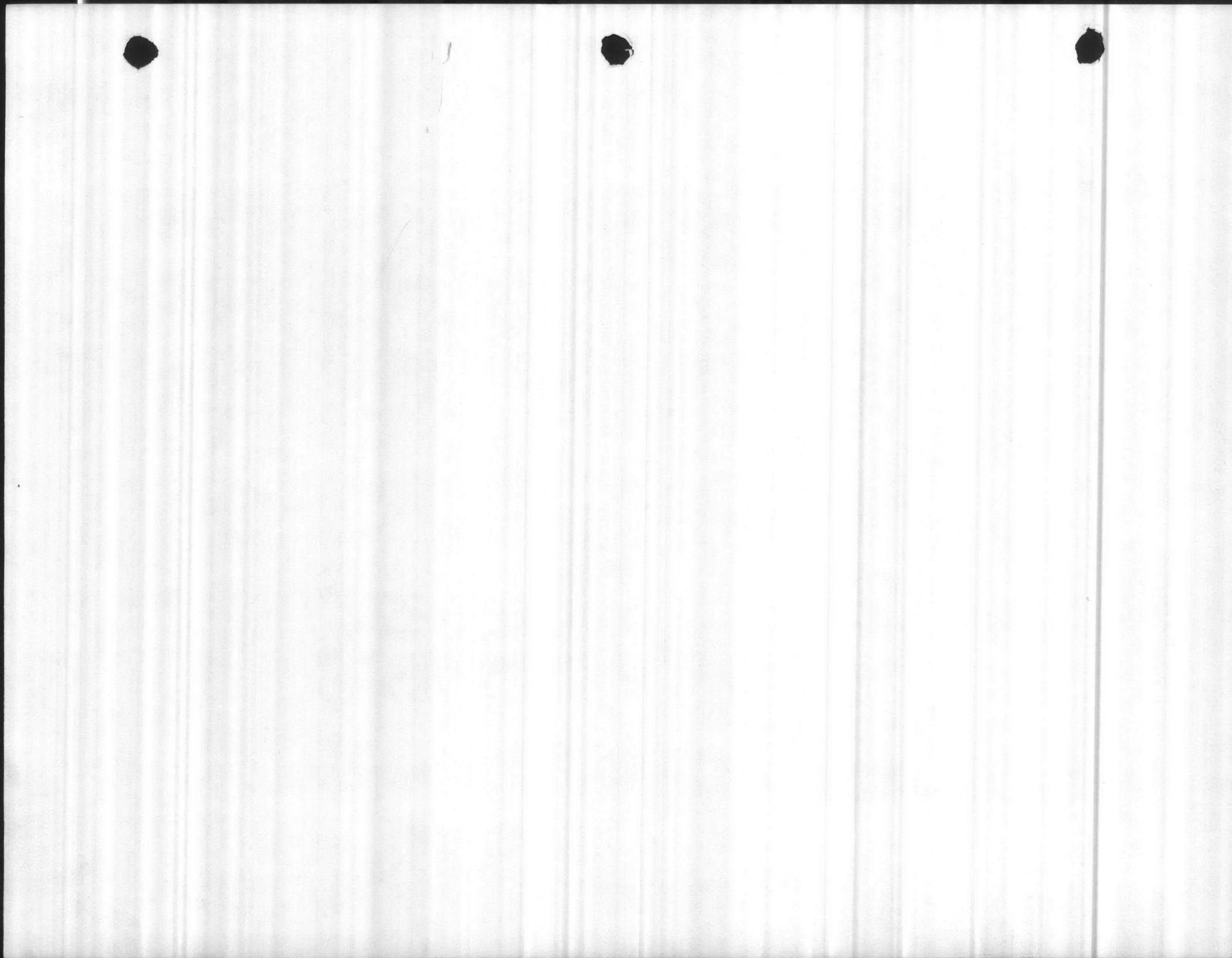
CONSOLIDATED ELECTRIC COMPANY
141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107

CHECKED
[Signature]
8-1-75

PAGE
1 OF 1

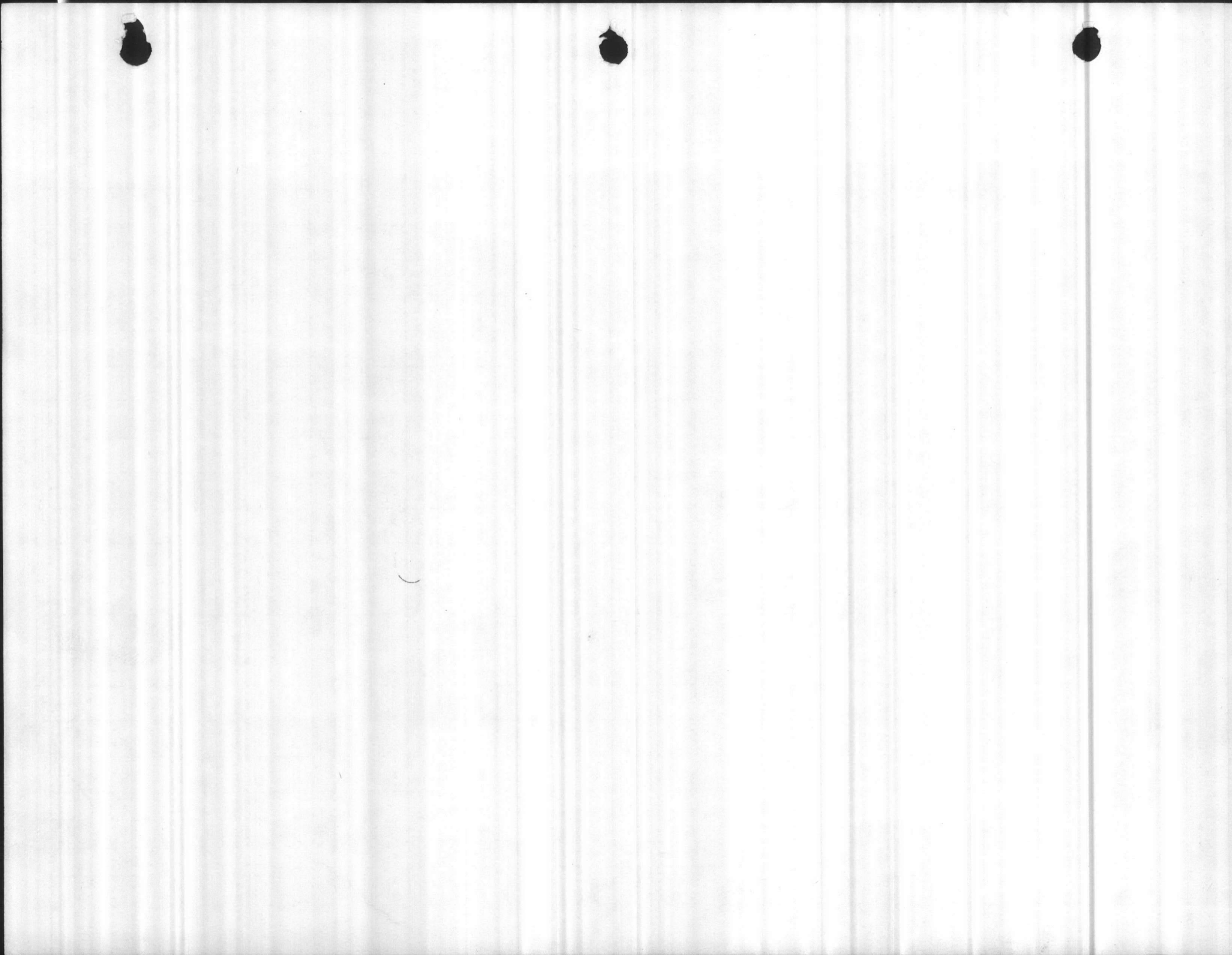
DRAWING NO
ES50129

REV.
B

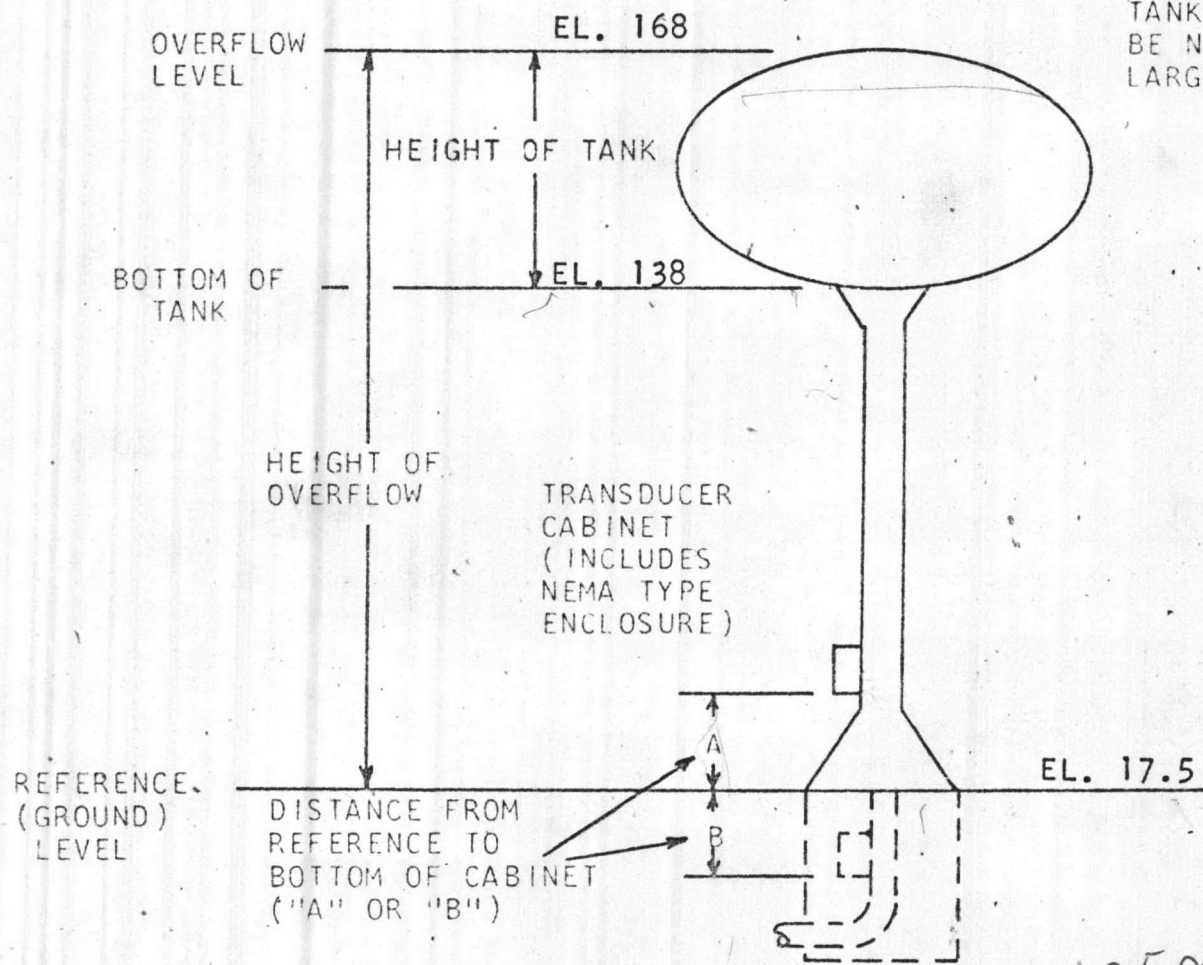


ITEM NO.	CECO PART NUMBER	SUB-VARIATION					K	DESCRIPTION	SPECS. OR MFG'S P/N	COMPONENT DESIGNATION
		01	02	03						
		QUANTITY REQUIRED								
1	901241-01	ref	ref	ref			Wiring Diagram			
2	WL00049	ref	ref	ref			Wire List			
3	600450-01	1	1	1			Assembly, Card Frame			
4	800055-01	7	7	7			Cardedge Connector Elco	00-6022-022-940-002		
5		21	21	21			Socket Key Cinch	50PK-2		
6	600084-01	1	1	1			DPS-01		A-07	
7	600060-01	1	1	1			DTD-01		A-12	
8	600009-02	1	1	1			DER-05		A-18	
9	600031-01	1	1	1			XPW-14		A-20	
10	600001-02	1	1	1			SES-06		A-22	
11	600062-01	1	/	/			SEA-04	This card is calibrated per job requirement	A-24	
12	600355-01	/	1	/			SIR-01		A-24	
13		/	1	/			XLV-05	This card is jumpered per job requirement	A-15	
14		14	14	14			Screw #4-40x $\frac{1}{4}$	Stainless Steel		
15		1	1	1			Grounding Solder Lug Waldom	At Top (Pin 22 End) of A-18 Socket		
16		13	13	13			Internal Shakeproof #4			
17	IM00402	REF	REF	REF			Instructions			

PL	PAGE	OF	REV.	TITLE	 CONSOLIDATED ELECTRIC CO. 141 SO. LAFAYETTE FREEWAY • ST. PAUL, MINN. 55107	DRFT		
	1	2				B	CHKD			DGL
DRAWING NUMBER						ENG	11-26-73	DGL
600463-XX						APP	12-11-73	<i>[Signature]</i>



RECORDER (OR METER) WILL INDICATE HEIGHT OF WATER ABOVE "BOTTOM OF TANK". FULL SCALE INDICATION WILL BE NEAREST STANDARD SCALE WHICH IS LARGER THAN "HEIGHT OF TANK".



REVISIONS

DATE

DESCRIPTION

NOTE: IF PRECISE FIGURES ARE NOT AVAILABLE, GIVE BEST ESTIMATE.

FIGURES SHOWN ARE PRECISE. SIGNED: GARY HOME

FIGURES SHOWN ARE ESTIMATED.

HEIGHT OF TANK (SPAN)	<u>30 FT.</u>
HEIGHT OF OVERFLOW	<u>150.5 FT.</u>
DISTANCE FROM REFERENCE TO BOTTOM OF CABINET - DIMENSION "A" OR DIMENSION "B"	<u>5 FT.</u>

*62.5 p.s.i.
runs over*

TITLE: TECHNICAL SPECIFICATION CAMPBELL ST. ELEVATED TANK TRANSDUCER CALIBRATION

DRAWN HJG
7-30-75

DESIGNED TWM

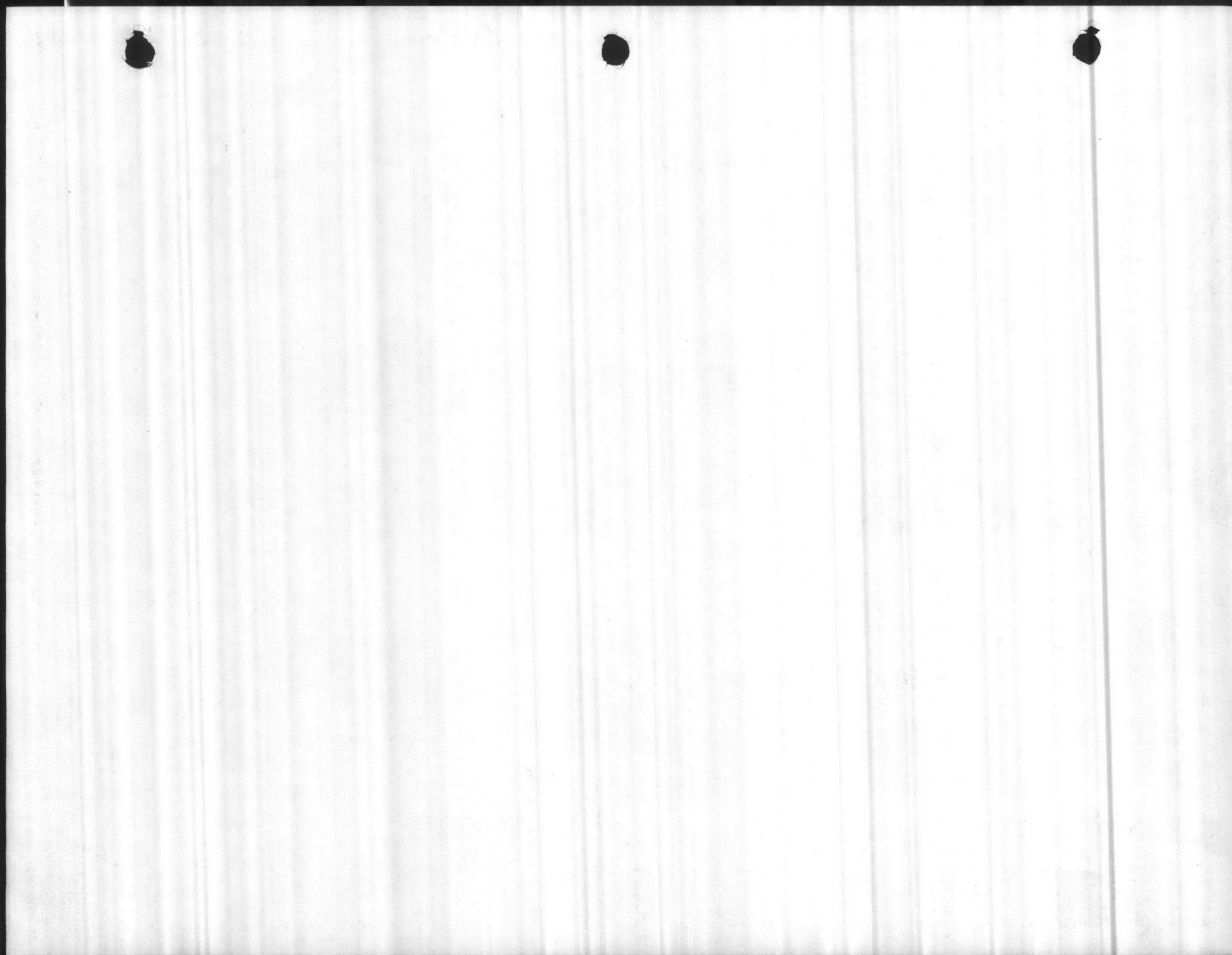
S.O. 15726 ITEM "P"
JOB NAME: JACKSONVILLE, N.C.

CONSOLIDATED ELECTRIC COMPANY
141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107

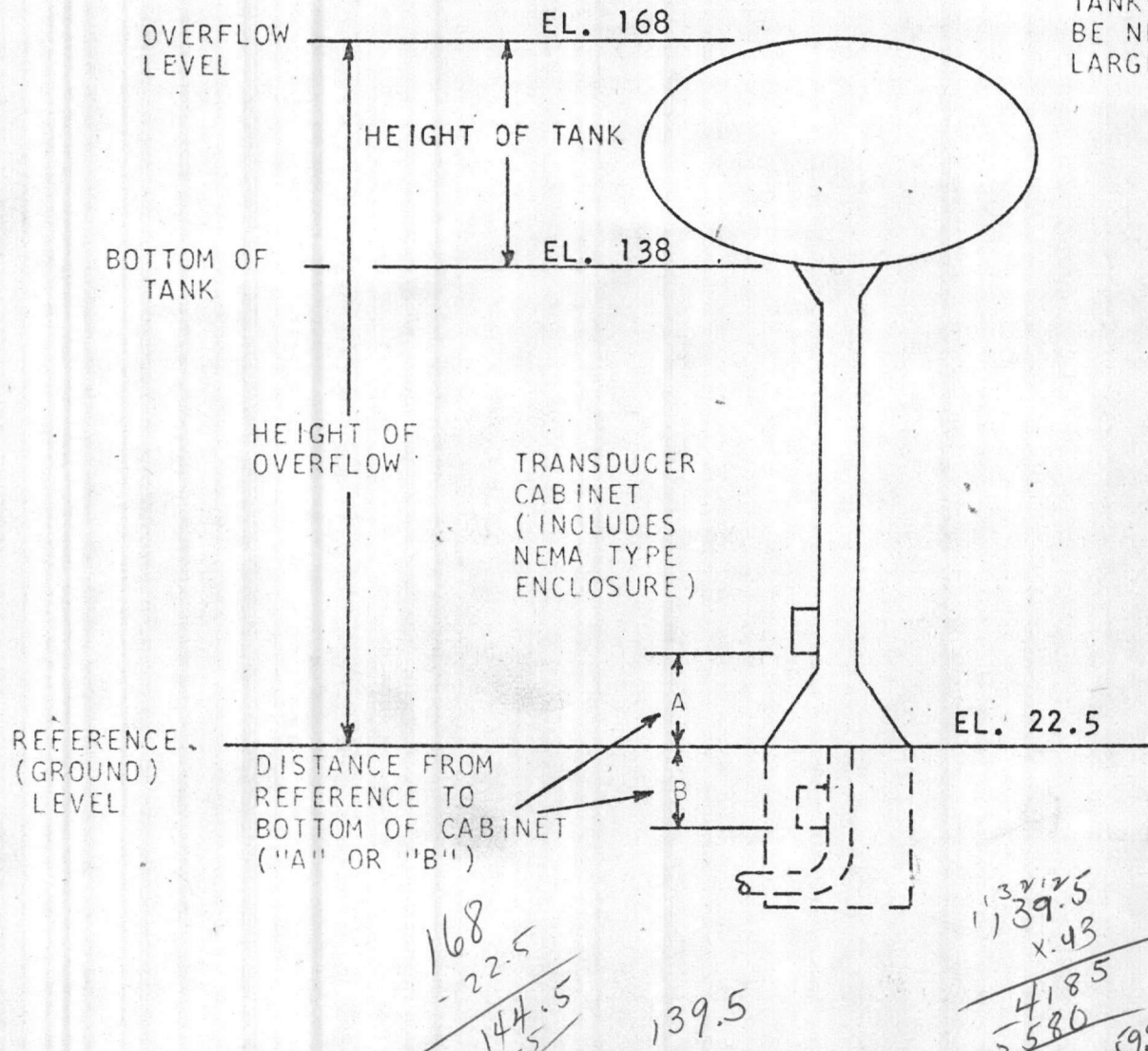
CHECKED
[Signature]
8-1-75

PAGE 1 OF 1

DRAWING NO ES50130
RF B



RECORDER (OR METER) WILL INDICATE HEIGHT OF WATER ABOVE "BOTTOM OF TANK". FULL SCALE INDICATION WILL BE NEAREST STANDARD SCALE WHICH IS LARGER THAN "HEIGHT OF TANK".



NOTE: IF PRECISE FIGURES ARE NOT AVAILABLE, GIVE BEST ESTIMATE.

FIGURES SHOWN ARE PRECISE. SIGNED: GARY HOME

FIGURES SHOWN ARE ESTIMATED.

HEIGHT OF TANK (SPAN)	30 FT.
HEIGHT OF OVERFLOW	145.5 FT.
DISTANCE FROM REFERENCE TO BOTTOM OF CABINET - DIMENSION "A" OR DIMENSION "B"	5 FT.

TITLE: TECHNICAL SPECIFICATION WHITE ST. ELEVATED TANK TRANSDUCER CALIBRATION

DRAWN HJG 7-30-75

DESIGNED TWM

CHECKED *shun* 7-1-75

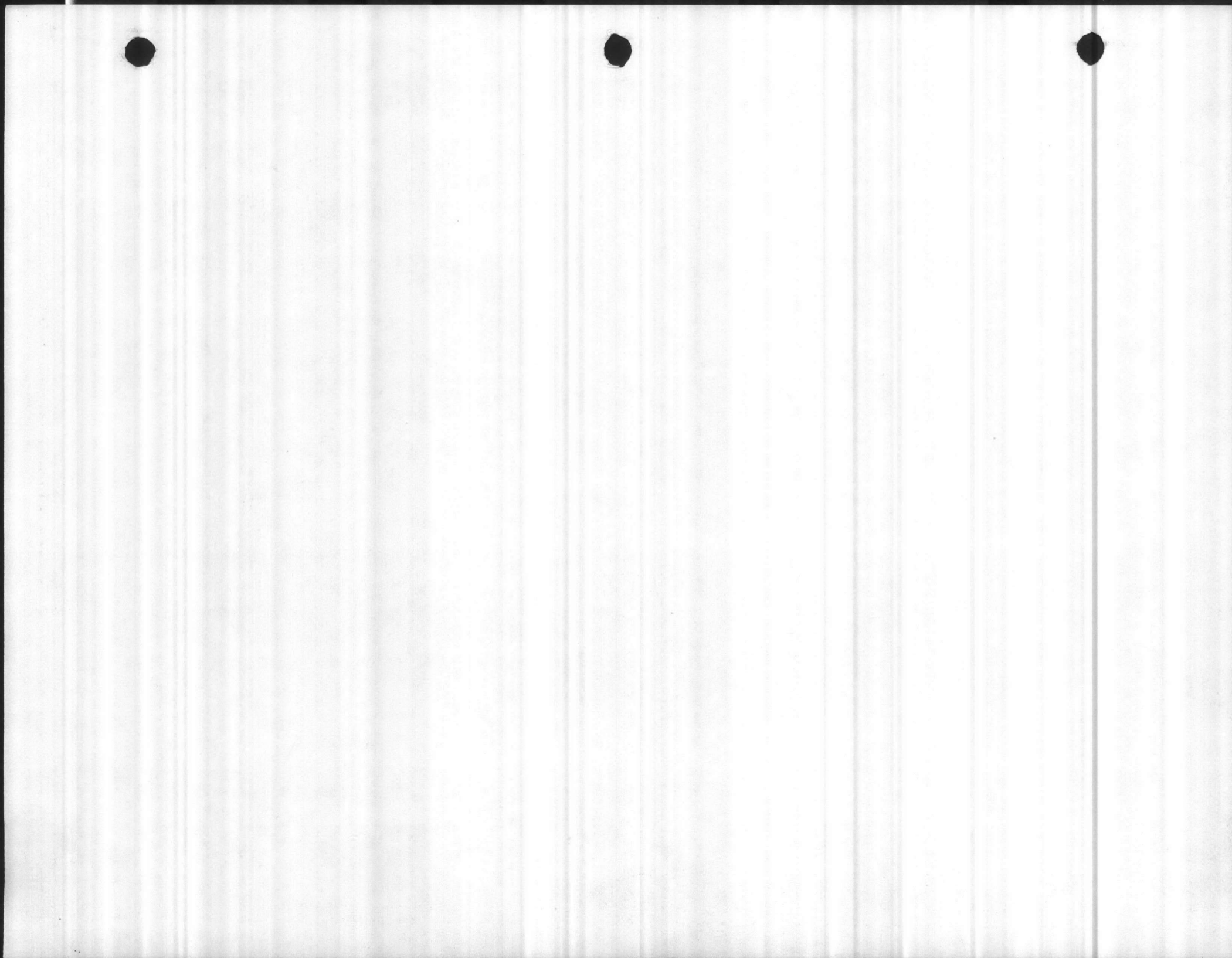
PAGE 1 OF 1

S.O. 15726 ITEM "Q" JOB NAME: JACKSONVILLE, N.C.

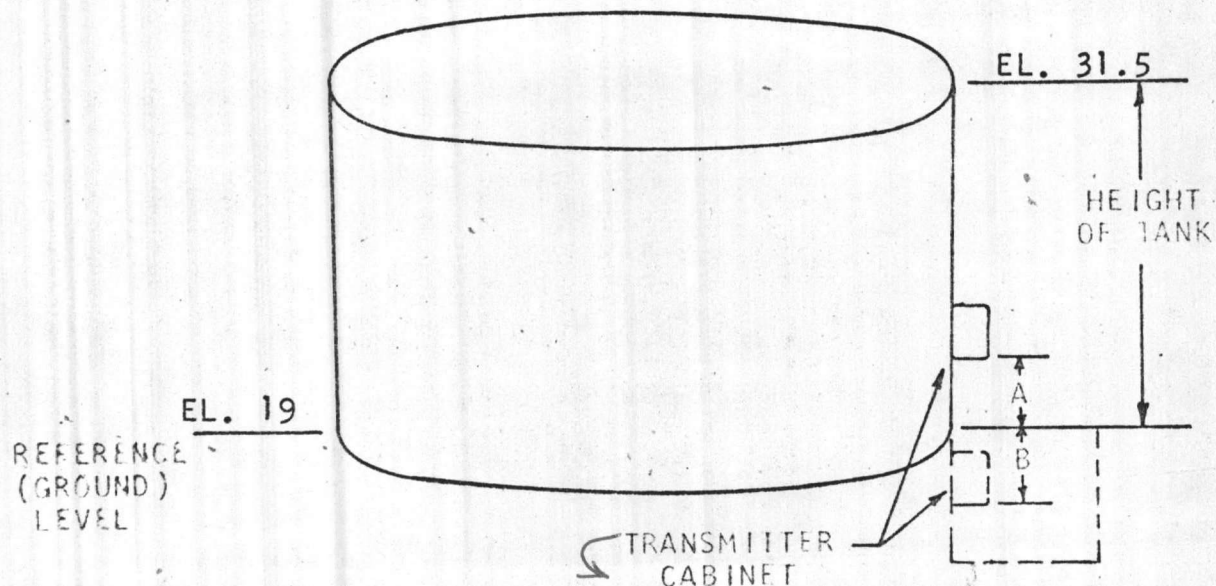
DRAWING NO ES50131

REV. B

CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD ST. PAUL, MINN. 55107



RECORDER (OR METER) WILL INDICATE HEIGHT OF WATER ABOVE "BOTTOM OF TANK". FULL SCALE INDICATION WILL BE NEAREST STANDARD SCALE WHICH IS LARGER THAN "HEIGHT OF TANK".



NOTE: IF PRECISE FIGURES ARE NOT AVAILABLE, GIVE BEST ESTIMATE.

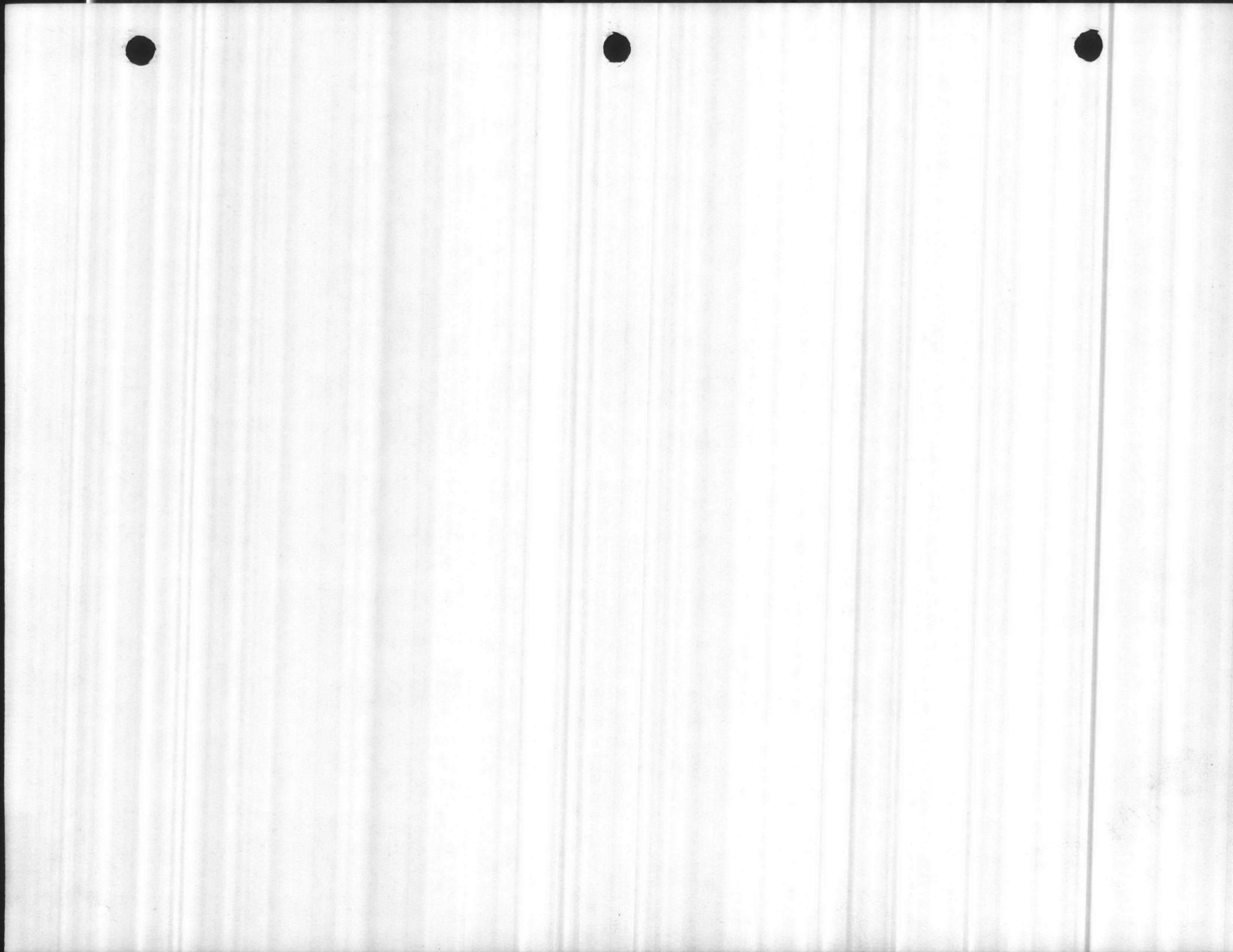
FIGURES SHOWN ARE PRECISE. SIGNED: GARY HOME

FIGURES SHOWN ARE ESTIMATED.

HEIGHT OF TANK 12.5 FT.
 METER SCALE 5 FT. TO 13 FT.
 DISTANCE FROM REFERENCE 1 FT TO BOTTOM OF CABINET - 5 FT.
 DIMENSION "A" _____
 OR
 DIMENSION "B" _____

*Locate inside Bldg. #110
 Pick up water pressure tap in piping (below grade) and protect against freezing by depth & bury.*

TITLE TECHNICAL SPECIFICATION NEW RIVER RESERVOIR TRANSDUCER CALIBRATION		DRAWN HJG 7-30-75	DESIGNED TWB	S.O. 15726 ITEM "R"
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55117		CHECKED <i>[Signature]</i> 8-1-75	PAGE 1 OF 1	JOB NAME: JACKSONVILLE, N.C. DRAWING NO. ES50132
©				REV B



REV.	CO NO.	DATE	BY	CHK	APP.
A	1578	11-7-75	RELEASE		

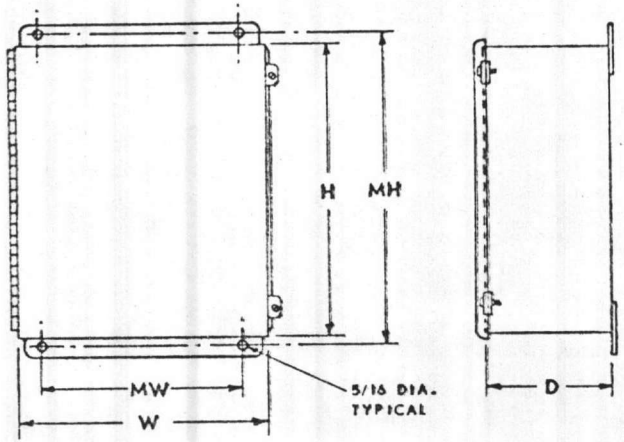


FIGURE 1 - Small NEMA 12 Enclosures

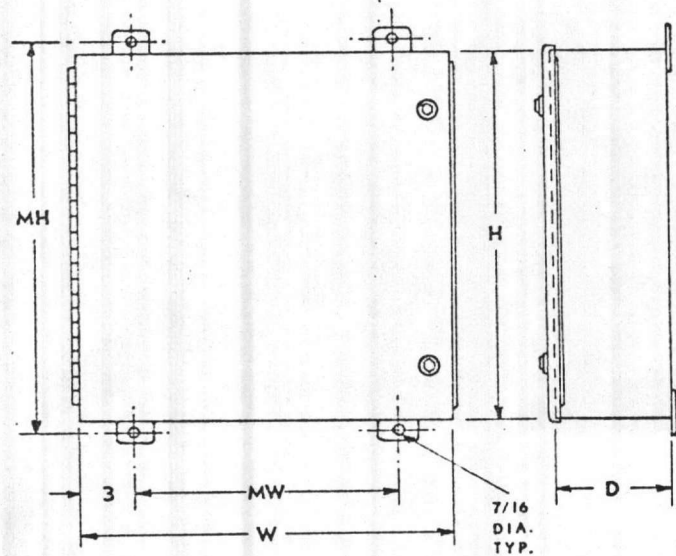


FIGURE 2 - Large NEMA 12 Enclosures

NOTES:

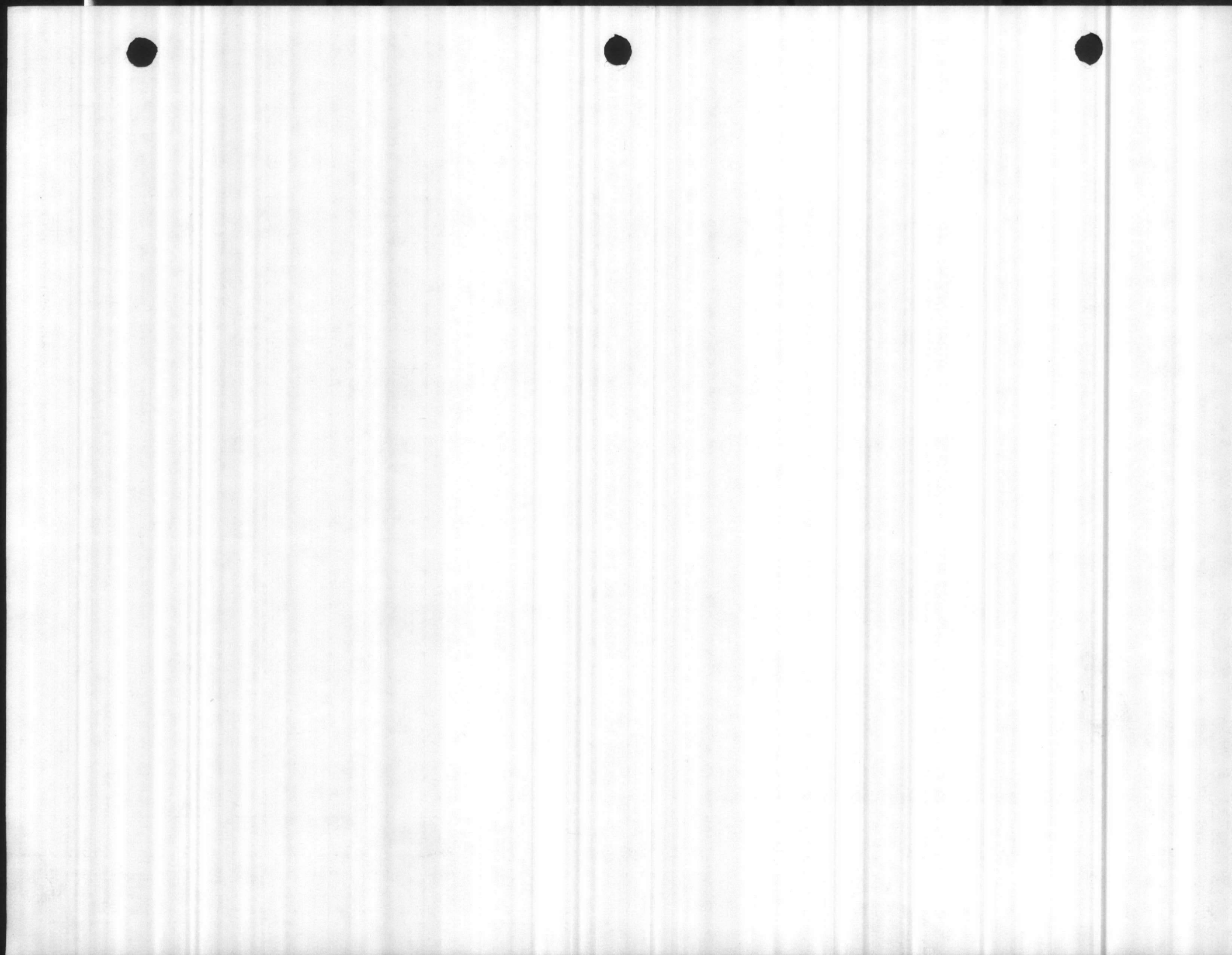
1. THIS DRAWING IS INTENDED TO GIVE ENCLOSURE OUTLINE AND MOUNTING DIMENSIONS ONLY. COMPONENT LAYOUTS WILL VARY, DEPENDENT UPON SPECIFIC JOB REQUIREMENTS.

DIMENSIONS (INCHES)					
	W	H	D	MW	MH
FIG. 1	10	12	5	8	12 3/4
	12	14	6	10	14 3/4
	14	16	6	12	16 3/4
FIG. 2	20	20	9	14	21 1/4
	20	24	9	14	25 1/4
	24	30	7	18	31 1/4
	30	36	7	24	37 1/4
	30	36	9	24	37 1/4
	36	48	11	30	49 1/4
	20	20	7	14	21 1/4

DESCRIPTION - NEMA TYPE 12 GENERAL PURPOSE ENCLOSURE:

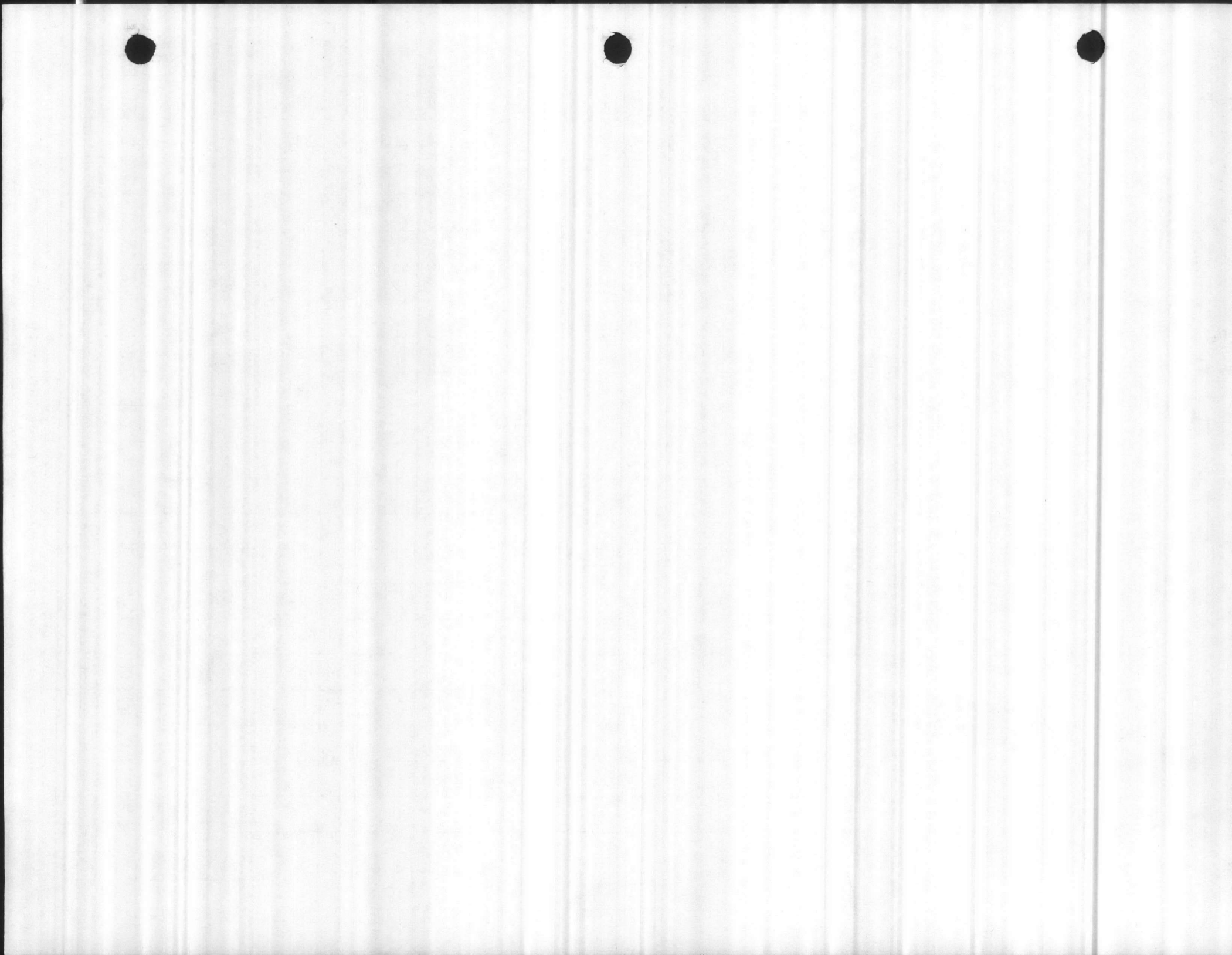
For general purpose applications indoors and where atmospheric conditions are normal, designed to prevent accidental contact with current-carrying parts of the equipment. A Type 1 enclosure serves as a protection against dust, and light, indirect splashing but is not dust-tight.

ENCLOSURE DIMENSIONS NEMA 12		S.O. ITEM "S"	
SHOP ORDER 15726	JOB NAME JACKSONVILLE, N.C.	MATERIAL 14 GA. CRS	
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		FINISH GRAY HAMMERTONE	
TOLE RANCES UNLESS OTHERWISE SPECIFIED. TWO PLACE DEC. 1. SIX THREE PLACE DEC. 2. ONE FRACTIONS 1/64. ANGULAR.	DO NOT SCALE	DESIGNED HUG DATE 7-11-75	DRAWING NO. IM 00305
		CHECKED	REV. A

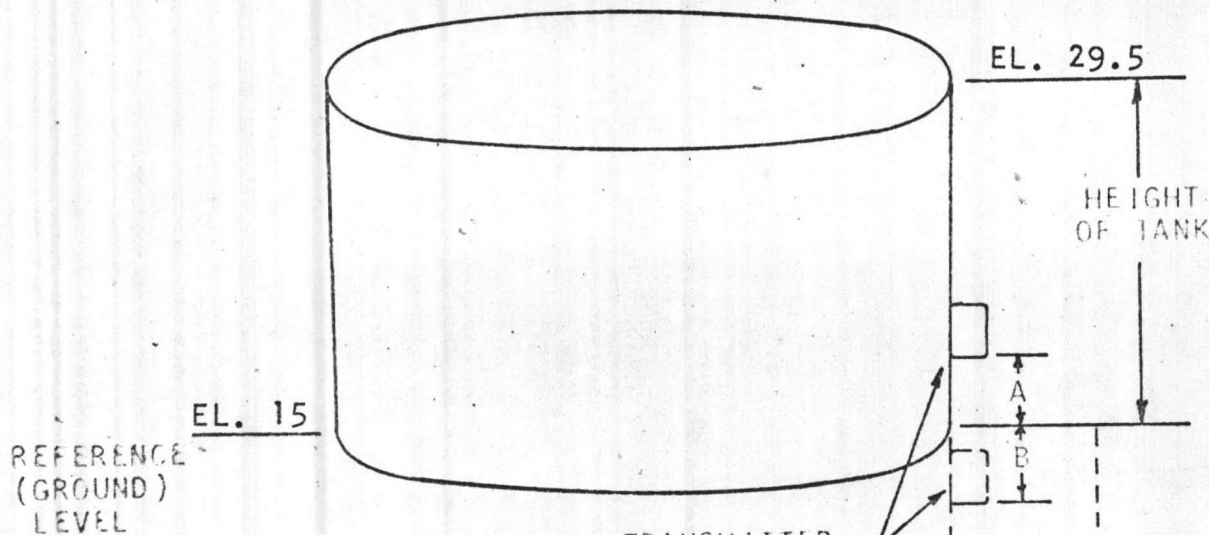


ITEM NO.	CECO PART NUMBER	SUB-VARIATION					K	DESCRIPTION	PL	PAGE 1	OF 1	DRAWING NO. 202001-01	COMPONENT DESIGNATION
		01											
1	DL01382	REF						Document List					
2	902105-01	REF						Wiring Diagram					
3		1						Encl., NEMA 12 ^{20x20x7} Hoffman	A20C20ALP				
4		1						Inner Panel ^{17x17} Hoffman	A20P20				
5	600463-01	1						Cecotronic Assembly					
6	600078-01	1						Transducer Assembly					
7		1						Term. Block Marathon	302			TB 1	
8		1						Ltng. Arrestor G.E.	9L15DCB002			LA (10)	
9		1						Thermoswitch CECO	2G-91			TH	
10		1						Heater, 120V. ^{75 Watts} Chromalox	SCB-75			HTR	
11		1						Receptacle Leviton	9063				
12		1						Circuit Bkr. West.	HQCL-1010			CB 1	
13		2						C.B. Surface Mtg. Clip West.	K82216				
14		1						Gauge, 3 $\frac{1}{2}$ " ^{0-15 lbs.} US Gauge	P844U				
15		1						Mtg. Flange Monnier	11520				
16		2						Valve, $\frac{1}{4}$ " Generant	3000-4				

PL	PAGE	OF	REV.	TITLE	S.O. 15726, ITEM "S"	DRFT	8/6/75	HJG
	1	1	A	BULL. E800, MODEL 121-RST		CHKD	8-6-75	<i>Jim</i>
DRAWING NUMBER					CONSOLIDATED ELECTRIC CO.	ENG		TJM
202001-01						141 SO. LAFAYETTE FREEWAY • ST. PAUL, MINN. 55107	APP	



RECORDER (OR METER) WILL INDICATE HEIGHT OF WATER ABOVE "BOTTOM OF TANK". FULL SCALE INDICATION WILL BE NEAREST STANDARD SCALE WHICH IS LARGER THAN "HEIGHT OF TANK".



NOTE: IF PRECISE FIGURES ARE NOT AVAILABLE, GIVE BEST ESTIMATE.

FIGURES SHOWN ARE PRECISE. SIGNED: GARY HOME

FIGURES SHOWN ARE ESTIMATED.

HEIGHT OF TANK 14.5 FT.

METER SCALE 5 FT. TO 15 FT.

DISTANCE FROM REFERENCE TO BOTTOM OF CABINET - 1 FT.
DIMENSION "A" 5 FT.

OR
DIMENSION "B" _____

TRANSMITTER CABINET
Locate inside Bldg. # 501
1 ft. above bottom of tank
Tap pressure lead off of 12" C.F. pipe outside of Bldg.

TITLE TECHNICAL SPECIFICATION CAMP GEIGER RESERVOIR TRANSDUCER CALIBRATION

DRAWN HJG 7-30-75

DESIGNED TWM

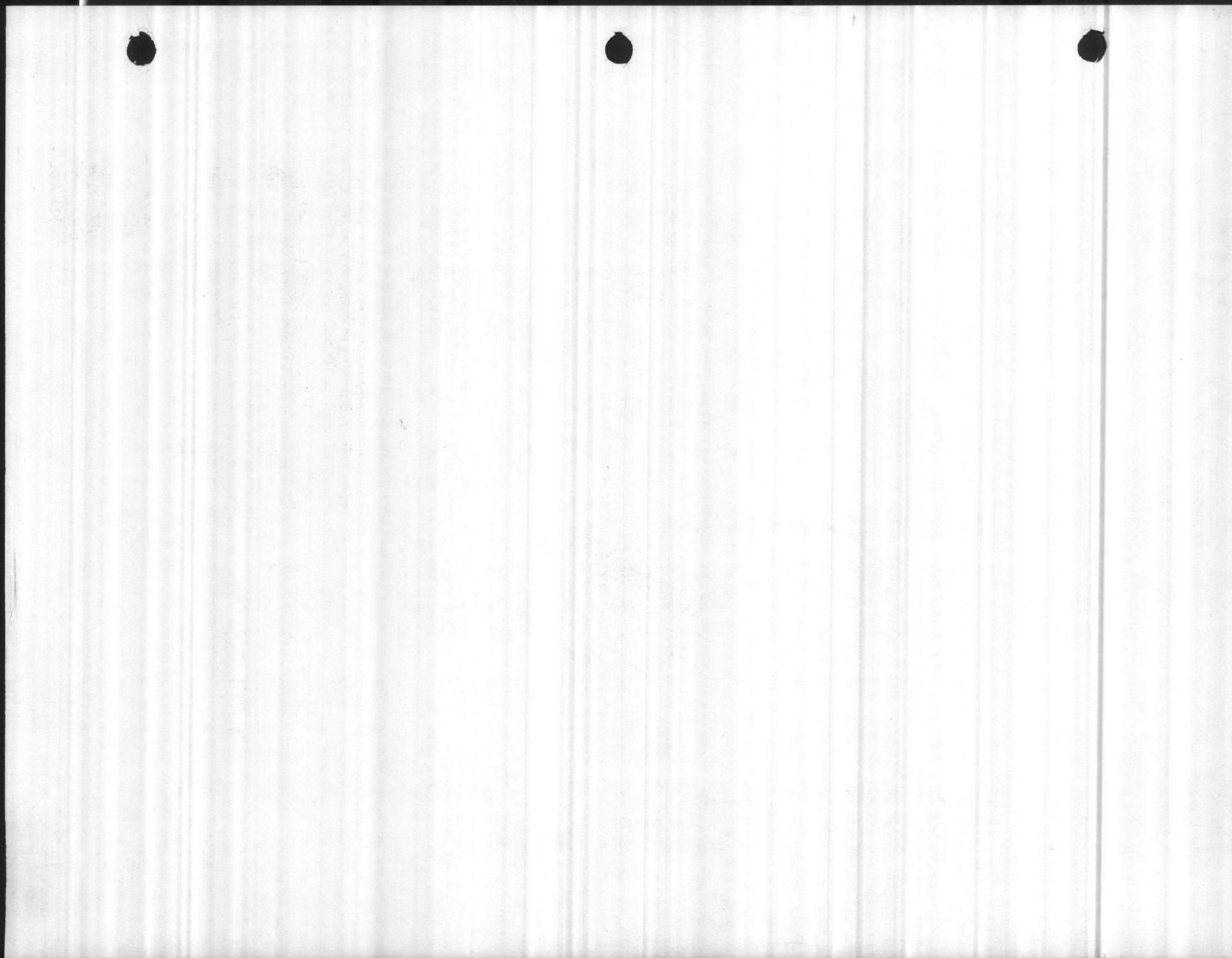
S.O. 15726 ITEM "S"
JOB NAME: JACKSONVILLE, N.C.

CONSOLIDATED ELECTRIC COMPANY
141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107

HE RED 8-1-75

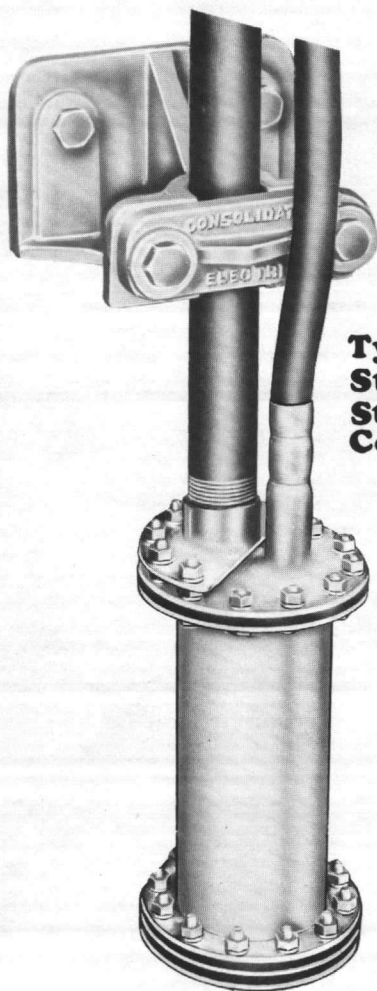
PAGE 1 OF 1

DRAWING NO. ES50133 REV B

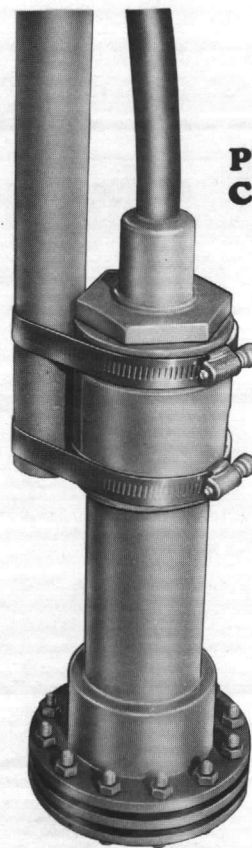




The Bulletin A1000 Submersible Level Transducer



**Type 316
Stainless
Steel
Construction**



**PVC
Construction**

A stationary submerged transmitter.....
producing a continuous, analog, electrical signal
which is directly proportional to the head-pressure
imposed on its bottom diaphragm by the height of the
liquid above it.

Used to sense.....
water, sewage, sewage sludge, fuel, process and other
liquid levels where the specific density of the liquid
is relatively constant.

CONSOLIDATED ELECTRIC CO.

RIVERVIEW INDUSTRIAL PARK • 141 SO. LAFAYETTE FREEWAY • ST. PAUL, MINN. 55107

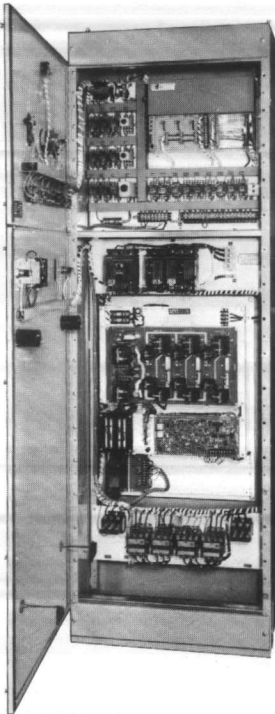
PHONE 612/224-9474

... rugged, "stand alone" level sensing transducer does the job you might have thought of a bubbler system for, but does it simply and reliably without the complexity and clogging that are often encountered with bubblers.

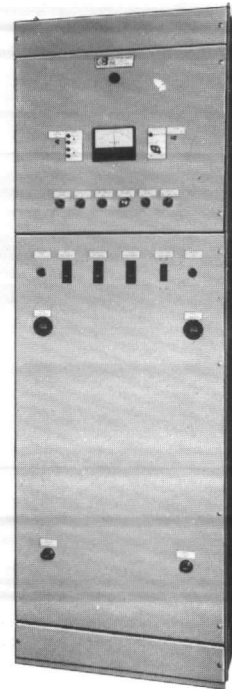
The Bulletin A1000 Submersible is used in

- **Raw Sewage Wet Wells**
- **Treatment Plant Sludge Sumps**
- **Water Reservoirs**
- **Rivers, Lakes and Streams**
- **Parshall Flume Stilling Wells**
- **Process Sumps**

or where surface freezing, inaccessibility or remoteness of sensor from controlled equipment dictates a submerged installation.



A CECOTRONIC Solid-State Sewage Pump Station Control providing adjustable-frequency variable-speed operation of two-pumps in response to wet well level variations. The pumps are operated in a full-duplex mode with separate lead-lag speed control ramp operation for single and parallel duplex operation. Full-speed contactors allow one inverter to be used for two pumps and also provide redundant ON/OFF operation from Bulletin B100, Model 9G Direct Acting Float Switches in the event of inverter or transducer outage. Manual mode option allows simulation of an input signal variation for test and adjustment purposes. Abnormal conditions are alarmed. Wet well level is displayed over a calibrated range. Solid-State adjustable-frequency inverter operates most standard motors and is often the only practical way to obtain adjustable speed operation of submersible sewage pumps. It has good efficiency over a broad speed range and is enjoying a rapidly growing popularity in municipal and industrial sewage and water pumping service.



The Bulletin A1000 Transducer signal is used to

- **Indicate, Telemeter or Record Liquid Level**
- **Control Pumps, Valves and Alarms**
- **Regulate Adjustable Speed Drives**
- **Sense Flow in Flumes, Rivers and Channels**

BASIC PRINCIPLE of OPERATION

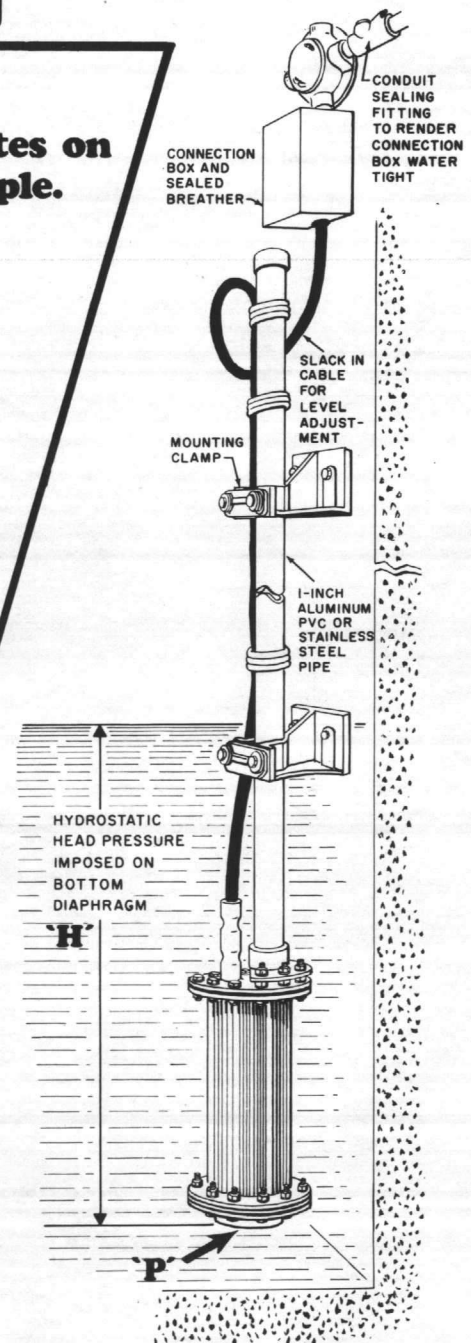
The Bulletin A1000 Level Transducer operates on a hydrostatic head - pressure-sensing principle.

It senses the pressure brought about by its depth of submergence and converts this pressure into an electrical signal. The operation of each of the several types of internal transducing mechanisms is described later. The transducer is typically mounted with its bottom diaphragm face at a fixed known reference elevation and its electrical output is directly proportional to level excursions above that reference elevation over a factory calibrated range.

The electrical output signals are potentiometric, D.C.voltage or D.C.current depending on the selected transducer mechanism type.

One pound of head-pressure (PSIG) is brought about by a submergence of 2.311 feet or 27.73 inches. Conversely, a submergence of 1.00 feet produces a pressure of .4327 pounds (PSIG). This pressure/depth relationship assumes a specific gravity of the liquid being measured of 1.0 (clear water at 68°F.). Variations in water temperature have almost no effect on these values. Most common water-based mixtures that are encountered in sewage plant operation, for example, are surprisingly close to the 1.0 value in their specific gravity. A very heavy sewage treatment plant sludge does not generally exceed a 1.02 specific gravity and thus a calibration based on clear water may even be valid for that type of level sensing. The Bulletin A1000 Transducer can be calibrated for liquids of any specific gravity as long as they remain reasonably constant in this value.

The pressure spoken of here is gauge pressure (relative to atmospheric pressure). The Submersible Transducer is supplied with a sealed breathing system (described under "General Construction") that relieves the internal pressure of the transducer housing to atmospheric pressure and thus makes the system insensitive to variations in temperature and barometric pressure.



P= Pressure in lbs. per square inch

H= Height of water in feet

$$P = H (X) .4327$$

$$H = P (X) 2.311$$

FEATURES

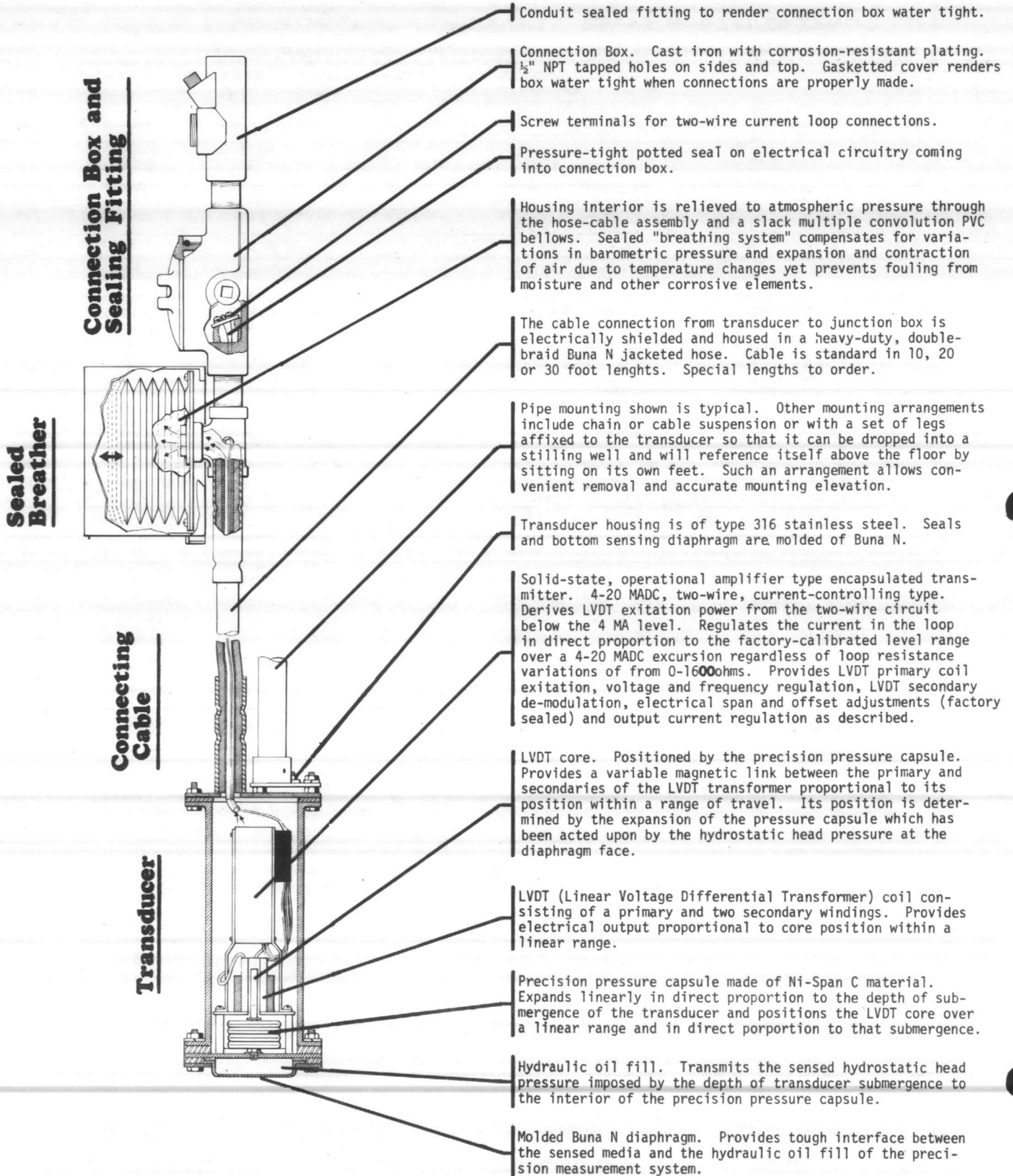
STAND-ALONE SYSTEM SIMPLICITY • PRECISION ELECTRONICS PERFORM IN A COMPLETELY-PROTECTED ENVIRONMENT

ACCURATE • RELIABLE • FOUL-FREE • ECONOMICAL • WIDE RANGE SELECTION • FACTORY CALIBRATION

SEALED BREATHING SYSTEM COMPENSATES FOR TEMPERATURE AND BAROMETRIC PRESSURE VARIATIONS

RUGGED CONSTRUCTION OF EITHER 316SS OR PVC PROVIDES RELIABLE PERFORMANCE IN UNBELIEVABLE SURROUNDINGS

Cross-Section of Model 157 GTMA Submersible Level Transducer and Connection Box Assembly



1 Conduit sealed fitting to render connection box water tight.

2 Connection Box. Cast iron with corrosion-resistant plating. 1/2" NPT tapped holes on sides and top. Gasketed cover renders box water tight when connections are properly made.

3 Screw terminals for two-wire current loop connections.

4 Pressure-tight potted seal on electrical circuitry coming into connection box.

5 Housing interior is relieved to atmospheric pressure through the hose-cable assembly and a slack multiple convolution PVC bellows. Sealed "breathing system" compensates for variations in barometric pressure and expansion and contraction of air due to temperature changes yet prevents fouling from moisture and other corrosive elements.

6 The cable connection from transducer to junction box is electrically shielded and housed in a heavy-duty, double-braid Buna N jacketed hose. Cable is standard in 10, 20 or 30 foot lengths. Special lengths to order.

7 Pipe mounting shown is typical. Other mounting arrangements include chain or cable suspension or with a set of legs affixed to the transducer so that it can be dropped into a stilling well and will reference itself above the floor by sitting on its own feet. Such an arrangement allows convenient removal and accurate mounting elevation.

8 Transducer housing is of type 316 stainless steel. Seals and bottom sensing diaphragm are molded of Buna N.

9 Solid-state, operational amplifier type encapsulated transmitter. 4-20 MADC, two-wire, current-controlling type. Derives LVDT excitation power from the two-wire circuit below the 4 MA level. Regulates the current in the loop in direct proportion to the factory-calibrated level range over a 4-20 MADC excursion regardless of loop resistance variations of from 0-1600ohms. Provides LVDT primary coil excitation, voltage and frequency regulation, LVDT secondary de-modulation, electrical span and offset adjustments (factory sealed) and output current regulation as described.

10 LVDT core. Positioned by the precision pressure capsule. Provides a variable magnetic link between the primary and secondaries of the LVDT transformer proportional to its position within a range of travel. Its position is determined by the expansion of the pressure capsule which has been acted upon by the hydrostatic head pressure at the diaphragm face.

11 LVDT (Linear Voltage Differential Transformer) coil consisting of a primary and two secondary windings. Provides electrical output proportional to core position within a linear range.

12 Precision pressure capsule made of Ni-Span C material. Expands linearly in direct proportion to the depth of submergence of the transducer and positions the LVDT core over a linear range and in direct proportion to that submergence.

13 Hydraulic oil fill. Transmits the sensed hydrostatic head pressure imposed by the depth of transducer submergence to the interior of the precision pressure capsule.

14 Molded Buna N diaphragm. Provides tough interface between the sensed media and the hydraulic oil fill of the precision measurement system.

The Bulletin A1000 Submersible Level Transducer contains a pressure-sensing mechanism within a submersible housing and has it connected to sense the external pressure imposed on the bottom diaphragm of the housing. That pressure is brought about by the height of liquid above the diaphragm mounting elevation. The diaphragm and housing seals are molded of Buna N material to be resistant to the wide range of liquids in which the Transducer is used. The diaphragm is tough and flexible (with an effective diameter of 2½" and a thickness of 1/16") and merely serves as an interface between the external liquid being sensed and an internal oil fill which transmits the diaphragm face pressure to the transducing mechanism.

Three types of transducer mechanisms are offered. The housings are provided in Type 316 stainless steel or in PVC construction. The Transducer is factory-calibrated to operate over a specific level excursion range and does not require nor allow field adjustment.

The cable from the Transducer to the Connection Box/Breather Assembly is a double-braid Buna N jacketed hose which provides for air transfer from the Transducer to the breathing assembly and houses the electrical signal conductors.

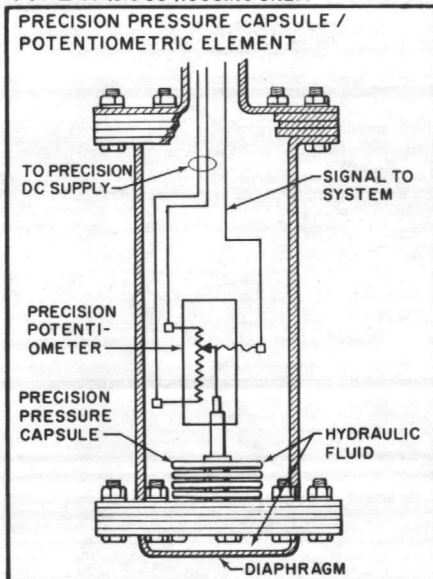
Three types of transducer mechanisms are offered;

Type R - Pressure Capsule/Potentiometric Element
(either wire-wound or conductive plastic)

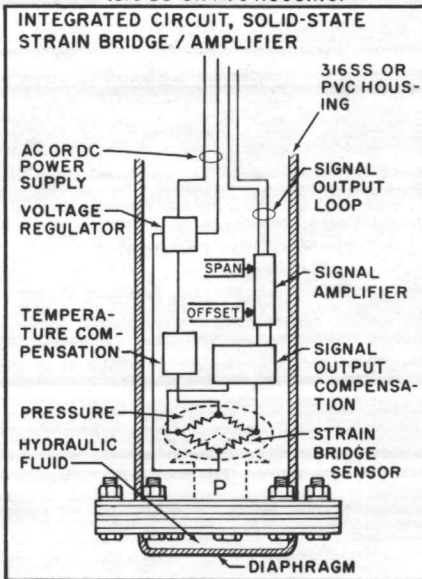
Type S - Pressure Diaphragm/Strain Bridge Amplifier
(solid-state, integrated circuit hybrid)

Type T - Pressure Capsule/L.V.D.T. (Linear Voltage Differential Transformer), Amplifier

TYPE R (316 SS HOUSING ONLY)

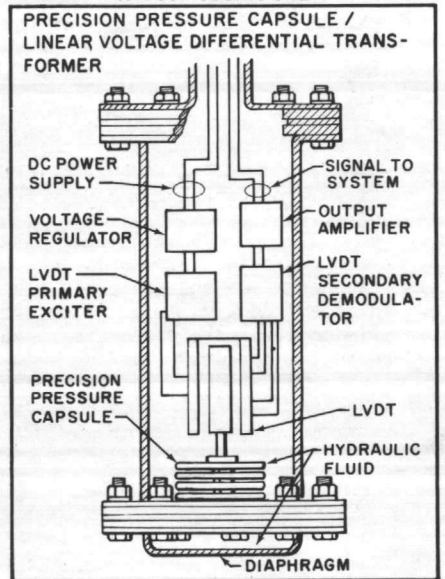


TYPE S (316 SS OR PVC HOUSING)



NOTE: TYPE S UNITS ARE AVAILABLE AS 2-WIRE, LOOP POWERED IN CERTAIN PRESSURE RANGES. (SEE SELECTION TABLE).

TYPE T (316 SS HOUSING ONLY)



NOTE: THE MODEL 1576-TMA 4-20 MADC 2-WIRE TRANSDUCER IS LOOP POWERED AND HAS ONLY TWO WIRES RUNNING TO IT. SEE CROSS-SECTION FOR DETAIL (ON OTHER PAGE).

Type R and T mechanisms convert the sensed pressure to a mechanical positioning. Type R positions the wiper of the potentiometer (either wire-wound or conductive plastic). Type T positions the core of a linear voltage differential transformer. The pressure capsule in each case is a precision assembly fabricated of NiSpanC material (for uniform performance under varying temperature). The potentiometric element output is direct by means of leads. The LVDT is a "frictionless" sensing means. It operates with an electronics package that provides voltage regulation, primary LVDT coil exci-

tation secondary LVDT coils demodulation and output signal amplification.

The Type S Transducer is solid-state in nature and involves a minute flexing of a sensing diaphragm in response to pressure change. A strain bridge is deposited on the back of the diaphragm and is furnished together with a solid-state electronics package which provides excitation of the bridge and the amplification of its output. The small size of the diaphragm/strain bridge transducer allows its installation in the basically - smaller PVC housing.

Type R Pressure Capsule/Potentiometric Mechanism

The Type R unit has a resistance element which is used as a voltage divider. The movable wiper of the potentiometric element is driven by the expansion of a precision pressure capsule.

A number of different potentiometric sensors can be incorporated in the Type R Transducer. They are available in different types of resistance element, head pressure ranges and accuracies as well as different current handling capabilities. They nominally have a 1000 ohm total resistance. One "family" has a full-exursion pressure range of 0-1.5, 0-6, 0-30, 0-60, etc. with a total error band (including hysteresis, linearity and resetability) of plus or minus 1% in the 15 lb. and higher range, 1.5% in the 6 lb. range and 2% in the 1.5 lb. range. Higher pressure ranges are also available. This group is of wire-wound element type. With a 120 degree F. ambient temperature this transducer is capable of dissipating 1 watt in its resistance element. The total resistance is held to a plus or minus 2% tolerance while the zero pressure calibration is held to 5% of total resistance and the full scale resistance value with respective pressure is also held to a tolerance of 5%.

Another group of potentiometric assemblies is of conductive plastic element construction. It is

available in 0-5, 0-15, 0-25 and 0-50 psig range. It has typical accuracies of +/- 1% of range, power ratings of 0.1 watt, +/- 1/2% of 1% repeatability, dither life of 5,000,000 cycles and resistance value of 1000 ohms +/- 10%.

With potentiometric elements it is necessary to externally trim the signal from the transducer to obtain the desired rangability and "calibration" in a particular control system application. That is, they are offered in a 3-wire configuration without spanning, offsetting or calibration other than as the ranges are indicated in the Table.

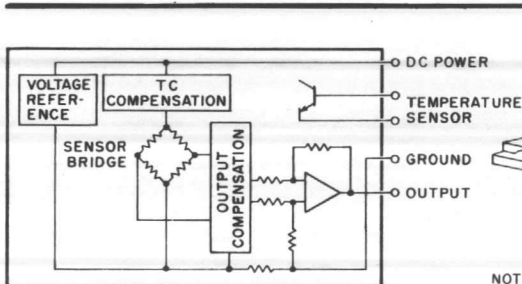
The Type R Transducers obviously involve a wear factor and are somewhat less accurate/sensitive than Types S or T. Their main advantage is lower initial cost and (in some instances) their simplicity of application to a particular control requirement.

Type R Submersible Level Transducers are furnished in the Type 316 Stainless Steel housing as standard. This assembly has a maximum O.D. of 4 1/2" and has the internal sizing required to accommodate a variety of potentiometric elements.

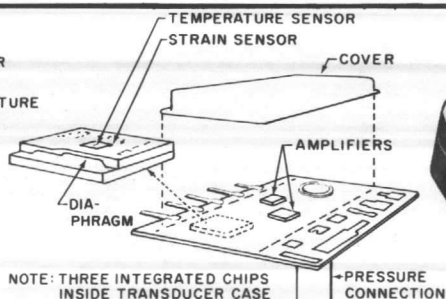
Type S Pressure Diaphragm/Strain Bridge Solid State Assembly

The pressure transducing function of the Type S Submersible Level Transducer (the conversion of the sensed pressure to a corresponding electrical value) is accomplished by a highly-accurate, temperature-compensated solid-state, integrated circuit/hybrid piezo-resistive package. The "diaphragm" of the sensor is chemically-etched in a defined area of an integrated circuit silicon die and a piezo-resistive strain gauge bridge is diffused into the opposite side. Signal conditioning and temperature-compensating transistor circuits are built onto the

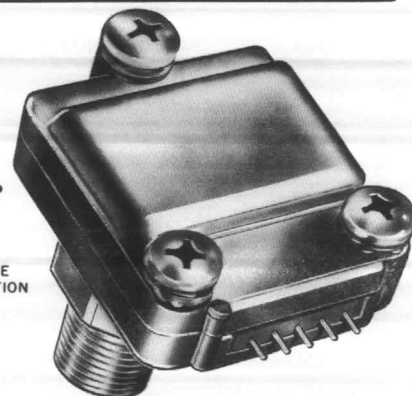
same IC chip and are computer-controlled-laser-trimmed for sustained accuracy under temperature variations. The combination of voltage-regulation, temperature-compensation, output signal amplification and buffering in the same integrated package together with judicious selection of matched resistive, comparative, voltage-regulating, signal-conditioning and load-driving elements assures consistent performance under the field conditions encountered in a wide range of industrial and public works environments.



CIRCUIT DIAGRAM OF IC TRANSDUCER SHOWS TEMPERATURE COEFFICIENT COMPENSATION AND ZENER VOLTAGE REFERENCE. TEMPERATURE SENSOR IS PHYSICALLY LOCATED IN THE CENTER OF PIEZORESISTIVE STRAIN BRIDGE. OUTPUT AND TC COMPENSATION CIRCUITS ARE LASER TRIMMED DURING MANUFACTURE.



NOTE: THREE INTEGRATED CHIPS INSIDE TRANSDUCER CASE INCLUDE SENSOR CHIP WITH COMPENSATION CIRCUITS, AND TWO OPERATIONAL AMPLIFIERS.



The Type S assemblies are available in zero-based ranges of 0-1.5, 5, 15, 30, 60, 100 and 300 psig. Accuracies are typically in the order of +/- 1% of range. Repeatability is better than 1/2 of 1% of range. Hysteresis is negligible.

The output signal from the Type S assembly is most commonly 4-20 MADC, 2-wire or 4-wire. A 2.5-12.5

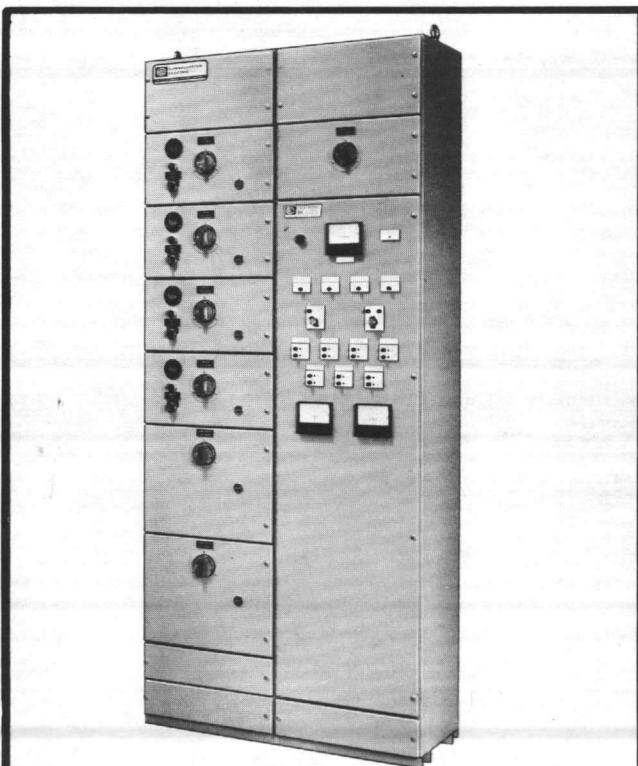
VDC signal is available for short-distance circuitry (within the same cabinet or room) but the 4-20 MADC is recommended for any distance and most application due to its resistance variation-compensation characteristic and ready interface with other instrumentation systems. Being solid-state the Type S mechanisms have no wear factor and if properly applied should have an essentially-unlimited life.

Type T Pressure Capsule / LVDT Assembly

The Type T Transducer uses a linear voltage differential transformer (LVDT) with an oscillator/demodulator to obtain a varying output signal which is directly proportional to the expansion of the signal precision pressure capsule and sensed pressure. The Type T Unit does not involve any sliding parts and is therefore inherently more sensitive and accurate than the Type R assembly.

The Type T Transducer precision pressure capsule mechanism is available in four standard pressure ranges as well as special ranges to order. Each capsule can be combined with a number of different LVDT units and span and offset capability to provide most any desired factory-calibrated operating range.

The precision pressure capsule is fabricated as a multiple convolution diaphragm assembly made of NiSpanC material which affords a high-repeatable, accurately-linear movement in response to sensed pressure variations. The LVDT is a combination of a 3-winding stationary transformer and a movable core which is positioned by the precision pressure capsule. The primary of the transformer is continuously excited by an AC voltage which is accurately regulated as to frequency and amplitude. The output of the two secondary windings of the LVDT is demodulated and cross-referenced so that an output signal is derived which is accurately related to LVDT core position and sensed pressure.



A Bulletin A1000 Submersible Level Transducer provides a wet well level-responsive input signal to this custom CECOTRONIC control system/motor control center in an industrial waste pumping application. The system automatically operates four (4) pumps and two (2) multi-position sludge valves. It indicates wet well level, valve positions, pump operation and alarms upon the occurrence of abnormal operating conditions.

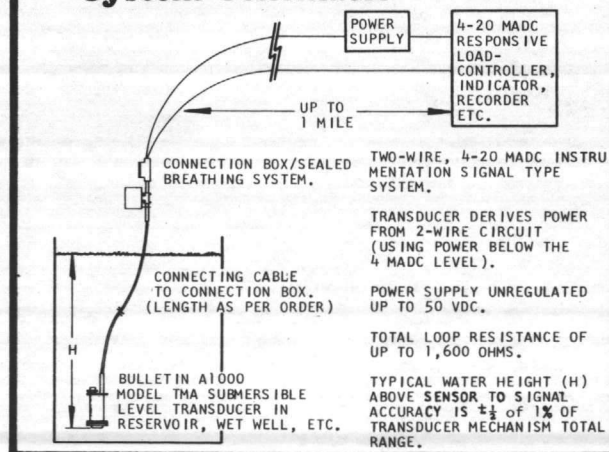
The Type T Submersible Level Transducer is made in two general forms; the form TVD which produces an output voltage signal and the TMA which regulates a 4-20 MADC instrumentation signal in response to a sensed pressure variation.

The Form TVD Transducer typically has a +/- DC voltage output and is used in custom CECOTRONIC control systems.

The form TMA Submersible Level Transducers incorporate an electronic package which produces a 4-20 MADC instrumentation signal output. The form TMA Transducer is a 2-wire unit which derives its excitation from the 2-wire instrumentation signal loop below the 4 MADC level. With a 20-50 VDC unregulated input power supply somewhere in the loop the 4-20 MADC signal of the form TMA Transducer will operate into a 0-1600 ohm load. See the Supply Voltage/Loop Resistance Table for correlation between the input voltage and the total loop resistance that is capable of being driven by the form TMA Submersible Level Transducer.

The Form TMA Transducer provides linearity of within .4% of full scale and it can be used in a current loop of up to one mile length. Care should be taken that the circuit is not subjected to lightning transients. In applications where there is any possibility of this, protection is recommended to avoid damage and downtime. The Form TMA 2-wire Transducer requires that loop power be supplied externally. It is offered factory-calibrated to the desired level excursion range for a particular application. It can be used directly as a current regulator for controlling; process controllers, recorders, indicators, etc. Regulated current flow is unaffected by change in circuit resistance over a range of from 0-1600 ohms.

Bulletin A1000 Type TMA Submersible Level Transducer System Schematic



TYPE TMA LOOP POWER/RESISTANCE TABLE

LOOP POWER	LOOP DRIVE CAPABILITY
20 VDC	0 Ohms
30 VDC	0 - 530 Ohms
40 VDC	0 - 1060 Ohms
50 VDC	0 - 1600 Ohms

Type TMA Voltage Range is 20 - 50 VDC

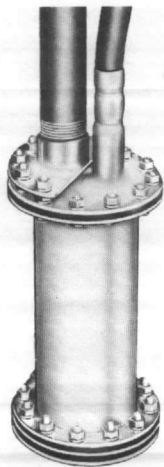
Two types of transducer housings are offered;

Type 316 Stainless Steel

The Type 316 SS housing accommodates any of the three types of transducer mechanism and is resistant to a wide range of corrosive media. The housing seals and bottom diaphragm are of Buna N synthetic rubber. The most common mounting arrangement uses a VERTICAL 1" pipe and the threaded fitting in the top of the Transducer. The pipe fitting is just a mounting means and does not enter the transducer housing. Cable or chain suspension is also used as suggested in the typical application sketches.

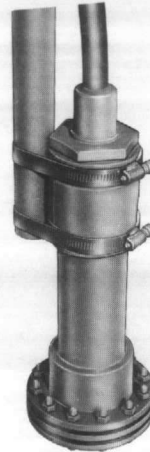
Special mountings can be fabricated such as a pipe socket to slip onto a pipe piling in a lake bottom, a three-legged "stool" fastened to the Transducer to rest on a reservoir floor when lowered down an existing guide pipe by means of its hose or a cable.

In deep tunnel applications a guide rail system and appropriate sliding truck have been designed. Review special mounting requirements with the Consolidated Agent or Factory for recommendation and quotation.



TYPE 316
STAINLESS STEEL
CONSTRUCTION

P.V.C. (Polyvinyl Chloride)



PVC
CONSTRUCTION

The standard PVC housing basically accommodates the Type S mechanism. Special configurations of the PVC housing can be made on special order to incorporate the other Transducer types if quantities justify the tooling expense.

The PVC housing is somewhat less expensive than the Type 316 assembly. It has superior corrosion resistance in salt water and some other process liquid applications. The same Buna N diaphragm and housing seals are used and the major diameter is thus the same as the Type 316 assembly.

The standard PVC mounting arrangement uses a vertical 1" pipe (by others) which is accommodated in a channel in the side of the top housing head. Two grooves are provided in the head to retain clamping bands which are furnished to hold the Transducer to the vertical 1" pipe. Stainless steel bands are supplied with the Transducer as standard. Bands of other material can be furnished on special order to meet specific corrosion conditions.

Breathing System Function

The sealed breathing system is an essential element of the Submersible Level Transducer assembly. Without its "breathing" capability the level sensing would be inaccurate. Without its sealed construction the Transducer would soon be disabled by moisture and corrosives.

The sealed breathing system continuously relieves the internal pressure of the Transducer housing to atmospheric pressure through a multiple-convolution slack bellows and thus allows the system to tolerate variations in temperature and baro-

metric pressure. Temperature variations cause expansion and contraction of the air in the transducer housing and would cause a significant sensing error if the breathing system were not provided. Variations in the barometric pressure imposed on the face of the liquid being sensed must also be exerted on the transducing mechanism so that such variations do not bring about an error in the sensed level. The breathing system is sealed so that the Transducer does not breathe "fresh" air from its environment and collect condensation and other contaminants and foul itself.

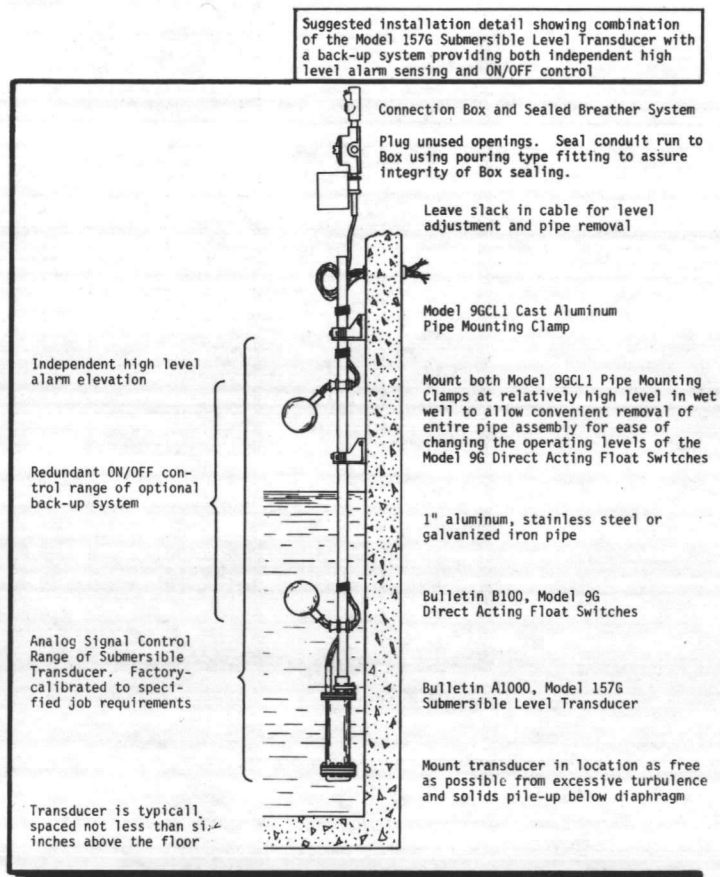
Provisions for Redundant / Back-up Control

The design of any automatic system should include a determination of the operation/non-operation that will be considered satisfactory in the event of the failure of any significant system element. It should also determine whether a "Back-up" system should come into operation automatically or if it will be satisfactory to assume that an alarm system will notify operating personnel of a component failure and that such personnel will transfer equipment operation to the redundant control.

In considering a possible failure of a Bulletin A1000 Submersible Level Transducer in a sewage pumping station system, for example, two basic approaches are commonly used;

- A second duplicate Transducer can be installed which will provide the same analog signal as the primary device. This second unit can be brought into control either manually or automatically as certain parameters are monitored to sense transducer failure.
- A redundant ON/OFF control mode can be initiated either automatically or manually which mode may use Model 9G Direct Acting Float Switches or other discreet level-sensing means. This arrangement is sometimes used with back-up motor control contactors in the case of adjustable-speed pumping systems so as to accommodate a failure of either the level-sensing transducer and/or the adjustable-speed drive system.

It is important to maintain complete independence of the primary and secondary control systems for sake of greatest reliability of operation. This may involve powering the systems from different sources especially where the back-up system involves gas-engine or other types of drive not requiring electric power. In these cases the back-up system is generally operated from the engine battery system or a control battery system that is paralleled with the cranking batteries but resistor-isolated to avoid voltage dips.

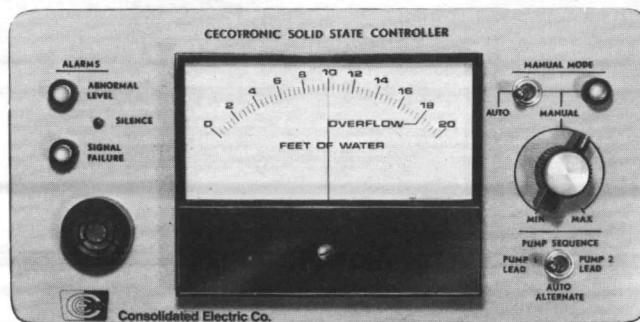


A thoughtful discussion of various-possible system failure modes and a determination of an acceptable system performance under this condition, when doing initial system design, will be found to be time and effort well spent. Your Consolidated Agent or Factory Sales Personnel will be glad to help in such considerations.

A CECOTRONIC Solid-State Control System door-mounted METER MODULE providing:

- System Signal Display (height, pressure, flow) showing the conditioned (quelled, spanned, offset) system input.
- Alarm Annunciator, dual-function, dim-glow lights with audible alarm, silencing and optional flash feature.
- Manual Mode Module including switch, light and manual potentiometer for simulating a full-range input signal.
- Automatic Alternator Control Switch providing manual or automatic sequencing of pumps. A duplex control is shown.

Other meter types (digital, recording, larger or smaller) and control/alarm facilities can be in the



METER MODULE as desired. The METER MODULE is one of many functional/convenience features available in CECOTRONIC Solid-State Control Systems having Submersible Level Transducer or similar signal input.

Table 3
Pressure Element Selection and Specifications

Item	Type	Element Press. Range Lbs./Sq. Inch	Equivalent Feet of Water	Equivalent Inches of Water	Proof Pressure lbs. psi.	Notes
1	R 1.5	0-1.5	3.46	41.5	2.2	A
2	R 5	0-5	11.53	138.4	7.5	B
3	R 6	0-6	13.84	166.1	9	A
4	R 15A	0-15	34.50	415.2	22	A
5	R 15B	0-15	34.50	415.2	22	B
6	R 25	0-25	57.67	692.0	37	B
7	R 30	0-30	69.20	830.4	45	A
8	R 50	0-50	115.37	1384.0	75	B
9	R 60	0-60	138.40	1660.8	90	A
10	T 1.5	0-1.5	3.46	41.5	10	C
11	T 5	0-5	11.53	138.4	18	C
12	T 10	0-10	23.07	276.8	30	C
13	T 18	0-18	41.52	498.2	50	C
14	S 1.5	0-1.5	3.46	41.5	15	D
15	S 5	0-5	11.53	138.4	30	D
16	S 15	0-15	34.60	415.2	40	D
17	S 30	0-30	69.20	830.4	50	D
18	S 60	0-60	138.40	1660.8	100	D
19	S 100	0-100	230.67	2768.	150	D
20	S 300	0-300	692.0	8304.	500	D

NOTES:

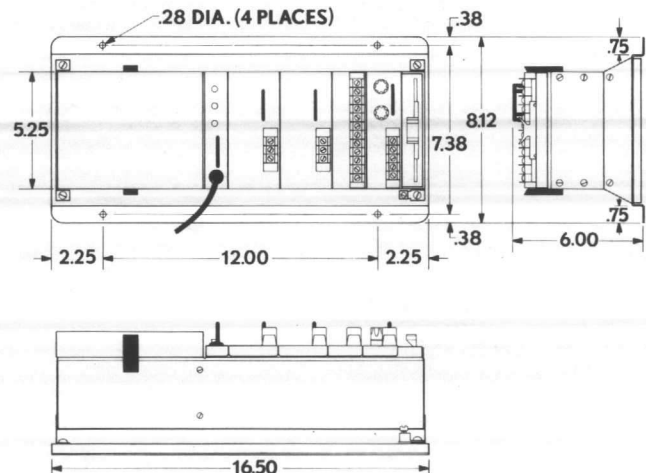
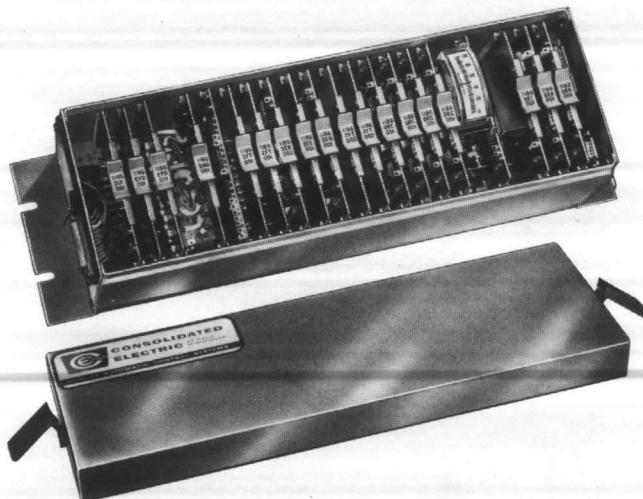
A- NI-SPAN-C SINGLE PRESSURE CAPSULE/HIGH-RESOLUTION (0.25%) WIREWOUND POTENTIOMETRIC ELEMENT. 1000 ohms +/- 1% Total Error Band (including hysteresis, linearity and resetability). R6 is +/- 1.5% and R1.5 is +/- 2% T.E.B. Power rating is 1 watt at 120 F. ambient. 5% of the total resistance is at "zero" level/pressure. 95% of the resistance is at the indicated full pressure.

B- NI-SPAN-C SINGLE PRESSURE CAPSULE/CONDUCTIVE PLASTIC POTENTIOMETRIC ELEMENT. Infinite resolution, +/- 2% Total Error Band (including hysteresis, linearity and resetability), 1/2% repeatability, Resistance - 1,000 ohms +/- 10%, Power rating 0.1 watt at 120 F. ambient. Acts as voltage-divider (has 100 ohms of resistance in wiper circuit. Plastic element and direct-drive gives 5,000,000 cycle dither life.

C- NI-SPAN-C MULTIPLE CONVOLUTION PRECISION PRESSURE CAPSULE/LVDT (LINEAR VOLTAGE DIFFERENTIAL TRANSFORMER). Four standard combined with special-order pressure elements and several LVDT sizes, give a broad selection of calibrated head pressure/level range. Infinite resolution. Total Error Band (including hysteresis and linearity) is +/- 1%, Repeatability is better than +/- 1/2 of 1%. The absence of sliding parts results in a relatively unlimited life. Input power-either low voltage DC or derived from the 2-Wire, 4-20 MADC loop. Output signal-either DC voltage or current.

D- PRESSURE DIAPHRAGM SOLID-STATE STRAIN BRIDGE INTEGRATED CIRCUIT TRANSDUCING ELEMENT. Seven pressure ranges - Infinite resolution - Over-all accuracy +/- 3%. Repeatability is better than +/- 1/2 of 1% - Linearity and hysteresis +/- .2% is typical. Unlimited life within normal physical and electrical range usage.

A CECOTRONIC single-frame chassis of plug-in function modules for use with the Submersible Level Transducer or similar input signal. Half-length "Mini-Frames" and multiples of the assembly shown together with a complete family of standard and custom modules perform most any control, indication, telemetry or alarm job.



Dimensions of the panel-mounting single-frame CECOTRONIC Control System function module assembly typically used with the Submersible Level Transducer or other CECOTRONIC sensor to perform ON/OFF control, automatic alternation, alarm silencing, analog output and other functions in response to level change.

Factory Calibrated Level-Sensing Ranges

Type R Transducers are only available as standard in the ranges listed in the Pressure Element Selection Table. Any exact ranging of the output signal must be done with external trimmers or signal converters. Refer such requirements to the Factory for recommendation.

Type S & T Submersible Level Transducers are factory calibrated to give a full-range output signal on a particular head-pressure (level) variation. The desired pressure can be the maximum listed in the Pressure Element Selection Table for the particular mechanism or it can be less than that maximum.

The accuracy of a particular Transducer and its control system will be a \pm percentage of the maximum pressure value of the transducer even though

the calibrated range may be considerably less. Therefore, to obtain the best possible accuracy in a given application use the Transducer element with the lowest possible maximum pressure rating consistent with the proof-pressure requirements of the particular application. The determination of the proof pressure requirement is obtained by considering the maximum head pressure that the sensor might sometime be subjected to by an unusually high level in the wet well, reservoir, etc.

The complete catalog number denotes the type of product, the specific gravity of the liquid which it is to sense, the Pressure Element, the Calibrated Range and the Length of the Cable from Transducer to Connection Box.

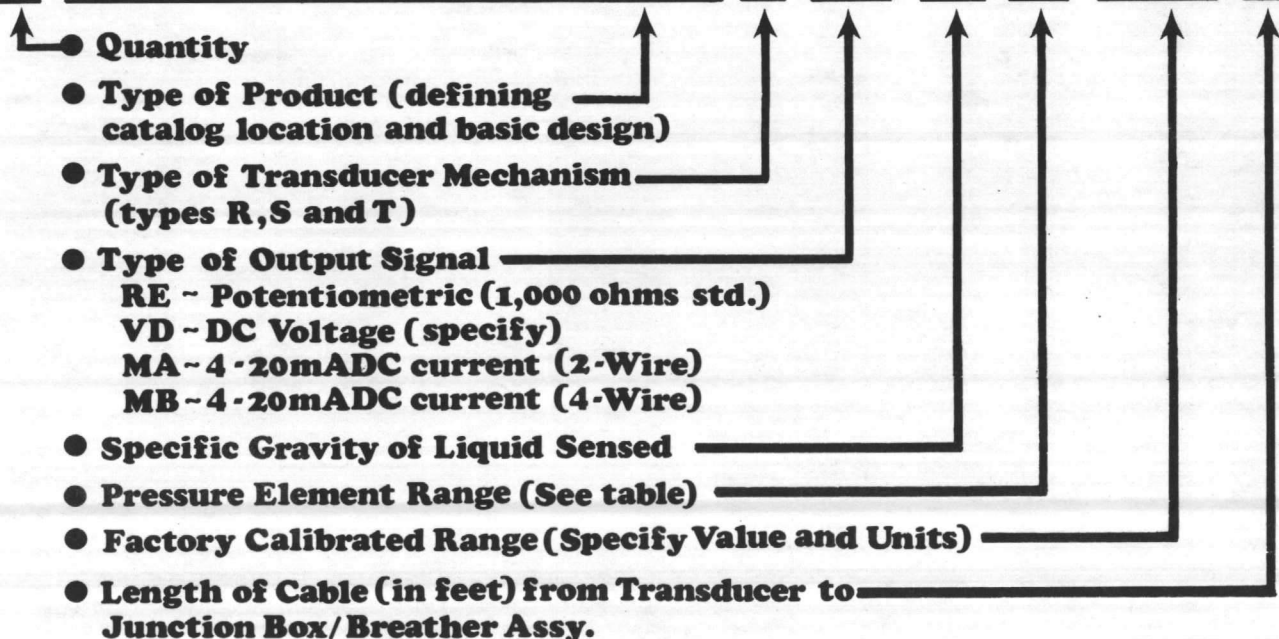
Catalog Number System Identification

The complete Catalog Number denotes:

- The Catalog Location (Bulletin reference)
- The Type of Product
- The Type of Transducer Mechanism
- The Type of Output Signal
- The Specific Gravity of Liquid Sensed
- The Pressure Element Range
- The Factory Calibrated Range
- The Length of Connecting Cable

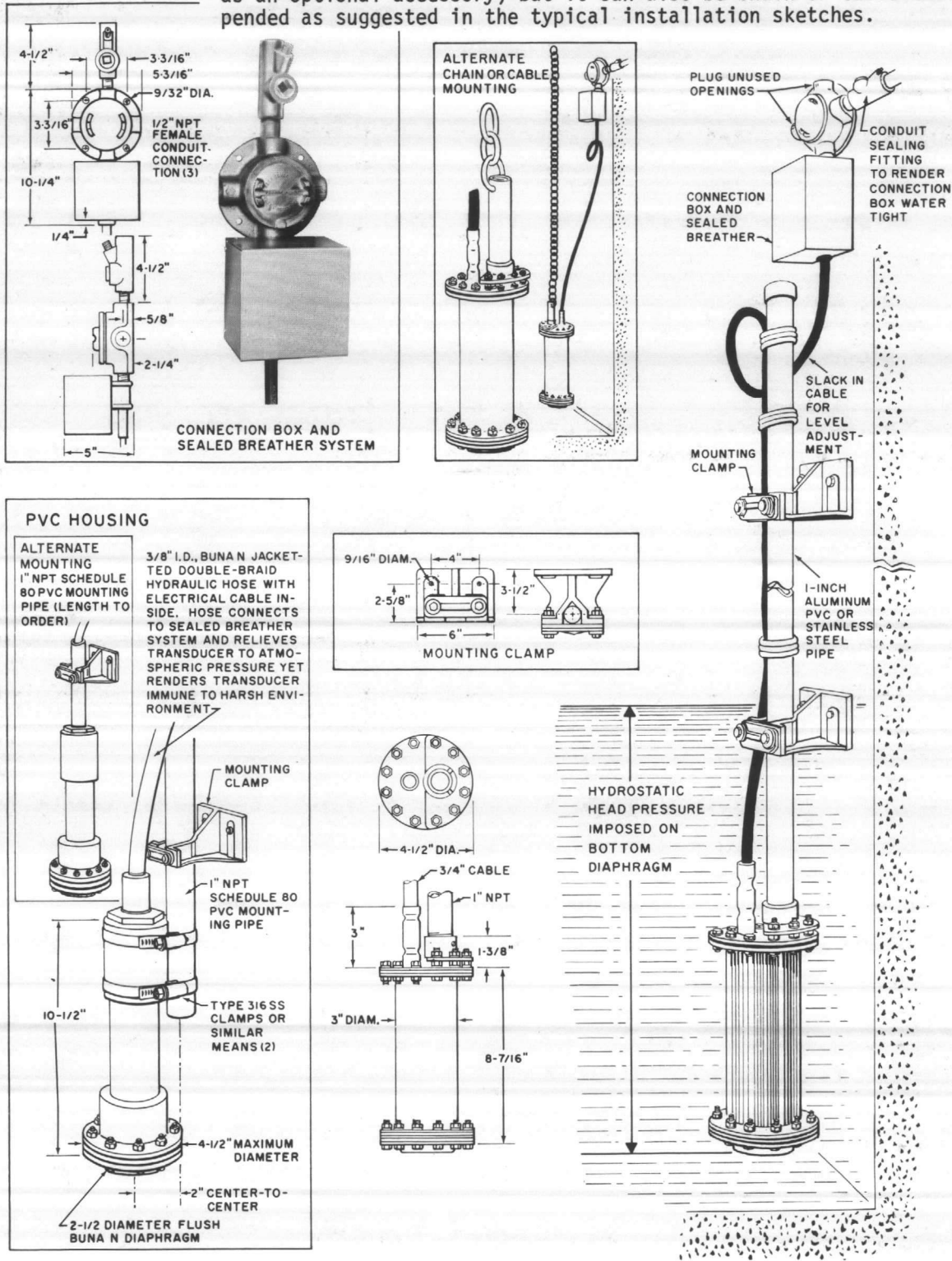
Example:

1 - Bulletin A1000, Model 157 G T MA -1.0 -T5 -10Ft. - 20



Installation Information

The Transducer is usually mounted by means of a 1" pipe and pipe mounting clamps (the Model 9G CL1 pipe mounting clamp is offered as an optional accessory) but it can also be chain or cable suspended as suggested in the typical installation sketches.



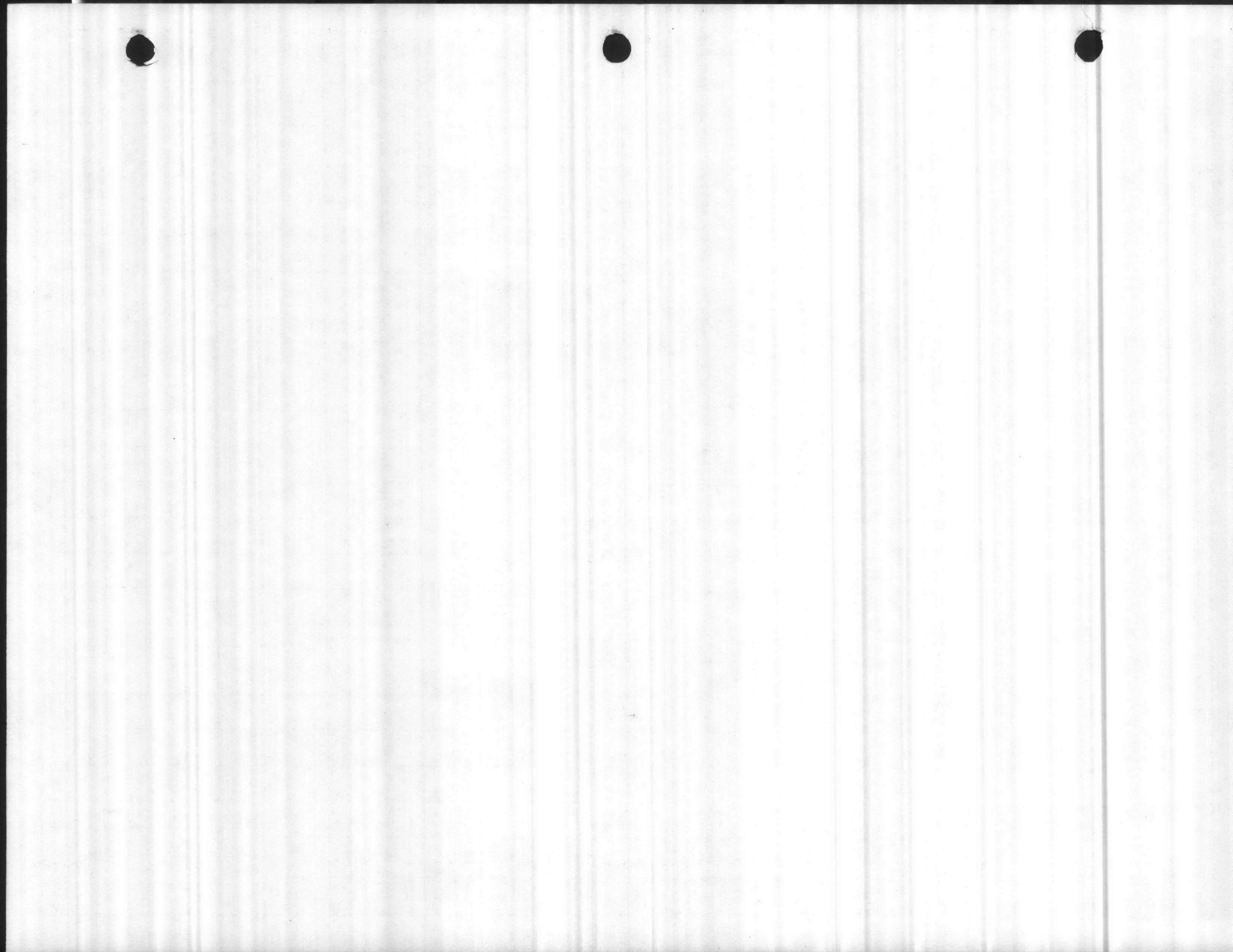
Consolidated Electric offers a comprehensive line of Control Devices and complete systems for pump, valve and alarm/monitoring system automation in Municipal/Industrial water supply and sewage works and similar process applications.

Call your Consolidated Agent for application assistance.



CONSOLIDATED ELECTRIC CO.

RIVERVIEW INDUSTRIAL PARK • 141 SO. LAFAYETTE FREEWAY • ST. PAUL, MINN. 55107



*CONNECT BOX & SEALED BREATHER ASSEMBLY. MUST BE LOCATED ABOVE FLOOD LEVEL.

CONDUIT RUN (BY CUSTOMER)

CECOTRONIC CONTROL SYSTEM

EL. +7.0

LEAVE SLACK IN HOSE FOR LEVEL ADJUSTMENT AND PIPE REMOVAL

RECORDER (OR METER) RANGE WILL INDICATE HEIGHT OF SPAN, AS "0 TO (SPAN)", UNLESS SHOP ORDER SPECIFIES OTHERWISE. FULL SCALE INDICATION WILL BE NEAREST STANDARD SCALE WHICH IS LARGER THAN "SPAN".

FLOOD HEIGHT

SPAN

Submersible Level Transducer

OFFSET
EL +5.0

EL. -4.0

- FIGURES SHOWN ARE PRECISE. SIGNED: M.L. ELROD
- FIGURES SHOWN ARE ESTIMATED.

HOSE LENGTH
A TO B 10 FT.

CABLE LENGTH
C TO D _____

SPAN 2 FT.

OFFSET 9 FT.

FLOOD HEIGHT 2 FT.

Transducer is typically spaced not less than six inches above the floor

TITLE TECHNICAL SPECIFICATION SEWAGE FILTER
SUBMERSIBLE LEVEL TRANSDUCER CALIBRATION

DRAWN HJG
7-30-75

DESIGNED TWM

S.O. 15726 ITEM T1 & T2
JOB NAME: JACKSONVILLE, N.C.

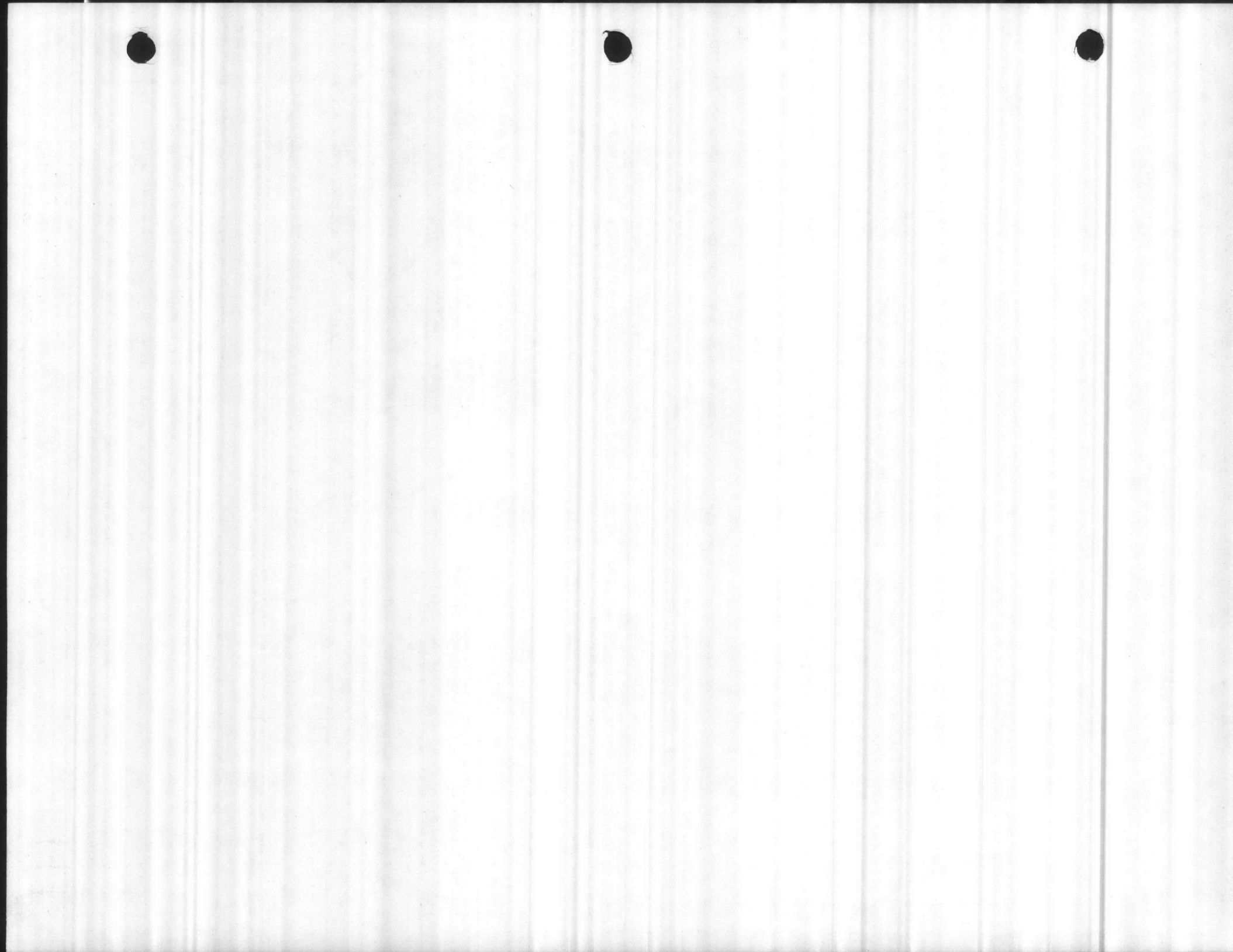
CONSOLIDATED ELECTRIC COMPANY
141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107

CHECKED *[Signature]*
8-1-75

PAGE 1 OF 1

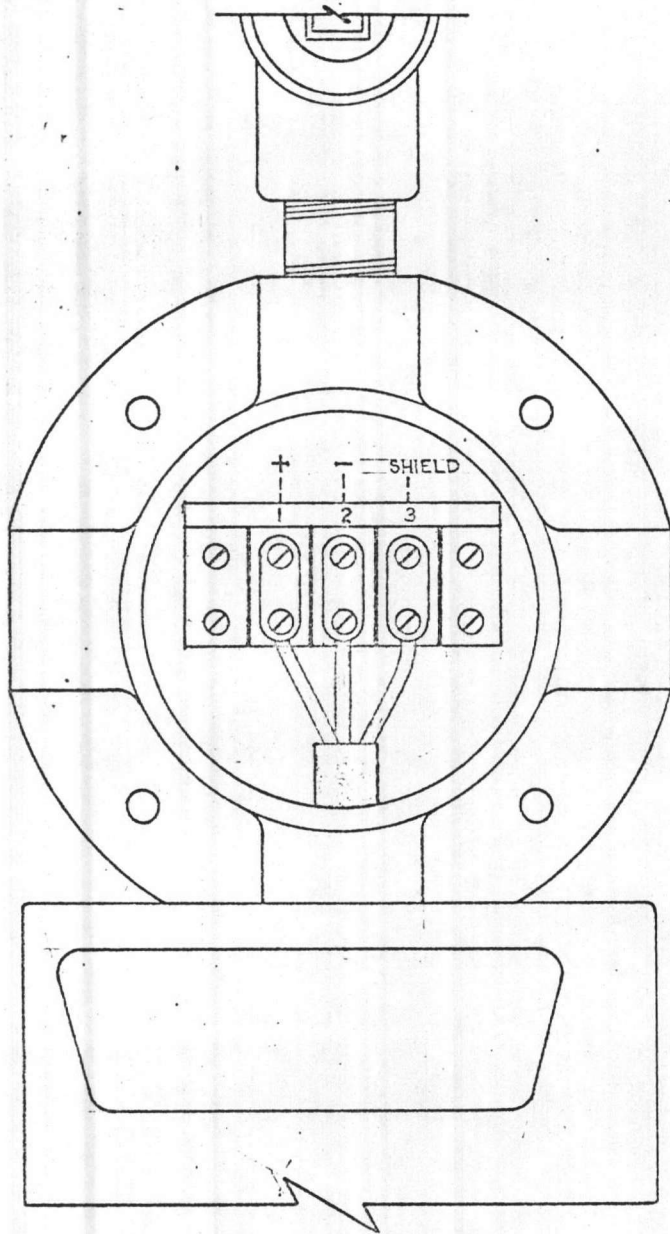
DRAWING NO
ES50134

REV *[Signature]*



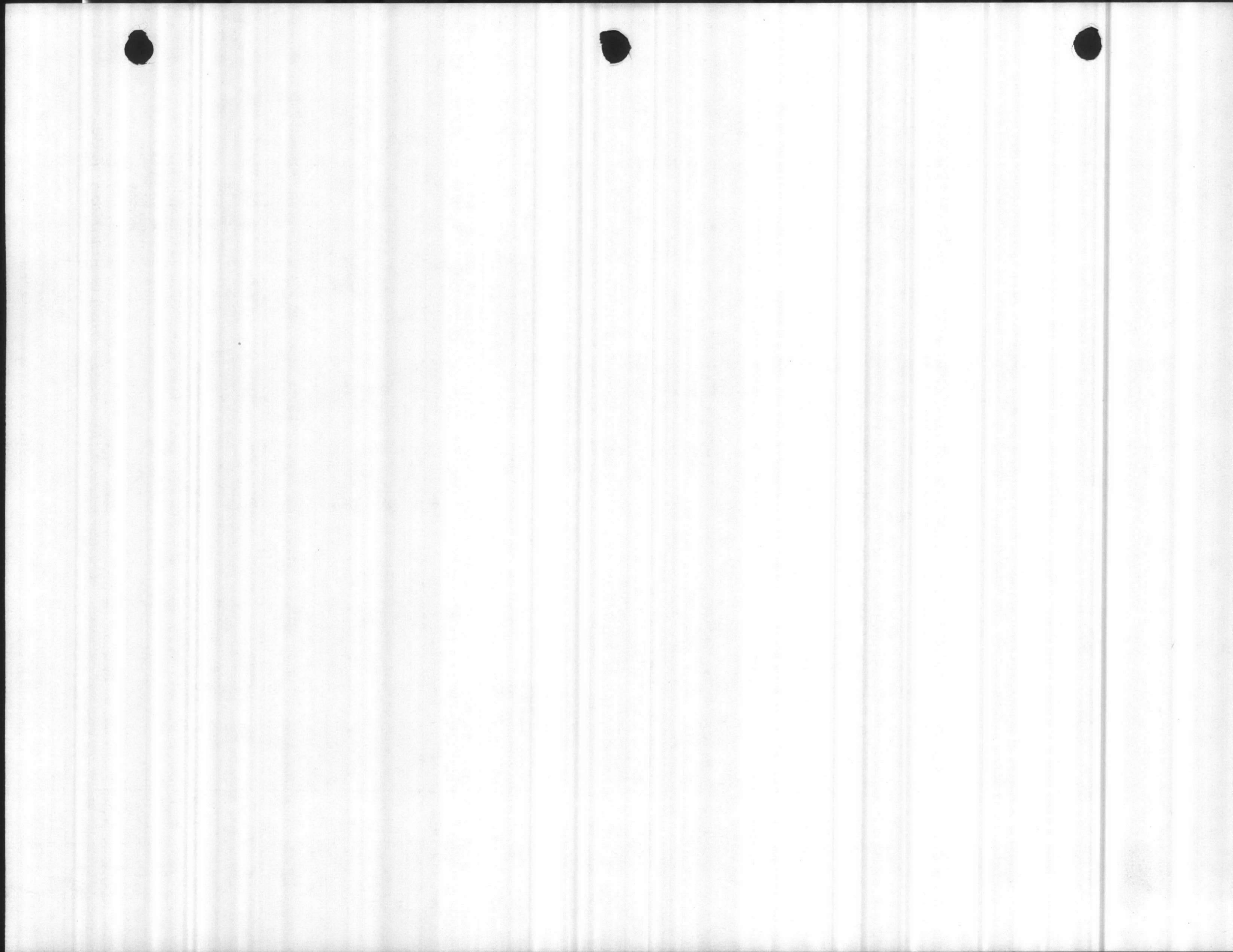
A B C D E F G H I J K L M N O P

REV.	CO. NO.	DATE	DESCRIPTION	CHK.	APP.
A			RELEASE		



TERMINAL 1 - TRANSDUCER, PLUS
 TERMINAL 2 - TRANSDUCER, MINUS
 TERMINAL 3 - CABLE SHIELD

TITLE: A1000 4-20 MA 2 WIRE-CONNECTION DIAGRAM		MATERIAL	
SHOP ORDER	JOB NAME	FINISH	
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107			
TOLERANCES: UNLESS OTHERWISE SPECIFIED: TWO PLACE DEC. ± .010, THREE PLACE DEC. ± .005, FRACTIONS ± 1/64. ANGULAR:	DO NOT SCALE	DESIGNED DATE	DRAWN R.L.W. CHECKED
DRAWING NO. IM00844			A





MODEL 9G DIRECT ACTING FLOAT SWITCH

Consolidated Electric Co.

RIVERVIEW INDUSTRIAL PARK 141 SOUTH LAFAYETTE FREEWAY ST. PAUL, MINNESOTA 55107 612/224-9474

APPLICATIONS:

- Sewage Lift Stations
- Storm Water Pumping Stations
- Water Reservoirs
- Process and Industries
- Waste Treatment Plants
- Alarms



The Consolidated Electric Company Bulletin B100, Model 9G Direct Acting Float Switch is a rugged, simple control device for the automatic operation of pumps, valves, or alarm systems in response to liquid level changes in sewage wet wells, sludge sumps, water reservoirs, process vats, etc. It is a single level sensing device that mounts at a fixed elevation and gives a closed or open contact in response to liquid level changes past the point of mounting. Inside the float housing is a mercury switch which is either normally-open or normally-closed when the float is in the normal or unoperated position.

Simplicity of mounting and lack of through-the-wall shafts with tape or rod linkages to the switching mechanism make it suitable for many difficult pump and valve control operations as well as alarm system uses. Even in liquids containing sanitary or process wastes, it will provide years of trouble-free operation responding to liquid level changes of less than one inch. The weight and buoyancy of the Model 9G Float are such that it will not ride up a large contaminant such as a cake of grease, but continues to

operate. Over fifteen years of successful field use in the tens-of-thousands, in applications ranging from clear water reservoirs to tanning and poultry waste, even sulfuric acid, have proven its reliability and ruggedness. Most frequently the Model 9G Float Switch is used in multiple for operation of pumps between selected liquid levels in both pump-up or pump-down applications.

FEATURES:

- Consistent Operation
- Simple and Reliable
- Easy Installation
- Long operating life
- High quality materials and components
- Diversity of uses

CONSTRUCTION

The 9G Float Switch consists of a 316 type stainless steel housing, mounting clamp, a flexible three-conductor cable with a synthetic rubber jacket and a mercury switch. The float housing is 5½ inches in diameter, with a stainless steel tube welded into its side and projecting into the float.

Inside the stainless steel tube is the mercury switch which is potted in epoxy. A dual circular crimp holds and permanently seals the switch assembly and cable securely to the stainless steel tube. The cable is 14 AWG with 105 strands per conductor made especially for underwater use and heavy flexing service. The mercury switch connects the black and white conductors of the cable. On all floats, the green conductor is an internal ground connection and **MUST BE RUN TO A SUITABLE EXTERNAL GROUND** connection in accordance with the National Electrical Code.

An additional synthetic rubber jacket acts as a hinge between the float and where the cable is held by the stationary clamp tube. The stainless steel tube clamp has an adapting fitting and two yokes for mounting on a vertical 1 inch pipe. Flexing and life tests indicate a life expectancy under normal operating conditions in lift station applications of 35 years.

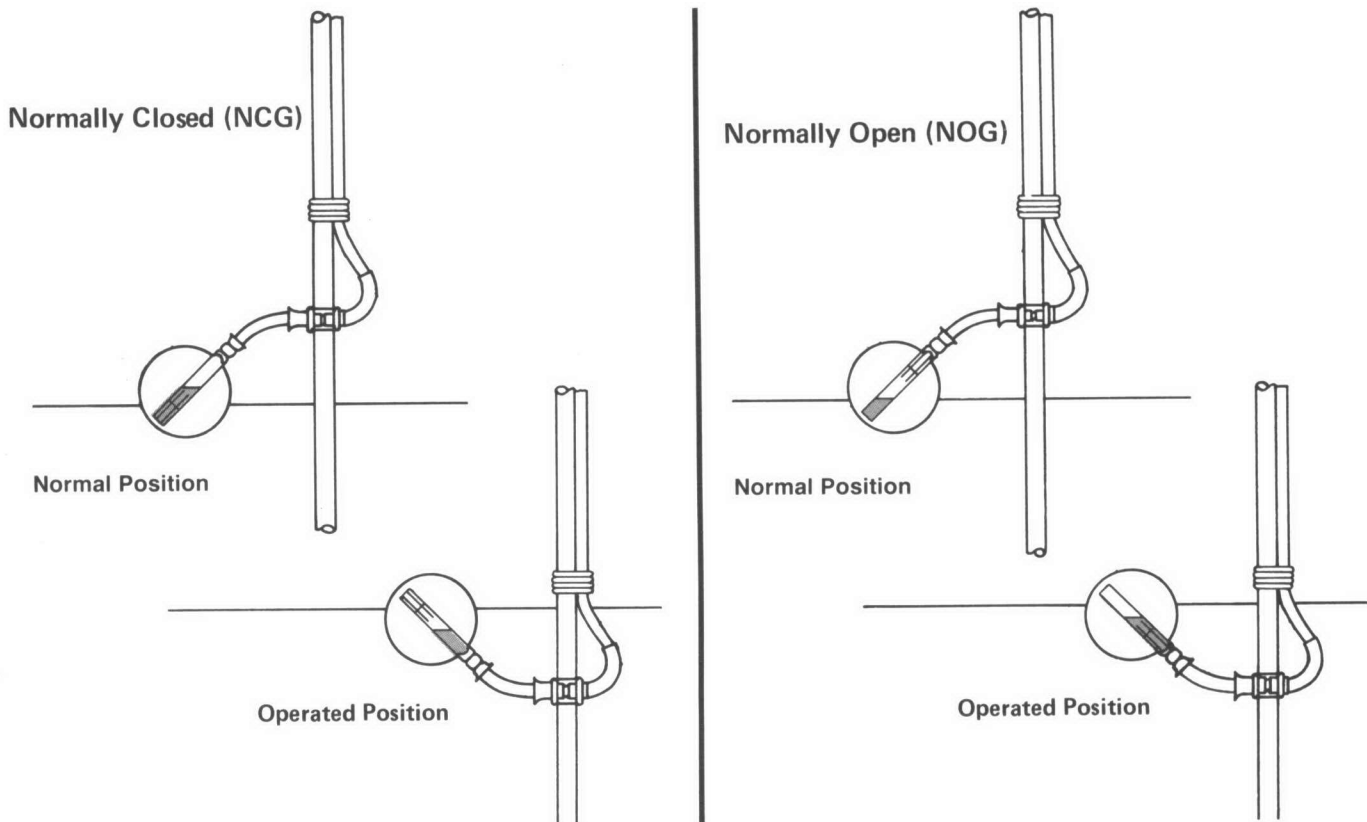
AUTOMATIC PUMP CONTROL

Automatic pump control of a single pump between two different operating levels requires three wire control, the use of a minimum of two floats, and a Consolidated Electric Bulletin B100, Model 29GR1 Single Pump Controller or equivalent control relay or magnetic motor starter.

A typical two pump sewage lift station control uses four floats and a Consolidated Electric B100, Model 29GR2 Pump Controller-Alternator as shown in Figure 1 for pump control and high level alarm.

Standard models of Consolidated Electric Company Bulletin B100, Model 29GR Pump Controllers that operate with the 9G Floats are available for the operation of one, two, or three pumps. Special pump controllers are available for the operation of any number of pumps. Controllers offer manual or automatic alternation, three-position "Hand-Off-Automatic" pump selector switches, and any type NEMA enclosure.

Standard Pump Controllers normally turn pumps on in order as 9G Float Switches successively operate by a rising or falling liquid level. All pumps turn off when the separate pump-off float operates. Normally-open float switches are used in pump-down applications and normally-closed are used in pump-up applications. Pump Controller options are available which will sequence the pumps in a selected program, provide well pump control into a reservoir and high service pump low level cut-out protection from the reservoir.



The mercury switch inside the Model 9G Float Switch will either open or close the switch contact when the liquid level rises as shown. Actual switching differential is less than one inch. The point of switch operation is when the liquid level passes the mounting elevation of the clamp.

LIFT STATION ALARM SYSTEM

Model 9G Float Switches readily adapt to local and remote alarm use for water or sewage level applications. They combine with telephone transmitters and receivers to link together any number of locations in a comprehensive alarm system to continuously monitor operation conditions.

Installation of a float switch in the dry-pit side of the lift station will detect a rising level due to pump packing or sump pump failure.

LOCAL MONITOR ALARM SYSTEM

For local visual alarm, 115 volt power from the lighting panel of the lift station is run through a Model 9G-NCG Float Switch mounted at a high level in the wet pit to operate a 230 volt monitor light outside the station. A passing patrol car or maintenance crew can observe the station status.

When the light is ON, it indicates AC power in the station, and the wet well level is not excessively high. With the light ON under normal conditions, the alarm is fail-safe. Using a 230 volt bulb on 115 volt service assures a long life.

CENTRAL MONITOR ALARM SYSTEM

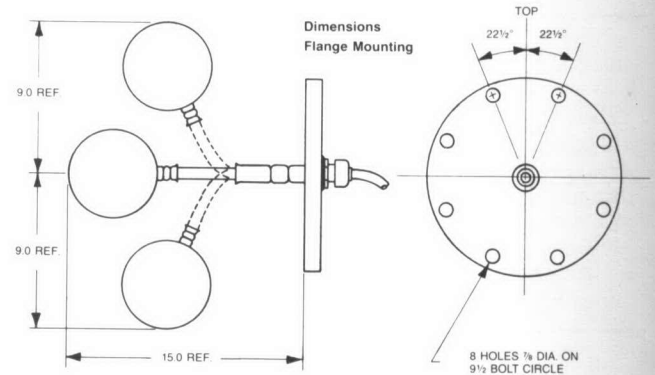
To monitor lift station operating conditions at a remote location, Consolidated Electric Bulletin G400 Central Monitor Alarm Systems using leased phone lines are available. There are different types of alarm and monitor systems to meet any requirement, each more comprehensive than the preceding. A single operator can monitor any number of remote lift stations around-the-clock, knowing immediately the operating status and of any malfunctioning equipment.

It is possible to intermix features of each type of monitor alarm system to meet individual requirements. The types of monitor alarm conditions the G400 will monitor include:

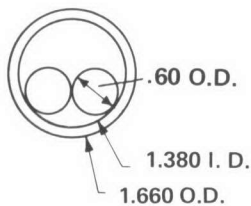
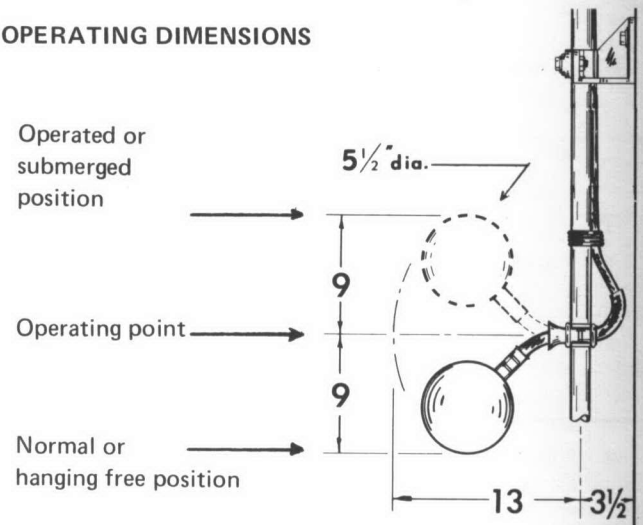
- AC power failure
- Loss of telephone communications
- High level in wet well
- Sump pump failure
- High level in pump chamber
- Pump Operation
- Wet well level
- Sewage Flow

FLANGE MOUNTING OPTION

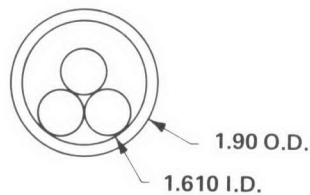
For use in pneumatic waste ejectors, hydro-pneumatic water tanks and similar applications needing a high pressure seal a flange mounting is available. The flange is one inch thick and the hole pattern for the eight bolts conforms to the American Standard for cast iron flanges, Class 125 (B16. 1-1948). Pressure rating is in the 125 pound class which rates the float for 175 pounds PSIG cold water, oil, or gas, non-shock. In an ejector, the Model 9G Float Switch would initiate a blow-down cycle of the chamber upon sensing a high level. Then the appropriate controls operate the air compressor or solenoid valve on a timed basis to effect the pneumatic removal of the chamber contents.



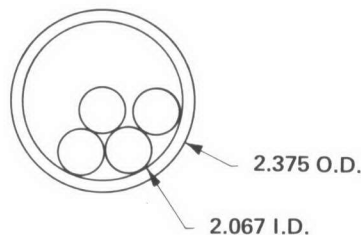
OPERATING DIMENSIONS



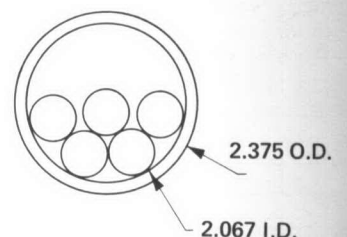
1 1/4 Inch Pipe



1 1/2 Inch Pipe



2 Inch Pipe



2 Inch Pipe

TYPICAL INSTALLATION FOR AUTOMATIC CONTROL OF SEWAGE LIFT STATION WET WELL

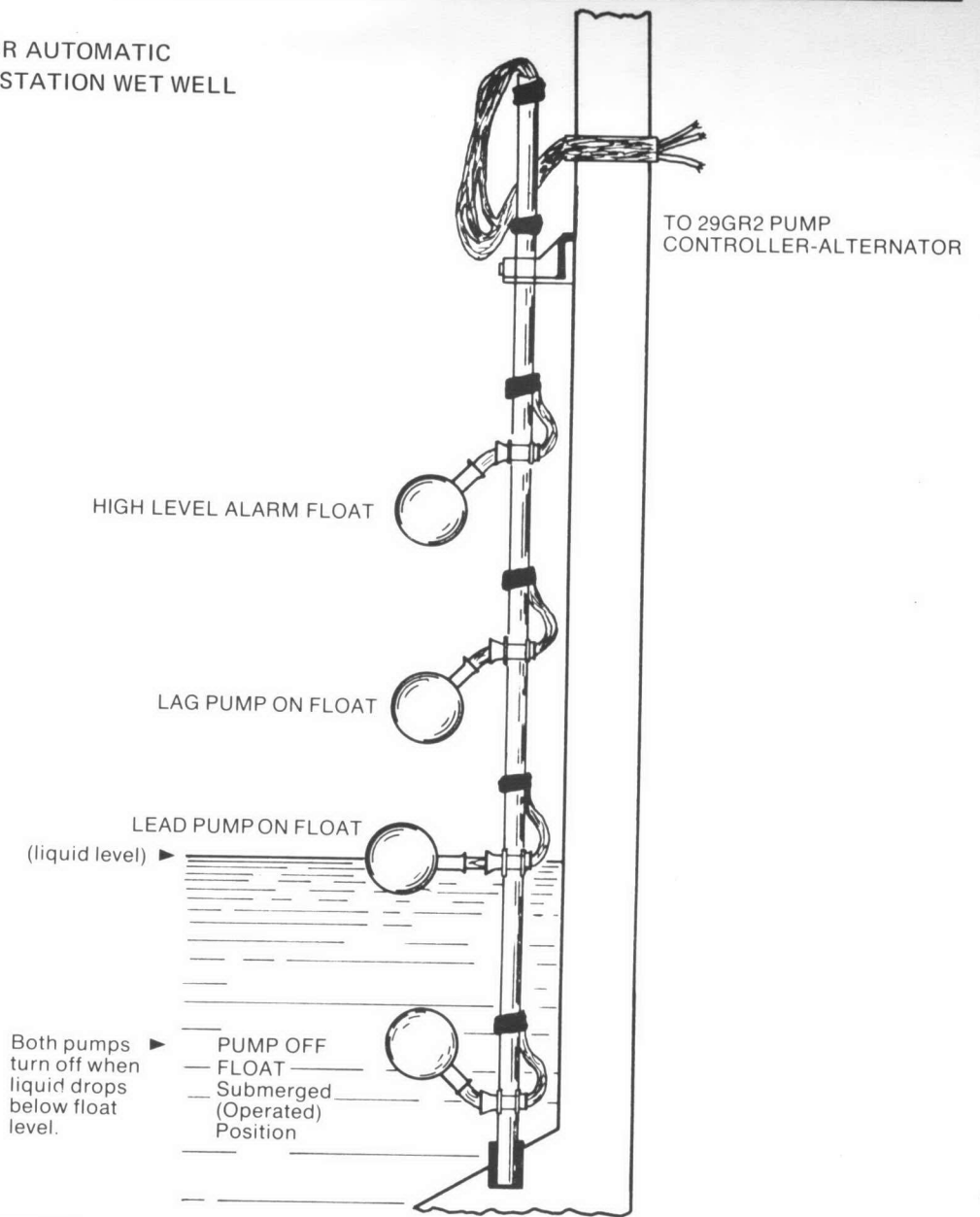
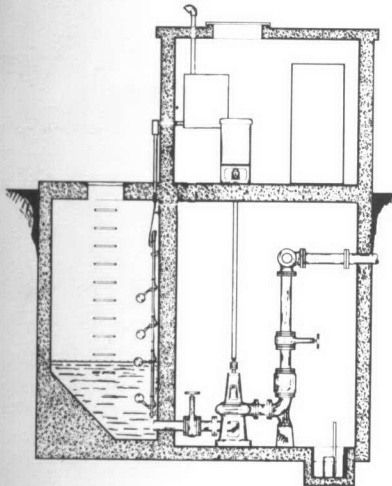


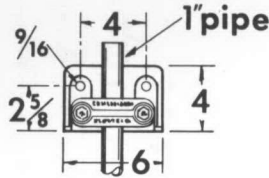
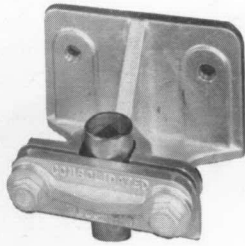
Figure 1



A typical application for the Model 9G Float Switch is for automatic control of pumps and high level alarm in sewage lift stations.

ACCESSORIES

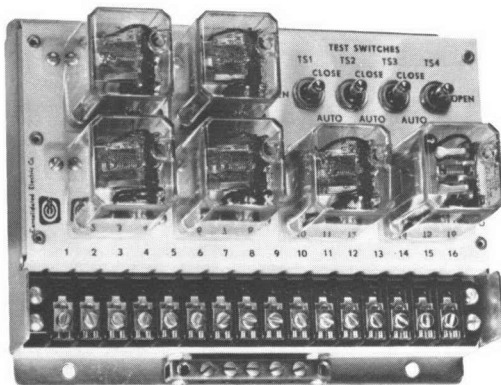
Accessories available for the Model 9G Float Switch include:



Model 9G-CL1 Pipe Mounting Clamp. This clamp positions and secures the vertical one inch float mounting pipe.



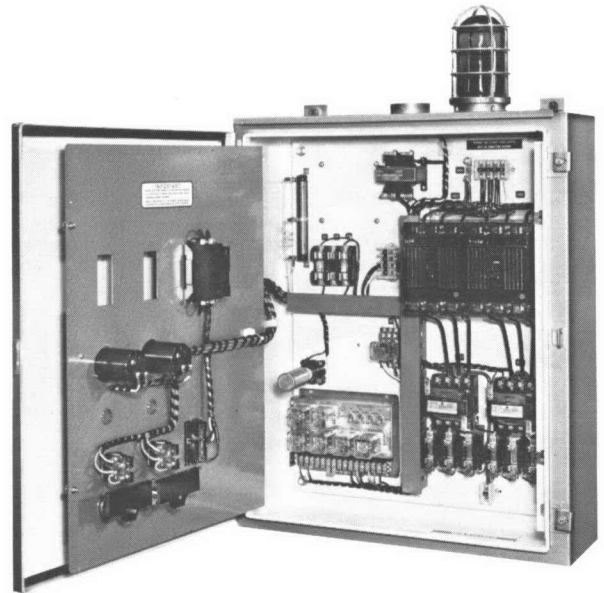
Model 9G-JCT1 Junction Box. A cast aluminum, NEMA 4 junction box for termination of floats and submersible pump motor cables in a wet well or water reservoir. Allows conventional wiring and conduit to be run from the junction box to a control panel. Has barrier type terminal blocks for eight control circuits, six power circuits (up to 75 Amps), and a seven lug grounding bar. Terminal blocks hold up to 4 AWG size wire. Accepts sealing fittings furnished with each Model 9G Float Switch.



Model 29GR Pump Controllers. A family of standard pump controllers for automatic control of one, two, or three pumps. The two and three pump models offer automatic pump alternation. Available in open construction, in various NEMA enclosures, or as part of a Powerpack Panel. (Model 29GR2 shown).



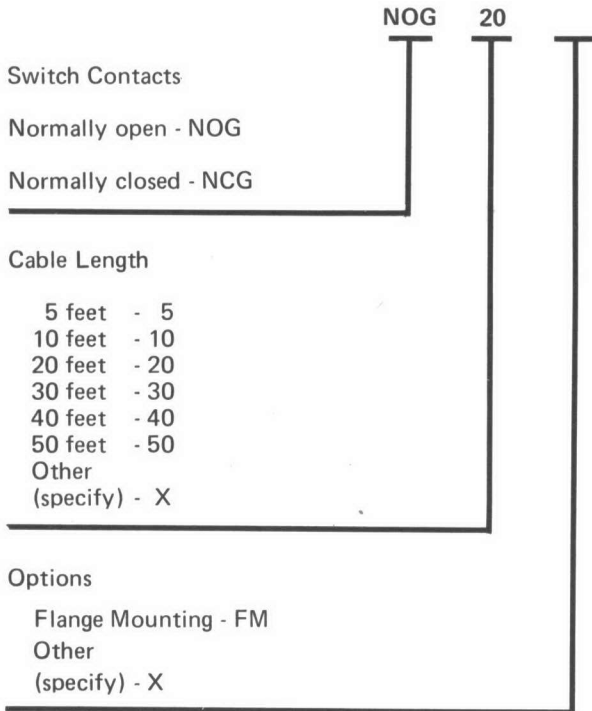
Model G400 Central Monitor Alarm Systems. A modular family of central monitor alarm stations that monitor any number of remote locations for various operating and alarm conditions.



Powerpack Panels. A standard family of panels for the automatic control of one, or two or three pumps. Available in various NEMA enclosures. Provides a complete comprehensive electric package for automatic pump control including motor control and alarm components and accessories.

HOW TO ORDER

Model 9G Direct Acting Float Switch



SPECIFICATIONS

ELECTRICAL

Load Contacts

RESISTIVE LOAD	30 Volts	115 Volts	230 Volts
AC	30 Amp.	20 Amp.	10 Amp.
DC	30 Amp.	12 Amp.	6 Amp.

MOTOR LOAD	115 Volts	230 Volts	AC LAMP LOAD
AC	.5 HP	.5 HP	1000 Watts
DC	.25 HP	.25 HP	1000 Watts

MECHANICAL

Weight: 6.5 lbs. (with 20 foot cable)
Cable Diameter: 5/8 inch
Shipping Weight: 8.5 lbs.

ENVIRONMENTAL DATA

Operating Temperature: 0° to +180°F.

TYPICAL SPECIFICATION

A Bulletin B100, Model 9G Direct Acting Float Switch shall be furnished to automatically detect liquid level change(s). A liquid rise of one inch from the rest position shall operate the float switch and reset will occur when the liquid level drops one inch. Mounting will be to a one inch vertical pipe.

This float switch shall be as manufactured by Consolidated Electric Company of Saint Paul, Minnesota. Installation shall be in accordance with project plans and manufacturer's instructions.

The float switch shall consist of a 316 type stainless steel housing 5½ inches in diameter, mounting clamp, a flexible three-conductor cable with a synthetic rubber jacket and a mercury switch. Inside the float housing will be a _____ (normally open/closed) mercury switch potted in epoxy. The electrical load for the switch contacts will be _____ (30/115/230 volts DC/AC) into a _____ (inductive/resistive) load.

The three-conductor cable shall be 14 AWG with 105 strands per conductor made for heavy flexing service and underwater use. Cable length shall be _____ (5/10/20/30/40/50 feet or other length). A green grounding wire will connect internally to the float housing.

Weight and buoyancy shall be such that contaminants like a cake of grease will not result in the float switch changing operating level more than one inch. Life expectancy under normal operation conditions in lift station applications shall be 35 years.

Operating temperature range shall be 0° to +180°F.

A complete line of accessories shall be available which will include: cable clamps, junction boxes, pump controllers for 1, 2, and 3 pumps, central monitor alarm systems, and Powerpack panels.

(Optional-) It shall have a Flange Mounting with eight bolts conforming to the American Standard for cast iron flanges, Class 125 (B16, 1-1948) with a pressure rating in the 125 pound class.

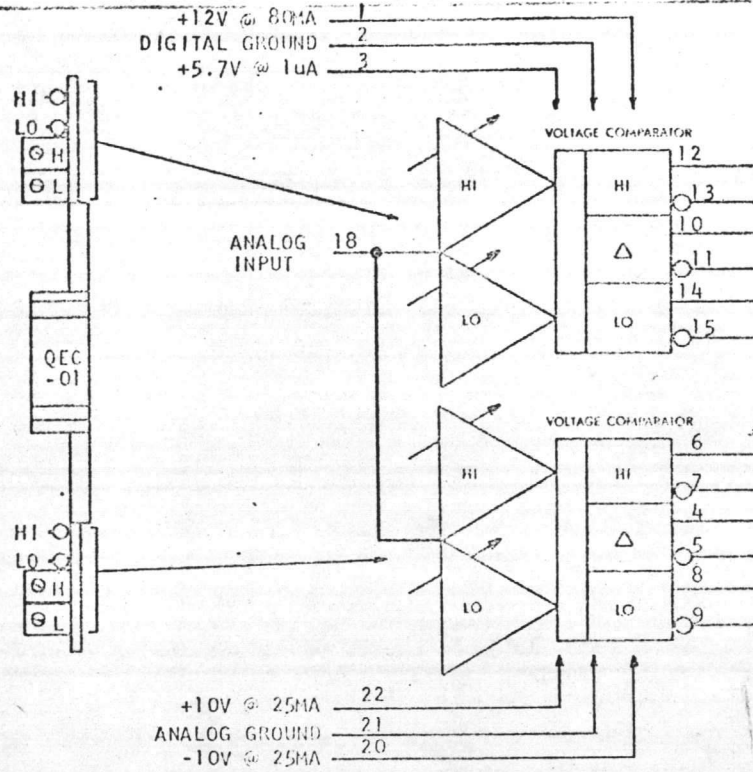
Specifications subject to change without notice.



Consolidated Electric Co.

RIVERVIEW INDUSTRIAL PARK
141 SOUTH LAFAYETTE FREEWAY
ST. PAUL, MINN. 55107 612/224-9474





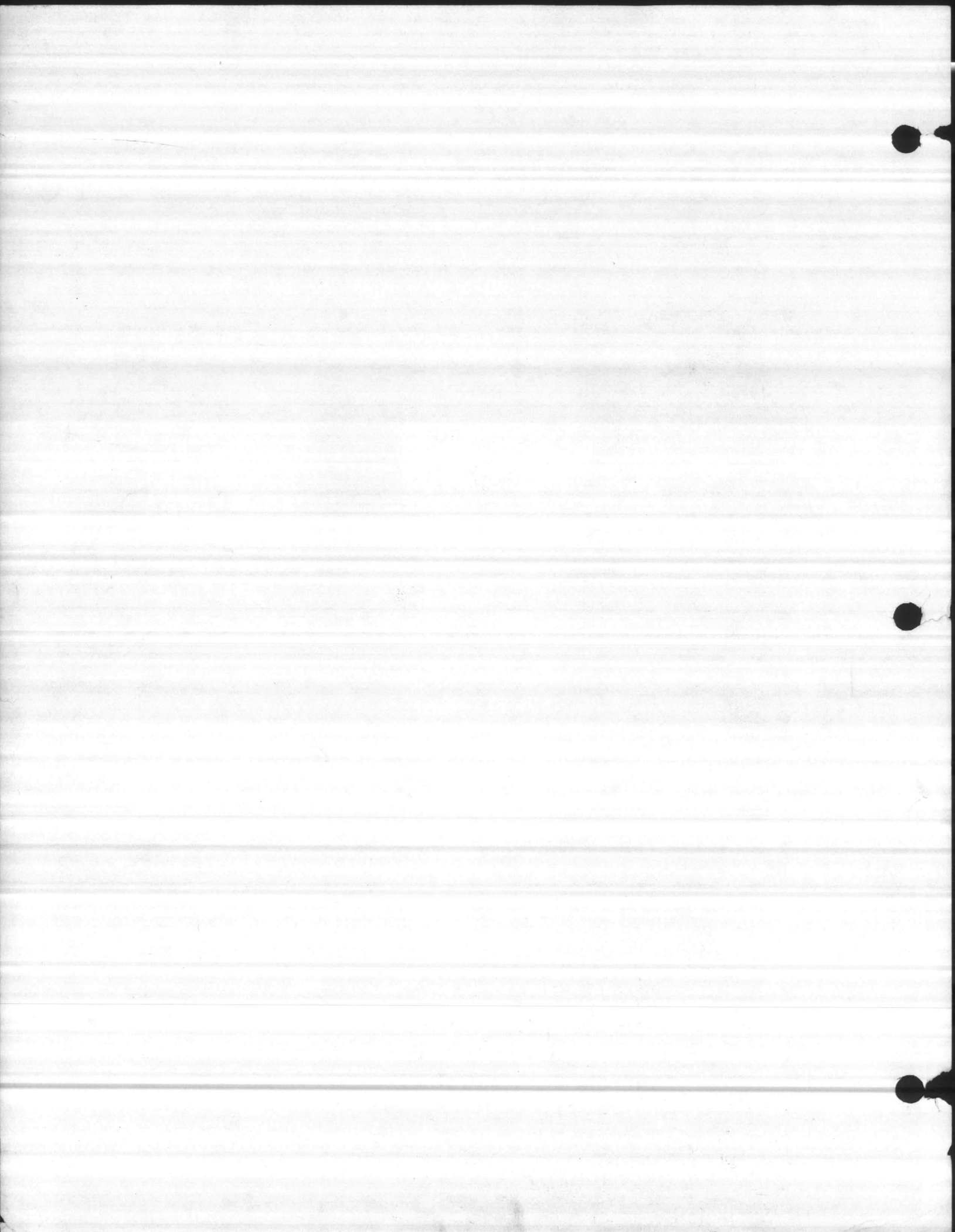
TITLE TECHNICAL DATA
QEC-01 600063-01

DRAWN DESIGNED
DGL

CONSOLIDATED ELECTRIC COMPANY
141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107

CHECKED PG-L
PAGE 3 OF 3

DRAWING NO
ES50065



QEC-01, QUAD VOLTAGE COMPARATOR

SCHMATIC ASSEMBLY

QEC-01 900177-01 600063-01

Four Voltage Comparators with one Input adjustable and the other connected to the card's Analog Input. The comparators have complimentary logic outputs.

The Comparators are divided into two pairs and are connected to two flip-flop circuits. With the direct logic outputs the card can produce Low and High alarm signals or similar non-differential outputs. And with the flip-flop outputs, it can produce pump control or similar outputs.

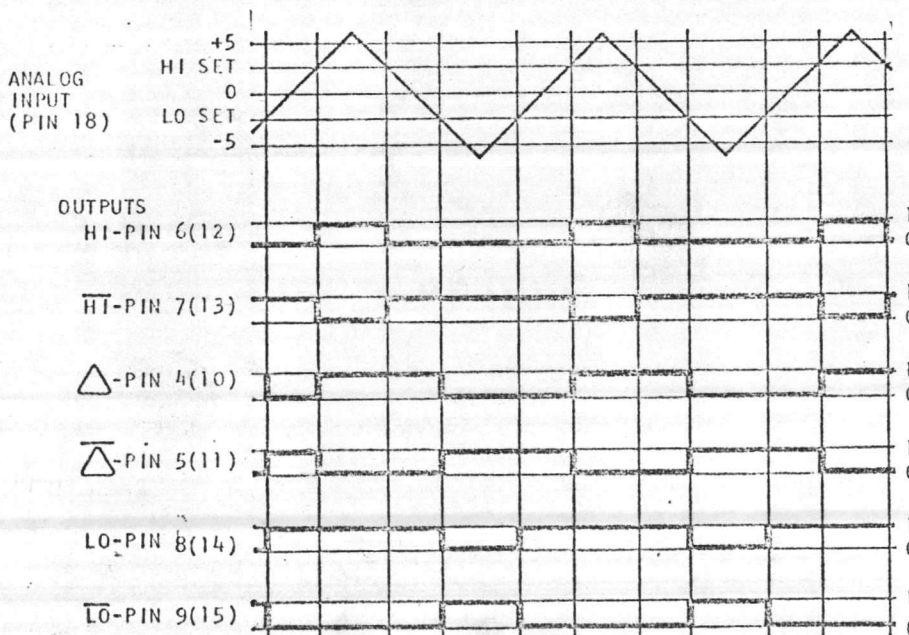
The Differential (flip-flop) output is set to one state by one comparator in the pair and reset by the other comparator in the pair. By proper adjustment of the two comparators one can start a pump at one level of pressure and stop it at another.

The adjustable input to each comparator is adjustable through the entire dynamic range of Cecotronic systems - -5 volts to +5 volts. Hysteresis of each comparator is less than .5% of total dynamic range.

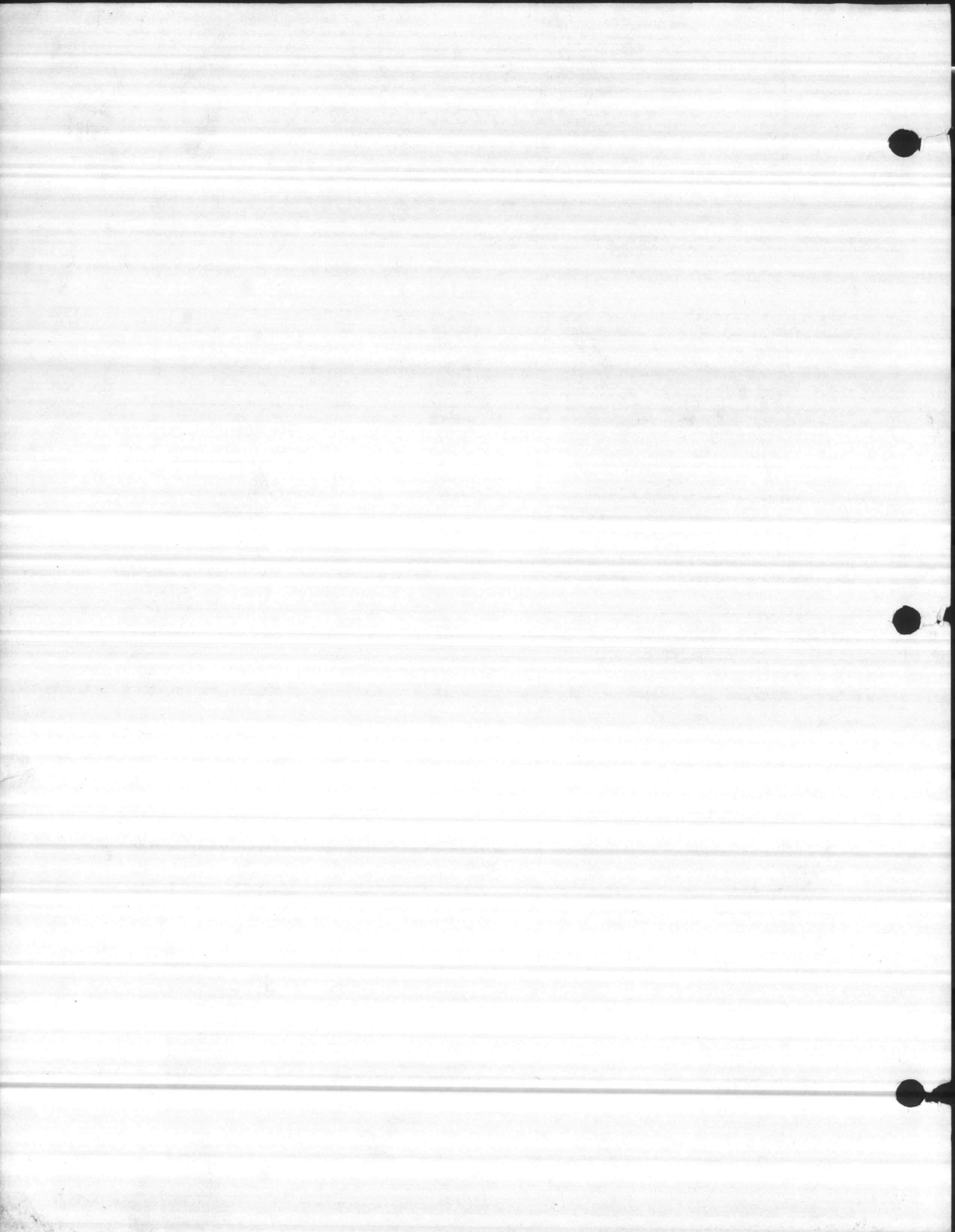
All outputs are Open Collector transistors (which switch to digital ground) with a maximum output voltage (logic 1) of +30 VDC and a maximum output current (logic 0) of 40 MA. Logic 1 is defined as the state when the output transistor not saturated. Logic 0 is defined as the state when the transistor is saturated, and capable of drawing current from a positive source.

The Indicators on the front edge of the card indicate when the set point comparators have been exceeded by the input analog signal. The "HI" indicator comes on when the signal is higher (more positive) than the "HI" adjustment. The "LO" indicator comes on when the signal is lower (more negative) than the "LO" adjustment.

TITLE: TECHNICAL DATA QEC-01 600063-01		DRAWN	DESIGNED		
			DGL		
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED	PAGE	DRAWING NO	REV
		DGL	1 OF 3	ES50065	A




TITLE: TECHNICAL DATA QEC-01 600063-01		DRAWN	DESIGNED		
			DGL		
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED	PAGE	DRAWING NO	REV
		DG-L	2 OF 3	ES50065	A



In the majority of cases the simplest way of performing this adjustment, with the situation previously explained, is to fill the tank and monitor the analog signal present at the analog test point on the SEA-04 card. Refer to Figure 1. With the tank full, the depth of submergence of the transducer can be varied until +5 volts D.C. is obtained at the analog test point found on the SEA-04 card. Then, with the transducer locked in place the fine adjustment potentiometer found on the SEA-04 card can be adjusted for exactly +5 volts D.C. at the analog test point. A digital voltmeter with an accuracy of at least three times that of the measuring system to be adjusted should be used for monitoring the analog signal voltage.

Offset Adjustment, 158 G Transducer

The offset adjustment on the 158G Transducer is normally made by filling the tank it is measuring. The coarse offset adjust is a mechanical adjustment found inside the 158G Transducer. By removing the blue R.F. shield from the transducer a knurled adjustment wheel will be found in the upper left hand corner of the transducer. By loosening the two locking screws on the linear variable displacement transformer coil mounting block, the coil can be shifted up or down by turning the knurled adjusting wheel. Refer to Figure 2. With the elevated tank full and monitoring the analog signal at the analog test point found on the SEA-04 card, the knurled adjustment wheel is adjusted for +5 volt D.C. The locking screws on the LVDT coil mounting block should now be tightened. Then, with the fine offset adjustment potentiometer found on the SEA-04 card adjust for exactly +5 volts D.C. A digital voltmeter with an accuracy of at least three times that of the measuring system to be adjusted, should be used for monitoring the analog signal voltage.

TITLE: CECOTRONIC TRANSDUCERS		DRAWN	DESIGNED DGL.	
 CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED	PAGE 5 OF 5	DRAWING NO IM00291.-
				FLV A



SEA-04, SINGLE VOLTAGE AMPLIFIER

SHEMATIC ASSEMBLY
SEA-04 900186-01 600062-01

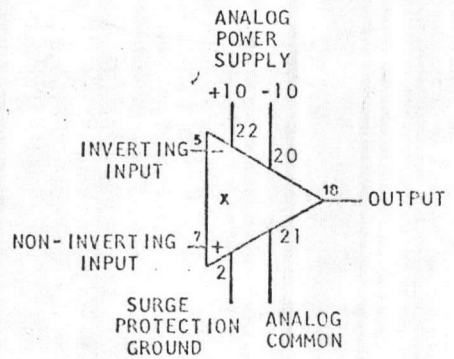
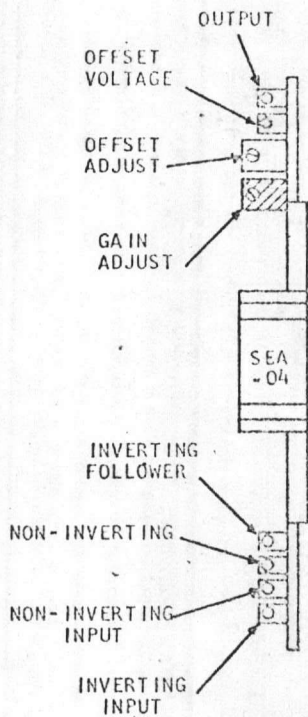
A differential amplifier designed to provide a calibratable input to Cecotronic systems.

Its gain is selected and adjusted for each individual application. The offset is adjustable + or -50 mv, as measured at the offset voltage test point. It is amplified by the selected gain of the unit.

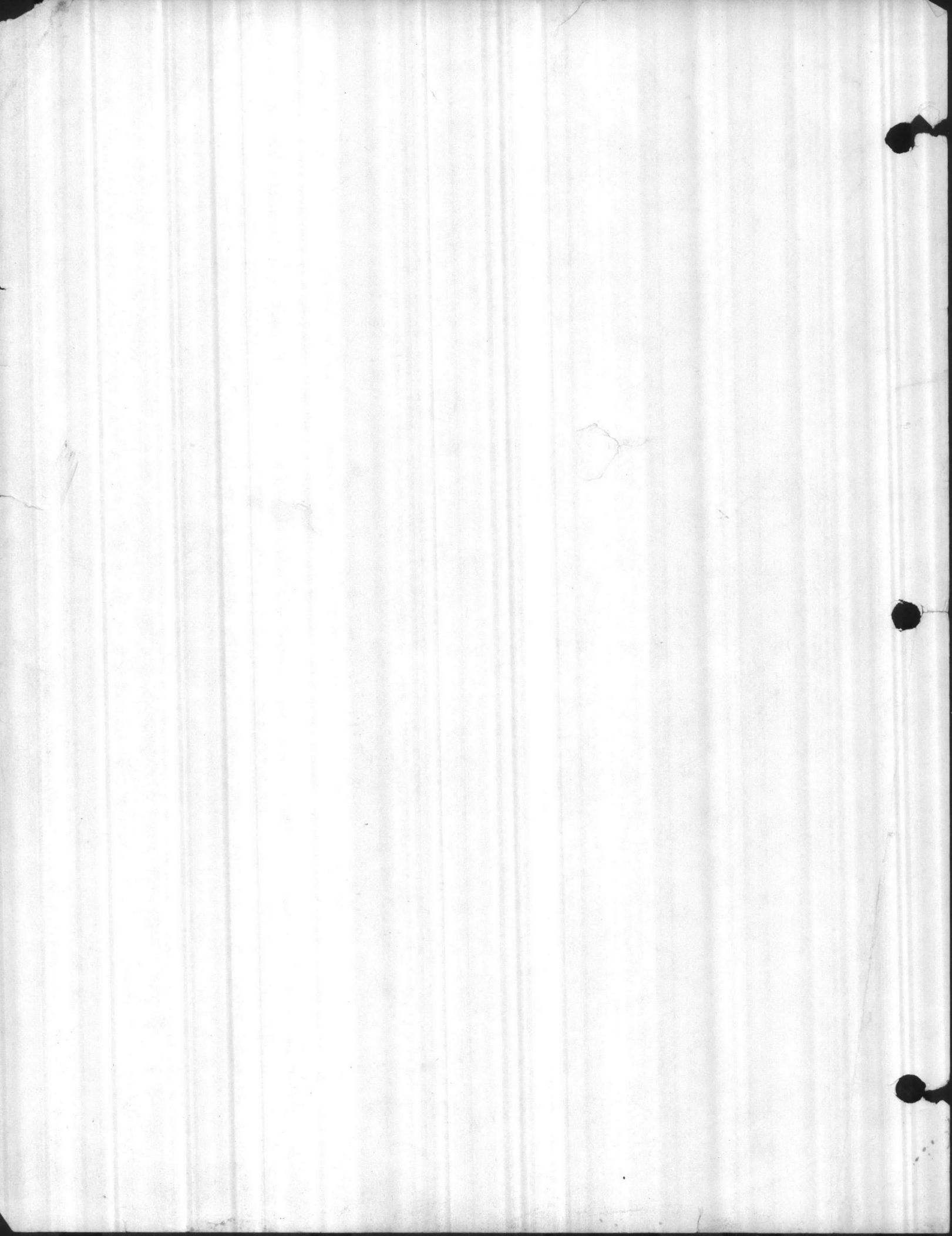
The two inputs are protected by Zener diodes, which will absorb large amounts of current, to prevent damage to the input amplifier I.C.'s. For proper operation of the protection circuit, Pin 2 must be grounded.

The amplifier requires + and - 10VDC for operation. The amplifier's offset, and thus accuracy, is dependent upon the accuracy of the 10 volt power supply. +10 input is on Pin 22, -10 input is on Pin 20. Pin 21 is common to the two supplies and also serves as common for the analog output.

TITLE: TECHNICAL DATA SEA-04 P/N 600062-01		DRAWN	DESIGNED	
			DGL	
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED DGL	PAGE 1 OF 2	DRAWING NO ES50063
				REV A



TITLE: TECHNICAL DATA SEA-04 P/N 600062-01		DRAWN	DESIGNED	
			DGL	
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED DGL	PAGE 2 OF 2	DRAWING NO ES50063
				REV A



INTRODUCTION


The transducer is the heart of any analog control or monitoring system. The transducer transforms the quantity being measured into an electrical signal commonly referred to as the "analog signal". An analog signal is a parallel representation of a measurable quantity such as a tank level, pressure, flow, etc. The output signal of a transducer is normally a low level D.C. analog signal or a current signal depending on the type transducer used.

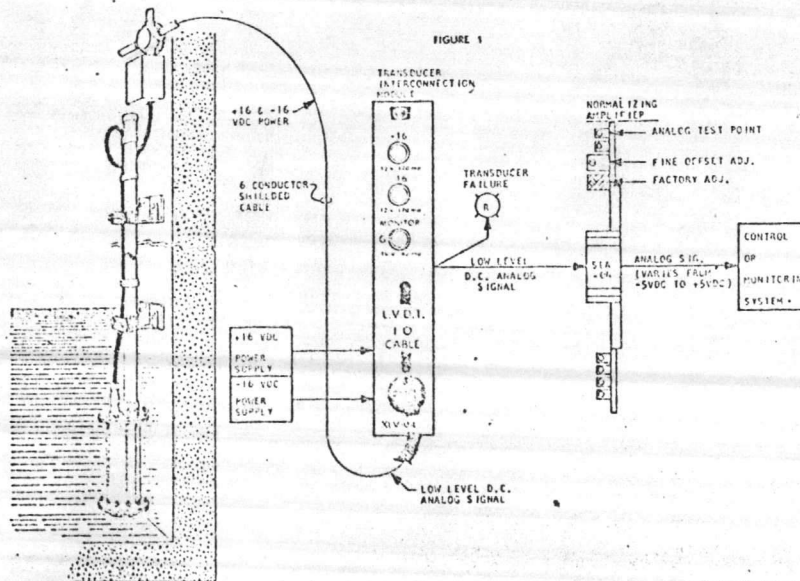
DESCRIPTION OF OPERATION


Submersible Type, Model 157 GT

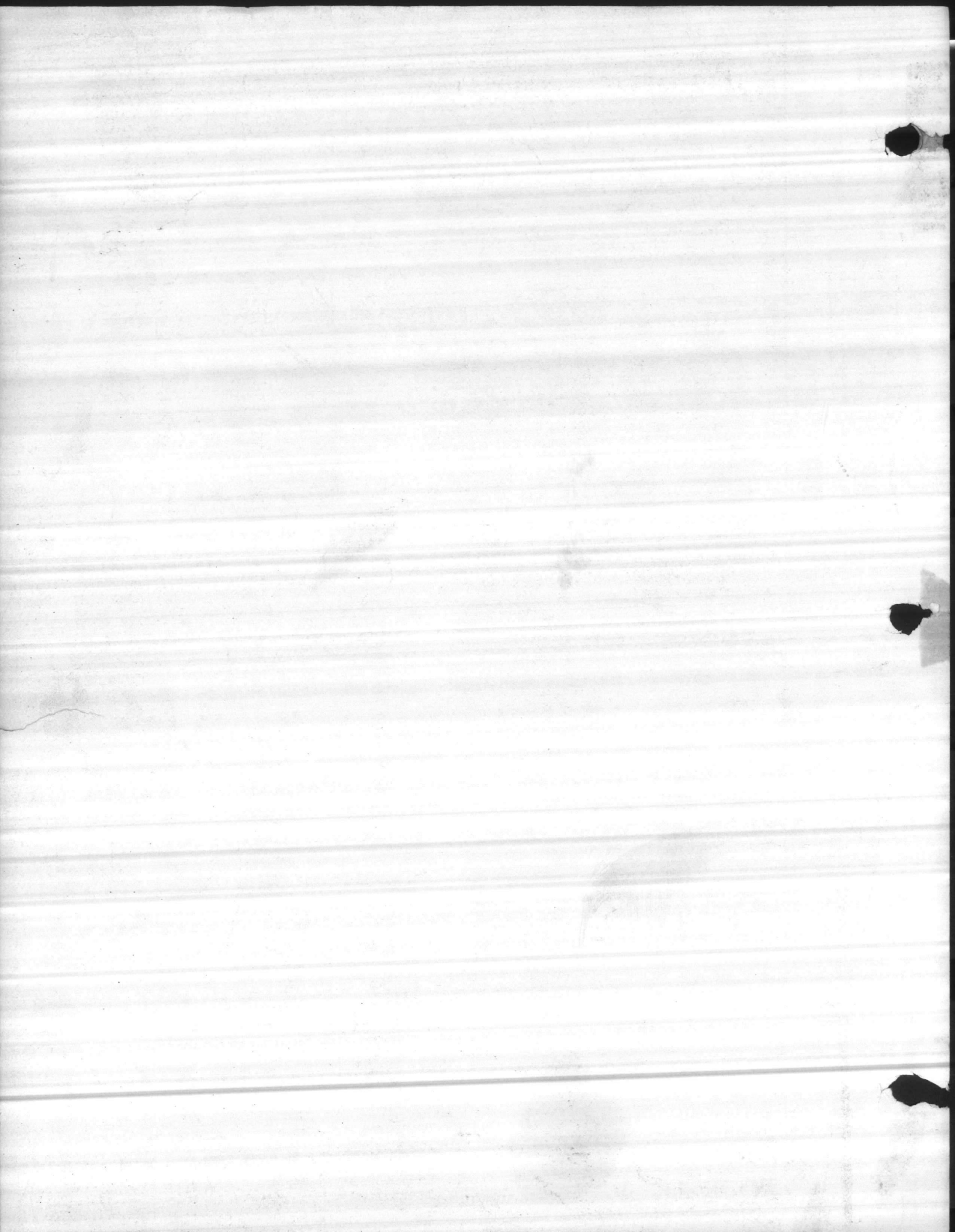
The submersible transducer continually senses the head pressure at its depth or submergence and converts this variable pressure into an analog signal. The components inside the transducer include a linear variable displacement transformer and core, a precision pressure sensing capsule, and associated electronics.

Refer to Figure 1. Power is supplied to the transducer via the Transducer Interconnection Module. Contained on the front of the XLV-04 module are two clear lamps labeled "+16" and "-16". These lamps are in series with the supplied power to the transducer. The normal operating current of the transducer is approximately 40 milliamps on the +16 volt supply and 30 milliamps on the -16 volt supply. The lamps are of a high current type so the normal operating currents cause only partial illumination of the lamps. With normal operating currents flowing through the lamps the +16 lamp will have a dim glow and the -16 volt lamp will have a very dim glow. If for any reason the transducer and its connecting cable would provide a low impedance path to ground for either of the supplies, as in the case of a short circuit, the corresponding lamp would come to full brilliance. Therefore, these lamps serve as both a monitor and a fault indicator, while providing short circuit protection to the connected power supplies. Also found on the front of

TITLE: CECOTRONIC TRANSDUCERS		DRAWN	DESIGNED		
			DGL		
 CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107	CHECKED	PAGE 1 OF 5	DRAWING NO	REV	
			HM00291	A	



TITLE: CECOTRONIC TRANSDUCERS		DRAWN	DESIGNED		
			DGL		
 CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107	CHECKED	PAGE 2 OF 5	DRAWING NO	REV	
			HM00291	A	



the XLV-04 module is a green monitor lamp. The transducer contains logic circuitry to detect a transducer failure. If a transducer failure has occurred, the green monitor lamp will go out. During normal operation of the transducer the green monitor light should be on. Also contained in the XLV-04 module is circuitry to provide a logic level output of the "Transducer Failure" data. The low level D.C. analog signal is received by the XLV-04 module and sent unchanged to the SEA-04 card titled Normalizing Amplifier. The Normalizing Amplifier amplifies the low level D.C. analog signal to the standard analog signal which is +5 volts D.C. to -5 Volts D.C. The fine offset adjustment potentiometer and a convenient analog test point are also found on the normalizing amplifier. The analog signal is then sent on to the control or monitoring system.

Non-Submersible Type, Model 158 G

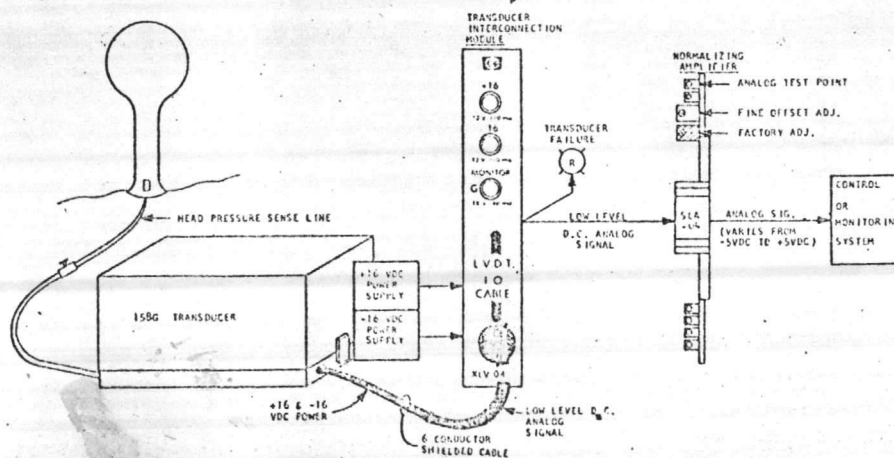
The 158G Transducer is normally used to sense the head pressure of an elevated tank. It contains a precision Bourdon tube to position the core of a linear variable displacement transformer. The 158G Transducer differs only in physical make-up to the 157GT Transducer. Refer to Figure 2. The circuitry and signal flow are identical to the 157GT Transducer.

Offset Adjustment, 157 GT Transducer

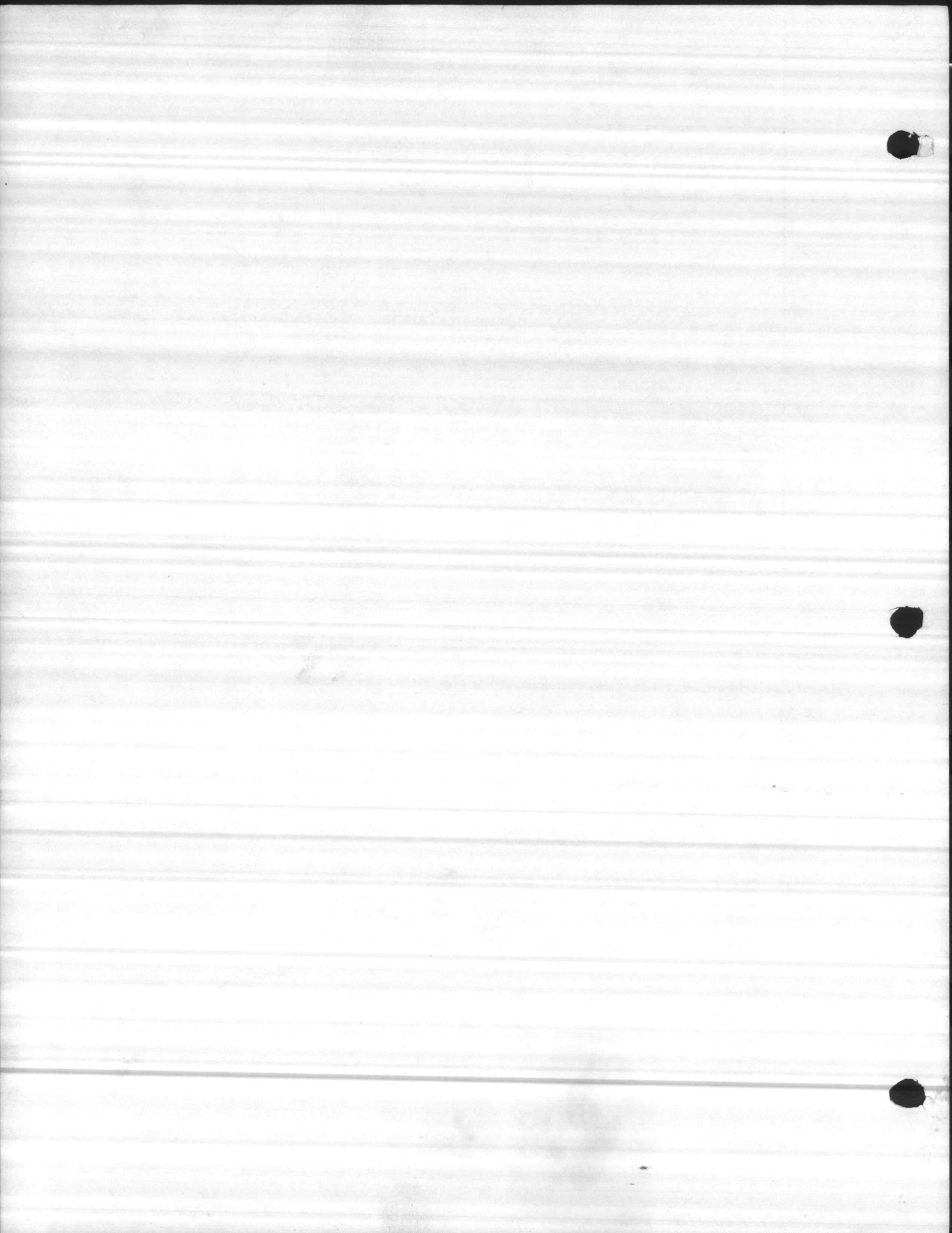
The only field adjustment normally required on the 157GT Transducer is the offset adjustment. A practical application of this adjustment would be the example where a submersible sensor calibrated for 20 feet of water is used to measure a tank that is 21 feet deep. Normally the bottom foot in the tank would be ignored and therefore the transducer would be mounted one foot off the bottom of the tank.

TITLE: CECOTRONIC TRANSDUCERS		DRAWN	DESIGNED		
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED	DGL	DRAWING NO	REV
			3 PAGE 5 OF	1M00291	A

FIGURE 2



TITLE: CECOTRONIC TRANSDUCERS		DRAWN	DESIGNED		
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED	DGL	DRAWING NO	REV
			4 PAGE 5 OF	1M00291	A



INTRODUCTION

The Cecotronic Pulse Width Modulation System, P.W.M. System is used whenever an analog signal must be sent from a remote location to a central location. The distance involved which constitutes the use of a P.W.M. System is normally a couple hundred feet up to approximately five miles. In order to accurately transfer analog information, the data must be transformed into data which is not affected by phone line resistance. The analog data is in the form of a small D.C. voltage which is continuously variable from minus 5 volts D.C. to plus 5 volts D.C. The Pulse Width Modulation System transforms this small D.C. voltage into a continuously variable pulse duration signal which makes it possible to transmit the information accurately. When the data is received the pulse duration signal is then transformed back into a D.C. analog signal. An accuracy loss of less than .1 percent is easily obtained with this system.

DESCRIPTION OF OPERATION, TRANSMITTER

Refer to Figure 1. The analog signal is sent to the XPW-14 card titled Modulator. This card transforms the variable analog signal into a pulse train whose duration is continuously variable from .1 second to .9 seconds. (These durations refer to the positive pulse). The output of the XPW-14 card is a pulse train whose repetition rate is approximately one cycle per second and whose positive duration is dependent on the analog signal applied to the input. The XPW-14 card also contains provisions for placing it in a calibration mode. The small button switch located on the bottom of the XPW-14 card enables the operator to place the system in the calibrate mode. The calibration switch directly above the calibration mode switch allows the operator to send any of three accurate calibration signals.

TITLE: CECOTRONIC PULSE WIDTH MODULATION SYSTEM		DRAWN	DESIGNED	
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED	DGL	
		1	PAGE OF 6	DRAWING NO IM00290
				REV A

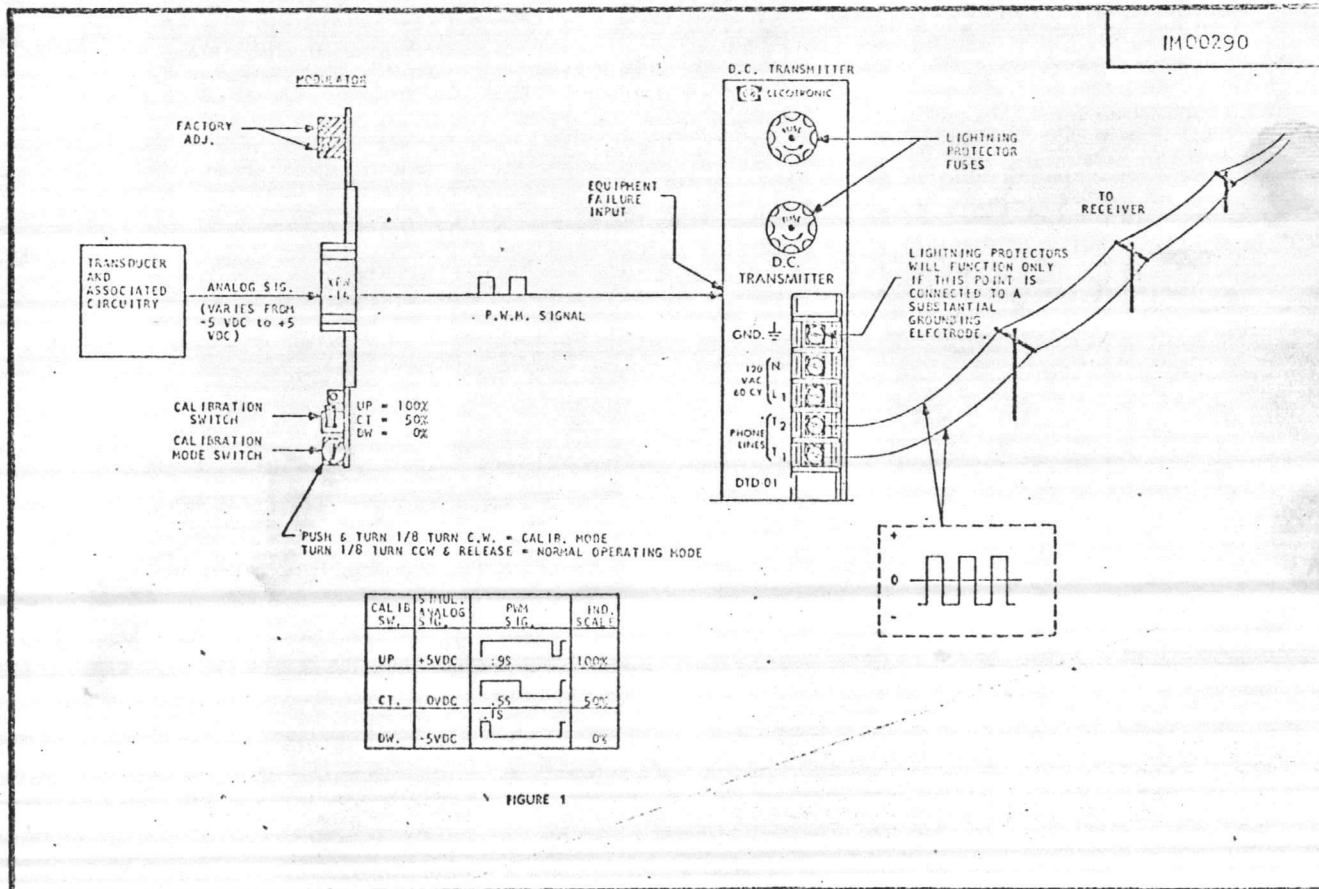
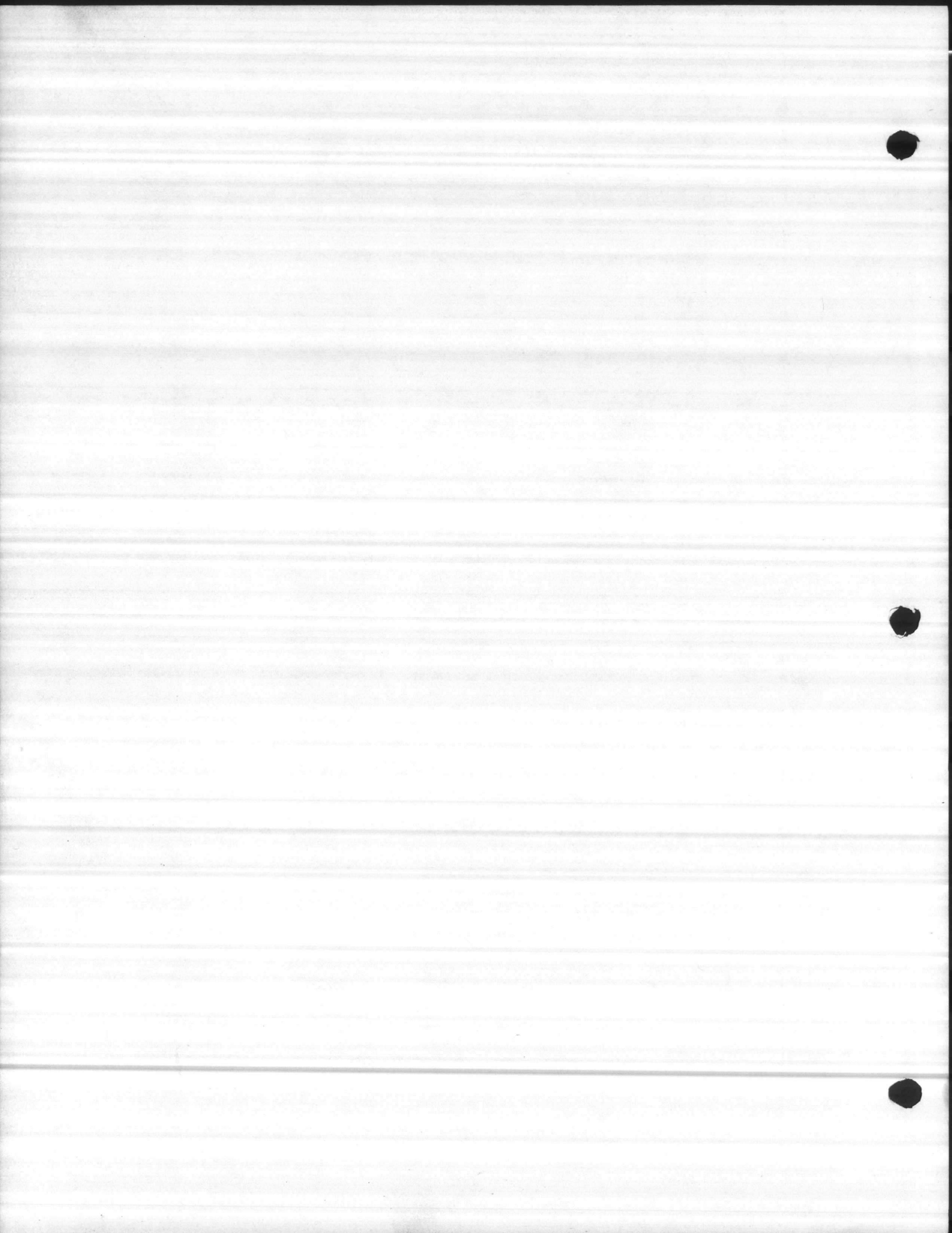
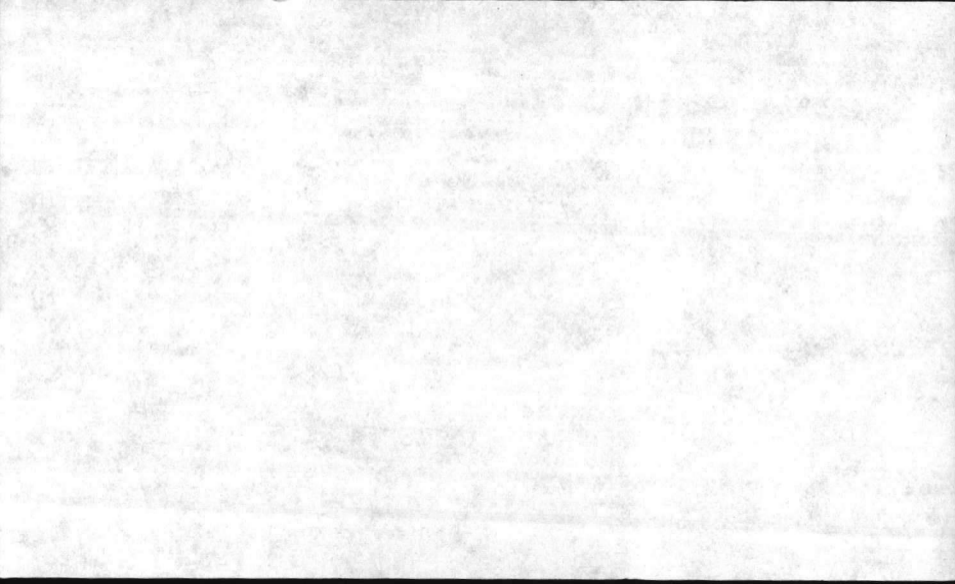
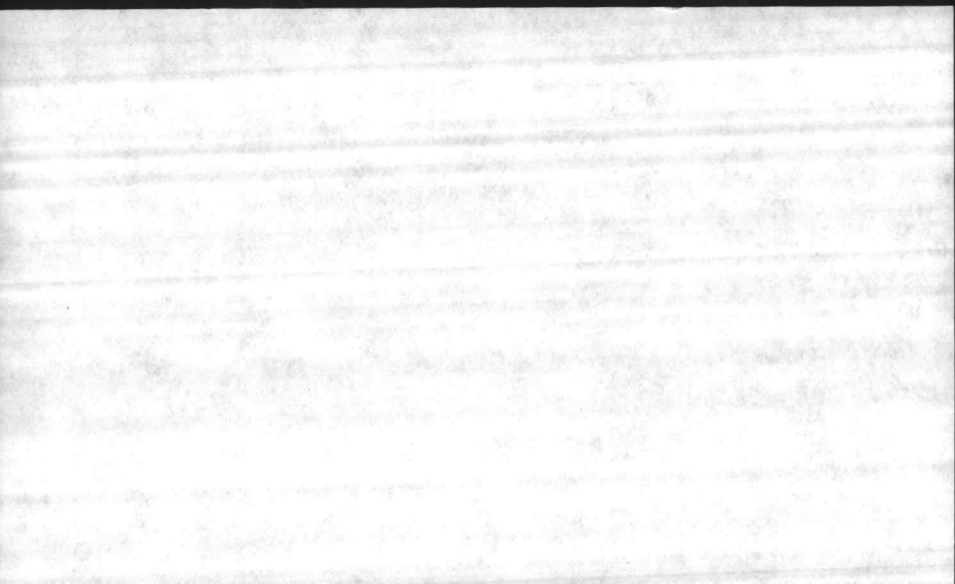


FIGURE 1

TITLE: CECOTRONIC PULSE WIDTH MODULATION SYSTEM		DRAWN	DESIGNED	
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED	DGL	
		2	PAGE OF 6	DRAWING NO IM00290
				REV A







The logic level PWM signal is then applied to the D.C. Transmitter module. The D.C. Transmitter conditions the PWM signal for transmission onto the phone line. The conditioning in the D.C. Transmitter includes increasing of the amplitude, isolation, and allowing its excursion to be both a negative and a positive voltage. The duration of the pulse is unchanged. Also applied to the D.C. Transmitter module is the equipment failure input. When an equipment failure has occurred, the D.C. Transmitter inhibits the negative portion of the pulse. With this situation, the analog signal is still received as the analog information is contained in the positive portion of the pulse. Also contained in the D.C. Transmitter module is the phone line protection circuitry.

DESCRIPTION OF OPERATION, RECEIVER

Refer to Figure 2. The PWM signal is received by the D.C. Receiver module. The D.C. Receiver contains a Mark and Space indicator light. The Mark light corresponds to a positive pulse and the Space light corresponds to a negative pulse. The D.C. Receiver transforms the received PWM signal into a logic level PWM signal with no change in pulse duration. The D.C. Receiver also contains phone line protection circuitry and isolation circuitry. The logic level PWM signal is then sent to the XPW-18 card titled Failure Detector. If the PWM signal does not contain "Space" data, the Failure Detector will indicate an equipment failure. If the PWM signal contains pulse durations that are not within the normal range of the system, the Failure Detector will indicate an over-range condition. If the PWM signal is not present, the Failure Detector will indicate a signal failure and an equipment failure. From the Failure Detector card, the PWM signal is sent to the XPW-15 card titled Demodulator. Within the Demodulator card the PWM signal is transformed back to a D.C. analog signal. The output of the Demodulator card is then sent to the associated control or monitoring system.

TITLE: CECOTRONIC PULSE WIDTH MODULATION SYSTEM		DRAWN	DESIGNED		
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED	DGL	DRAWING NO	REV
			PAGE 3 OF 6	IM00290	A

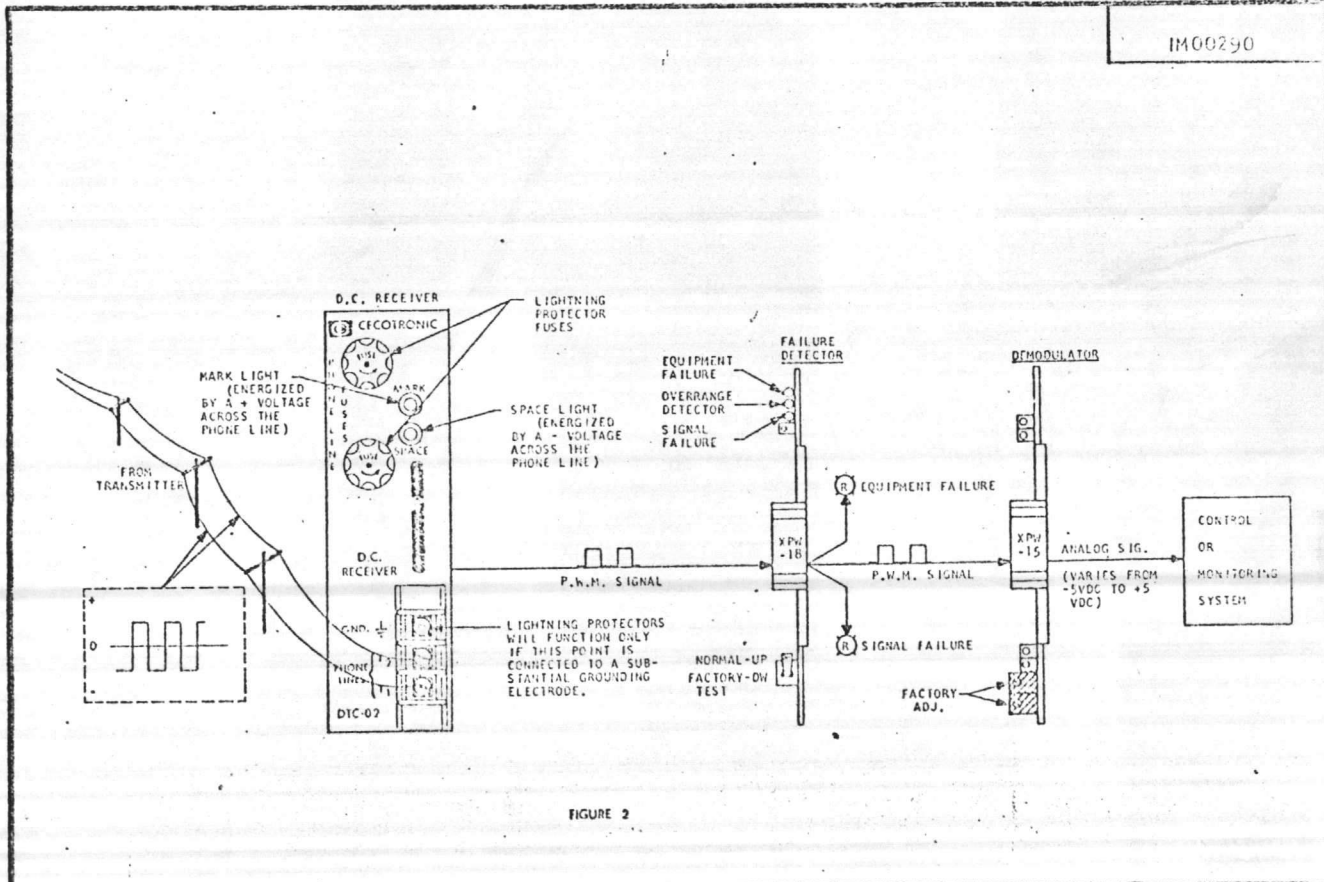
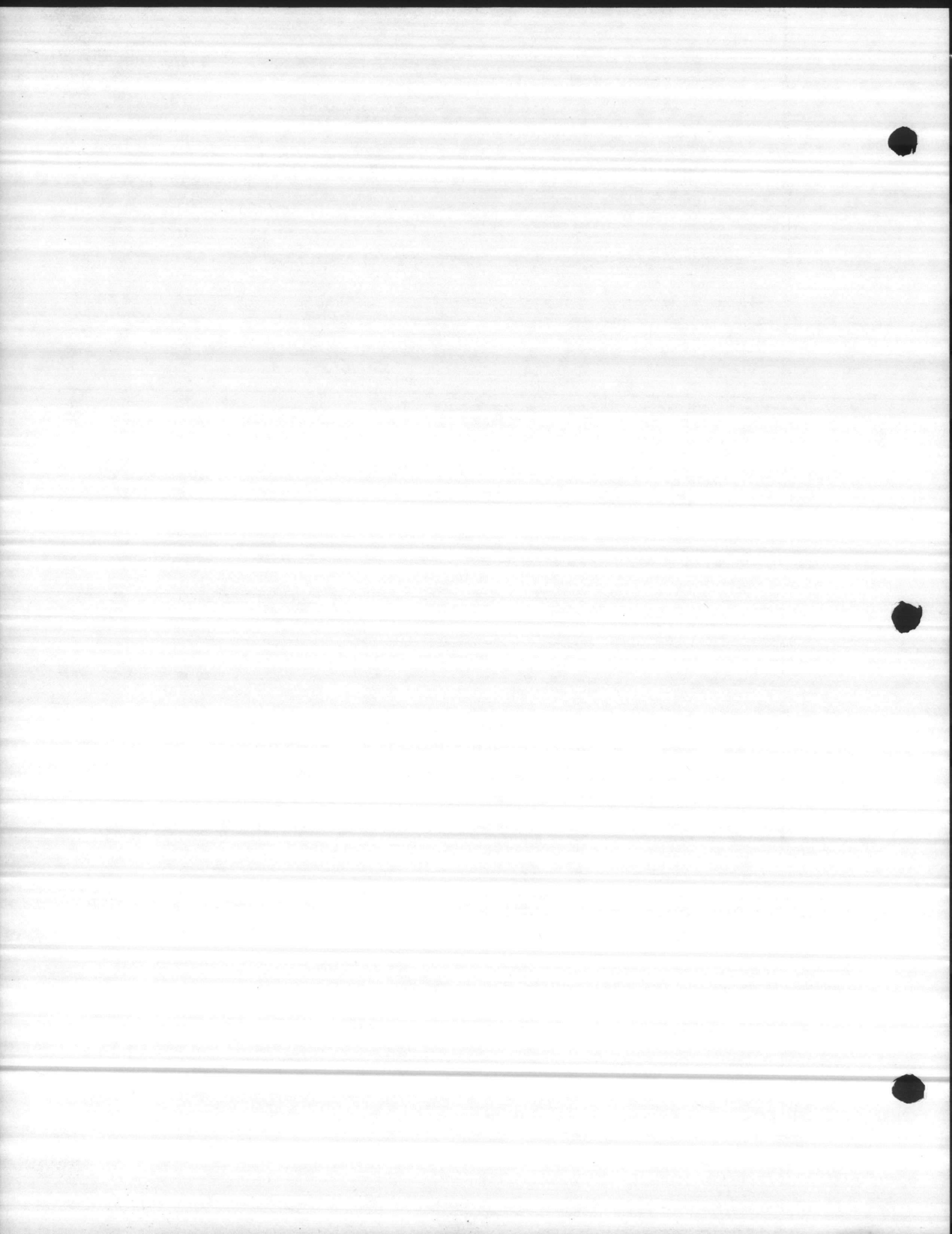


FIGURE 2

TITLE: CECOTRONIC PULSE WIDTH MODULATION SYSTEM		DRAWN	DESIGNED		
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED	DGL	DRAWING NO	REV
			PAGE 4 OF 6	IM00290	A




PHONE LINE PROTECTOR CIRCUIT

The D.C. Transmitter and D.C. Receiver modules contain a transient voltage protection circuit. These circuits protect the electronic components from high voltage transients induced onto the phone lines. These protectors contain a surge voltage protector (SVP) and a fuse. If a transient of approximately 90 volts or more is induced onto either phone line, the SVP will become a very low impedance to ground. If the transient is of ample duration and power, the phone line fuse will open.

The most common source of transients is lightning. If lightning occurs close enough to the phone line system it will induce a voltage transient of ample amplitude and duration to open the phone line fuses. Therefore, it is common for the phone line fuses both on the D.C. Transmitter and D.C. Receiver to open during an electrical storm. The four major factors that determine the likelihood of opening a phone line fuse during an electrical storm are as follows:

1. Proximity of lightning occurrence to the phone line.
2. Type of phone line (overhead, shielded, buried, etc.)
3. Length of phone line.
4. Geographical location of phone line.

Having only partial control over one of these factors, (type of line) makes it difficult to accurately predict the occurrence rate of opening the phone line fuses.

TITLE: CECOTRONIC PULSE WIDTH MODULATION SYSTEM		DRAWN	DESIGNED DGL	
 CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED	PAGE 5 OF 6	DRAWING NO IM00290 REV A

PWM SYSTEM FUNCTIONAL AND CALIBRATION CHECK


At the Remote Transmitter, find card XPW-14 under blue R.F. cover. On the bottom edge of the XPW card find a small button switch. By pushing and turning 1/8 turn clockwise the system is placed in the calibrate mode. Directly above the button switch find a small toggle switch. With the toggle switch in the UP position the Transmitter will transmit a signal equal to 100% scale or full scale. Observe and record the reading on the indicator at the Receiver. With the toggle switch in the CENTER position the Transmitter will transmit a signal equal to 50% scale or half scale on the indicator at the Receiver. Observe and record this reading. With the toggle switch in the DOWN position the Transmitter will transmit a signal equal to 0% scale or zero scale on the indicator at the Receiver. Observe and record this reading.

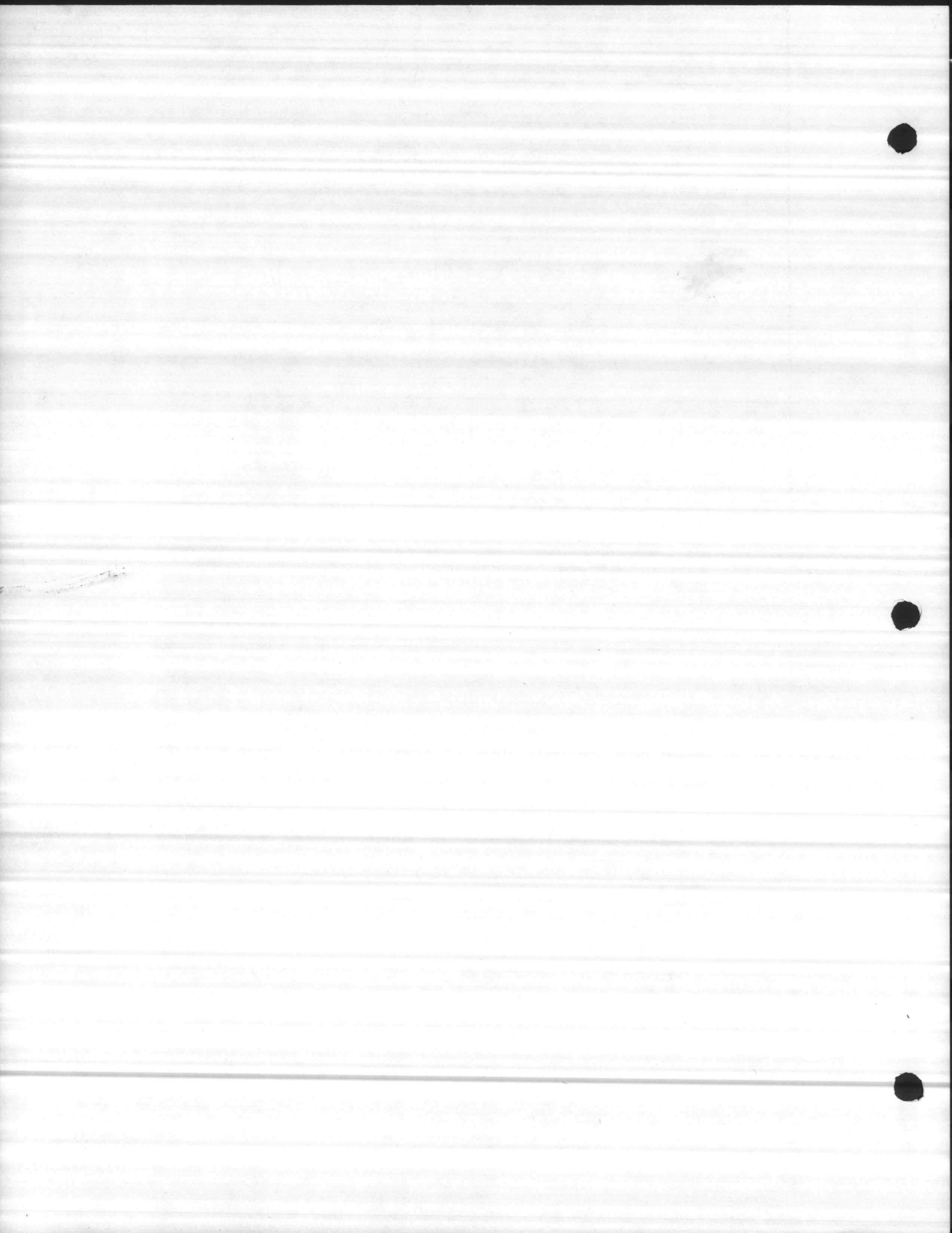
If the readings obtained fall outside the required system accuracies, the system will require re-calibration by a factory serviceman or a CECO representative.

Find the D.C. Receiver Module at the Receiver. Find two lights on the front of the module labeled MARK and SPACE. The following relationships apply to the three calibrate positions:

CALIBRATE SW. POSITION	INDICATOR SCALE	(SEC) MARK	(SEC) SPACE
UP	100%	9/10	1/10
CENTER	50%	1/2	1/2
DOWN	0%	1/10	9/10

Turn small button switch counter clockwise 1/8 turn and release. This places the system back in the normal operation mode. Note: With the calibration mode switch in the "Normal Operating Mode", the calibration switch has no effect on the system operation.

TITLE: CECOTRONIC PULSE WIDTH MODULATION SYSTEM		DRAWN	DESIGNED DGL	
 CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED	PAGE 6 OF 6	DRAWING NO IM00290 REV A



SES-05, 06, 07, 08, 09 AND 10, SINGLE VOLTAGE SIMULATOR-QUELLER

	SCHEMATIC	ASSEMBLY
SES-05	900001-01	600001-01
SES-06	900001-02	600001-02
SES-07	900001-03	600001-03
SES-08	900001-04	600001-04
SES-09	900001-05	600001-05
SES-10	900001-06	600001-06

The purpose of the SES card is twofold. First, it is to provide a means manually simulating a variation in the analog input to a system, and second, to provide a controlled response time to an input change.


The basic style, SES-06 and SES-09 include several controls for the user:

A toggle switch selects manual or auto operation. In the manual position, the SES's output responds to a potentiometer on the bottom front edge of the card. This allows the user to exercise the system through its entire dynamic range. With the switch in the auto position, the output precisely follows the input.

A potentiometer is located at the top front edge of the card. Its purpose is to adjust the rate at which the Queller responds to a sudden change in the input.

On the SES-05 and 08, the manual adjust potentiometer is omitted, and a pin connection made for remotely locating the manual control.

On the SES-07 and 10, the manual potentiometer and the auto-manual selector switch are omitted, and pin connections are made for remotely locating these controls.

TITLE: TECHNICAL DATA SES-XX 600001-XX		DRAWN 10-19-73	DESIGNED DGL	
 CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED DGL	PAGE 1 OF 5	DRAWING NO ES50070 REV A


When using the SES-05, 07, 08 and 10, it is recommended that the SMM-01 Manual Mode buffer be used. It provides exciter voltage for the manual control, buffering for the selector switch, and an amplifier for use with a -100 to +100 microamp meter movement to indicate the output signal of the SES.

The SES-05, 06 and 07 have adjustable quelling rates which are extremely long. They may be adjusted to take up to 10 minutes to go from minimum to maximum when the input changes suddenly.

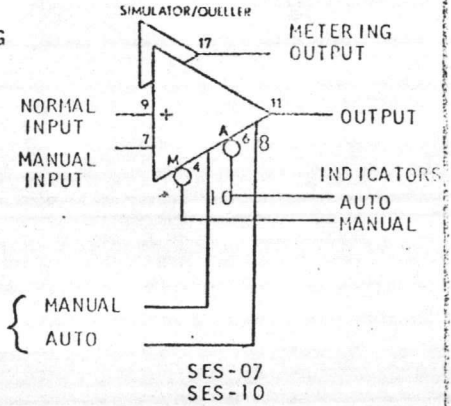
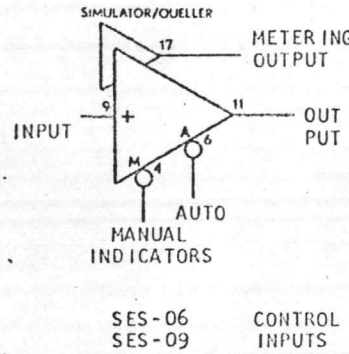
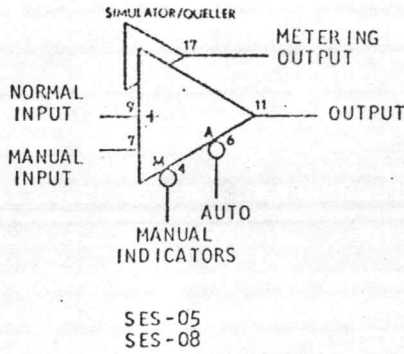
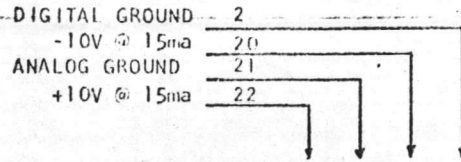
The SES-08, 09 and 10 operate similarly, except that the time is much shorter-maximum time is 1.5 minutes.

The output of these cards will ramp linearly to the value of the input at a rate which is described above.

When in the Manual Mode, the output will follow the manual input rapidly, though not instantaneously.

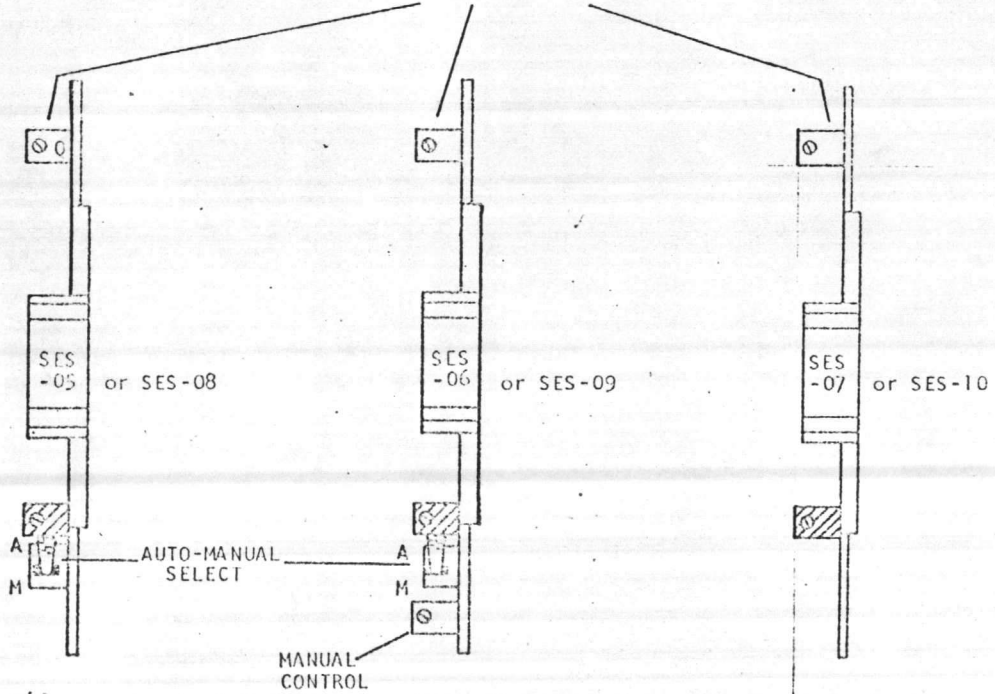
TITLE: TECHNICAL DATA SES-XX 600001-XX		DRAWN	DESIGNED DGL	
 CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED DGL	PAGE 2 OF 5	DRAWING NO ES50070 REV A



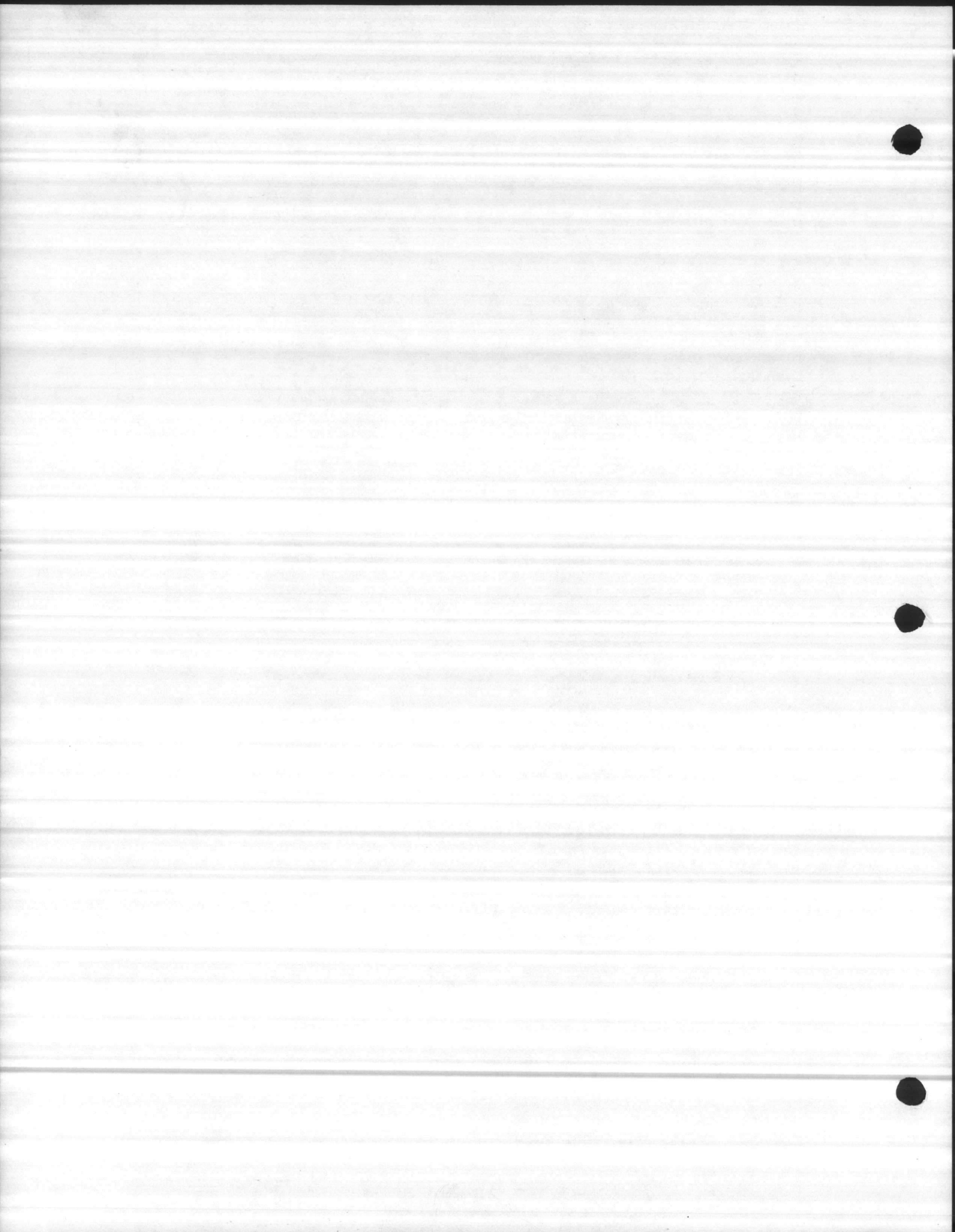


TITLE	TECHNICAL DATA SES-XX 600001-XX	DRAWN	DESIGNED DGL	
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED DGL	PAGE 3 OF 5	DRAWING NO ES50070 REV A

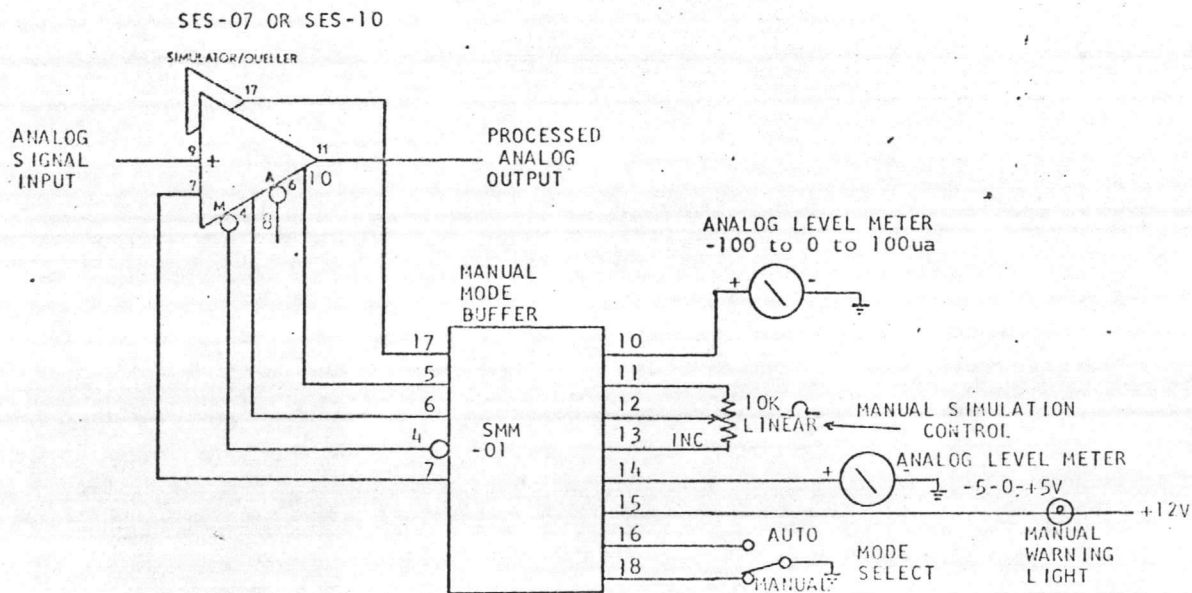
QUELLING RATE ADJUST



TITLE	TECHNICAL DATA SES-XX 600001-XX	DRAWN	DESIGNED DGL	
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED DGL	PAGE 4 OF 5	DRAWING NO ES50070 REV A



TYPICAL APPLICATION OF
SIMULATOR/QUELLER WITH
MANUAL MODE BUFFER FOR
USE WITH EXTERNALLY MOUNTED
CONTROLS.



TITLE TECHNICAL DATA SES-XX 600001-XX		DRAWN DGL	DESIGNED DGL	
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED DGL	PAGE 5 OF 5	DRAWING NO. ... ES50070
				REV A



CARD, DTC-02

	SCHMATIC	ASSEMBLY
DTC-02	900196-01	600087-01

DTC-02 DUAL TELEPHONE CIRCUIT RECEIVER


The DTC-02 is designed to receive polar DC signals as received on a leased telephone circuit. It includes transient protection and common mode isolation. (Terminal GND must be properly grounded for proper operation of the transient protection circuit.)

MARK/SPACE. The Receiver separately detects mark and space signals, and produces complimentary outputs. Additionally, a differential output is produced, (Also with complimentary outputs) by a flip flop which is set by reception of a mark, and reset by reception of a space. A mark is defined as occurring when terminal T1 is negative of Terminal T2.

The outputs operate as follows:

When a mark is received, Pin 17 is at a logical "1", and Pin 16 is at a logical "0". When a mark is not received, Pin 17 is at a logical "0" and Pin 16 is at a logical "1".

When a space is received, Pin 12 is at a logical "1" and Pin 13 is at a logical "0". When a space is not received, Pin 12 is at a logical "0" and Pin 13 is at a logical "1".

TITLE: TECHNICAL DATA DTC-02 P/N 600087-01		DRAWN	DESIGNED DGL	
	CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107	CHECKED DGL	PAGE 1 OF 3	DRAWING NO ES50061
				REV C


The flip-flop outputs appear on Pin 14 and 15. When the flip-flop is set, Pin 14 is at a logical "1" and Pin 15 is at a logical "0". When the flip-flop is reset, Pin 14 is at a logical "0" and Pin 15 is at a logical "1". Reception of a mark sets the flip-flop and reception of a space resets it.

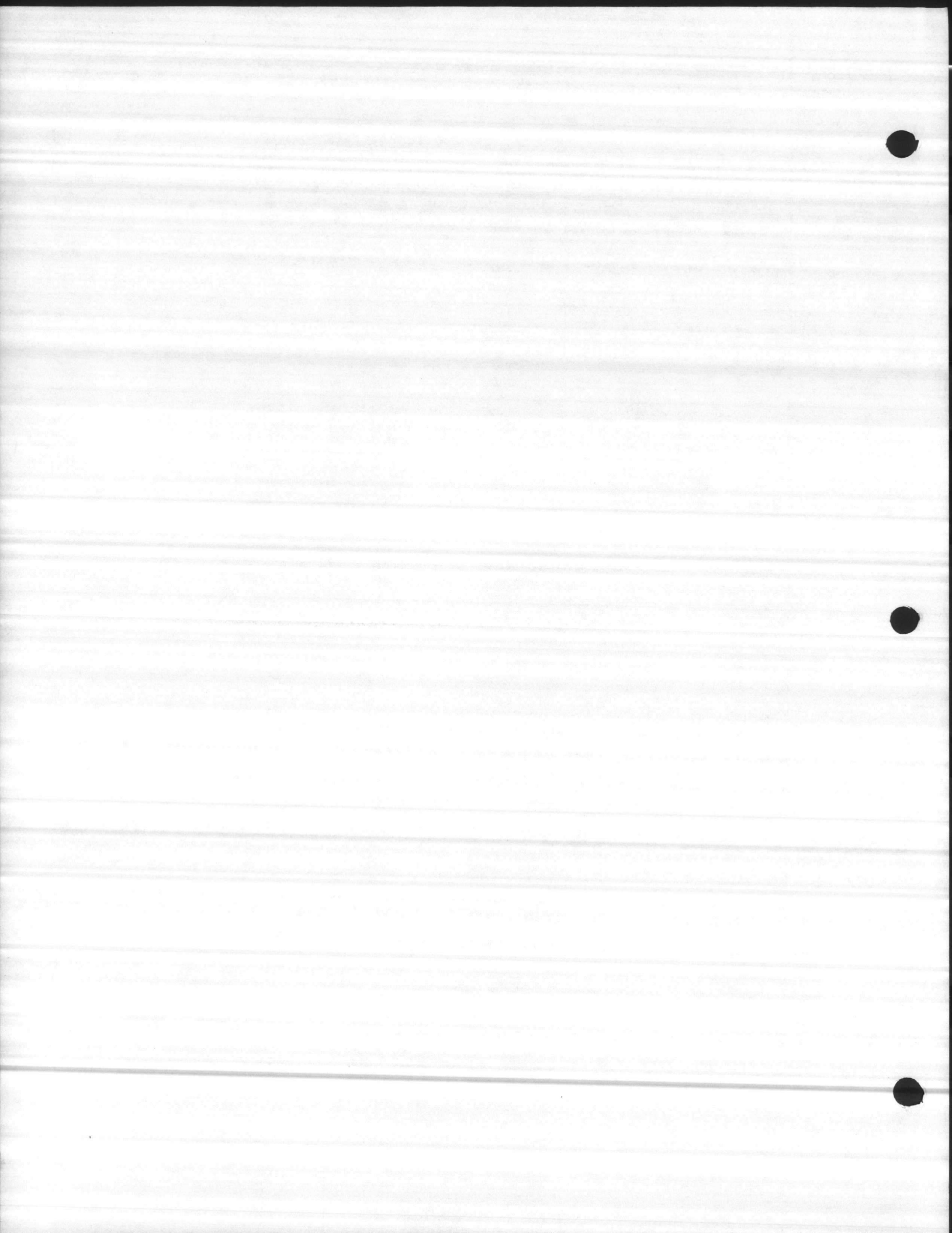
The outputs are all open collector transistors. Ratings: Maximum output current (Logic "0") - 40 MA. Maximum output voltage (Logic "1") - 30V.

Power Requirements: +12 VDC unreg. @ 75 MA.
+12 in on Pin 22
Circuit common on Pin 21

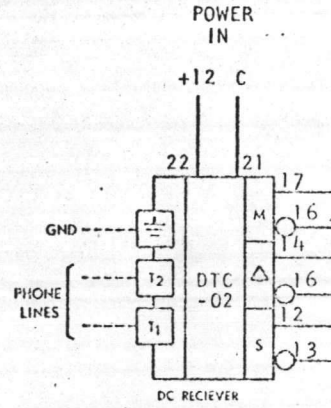
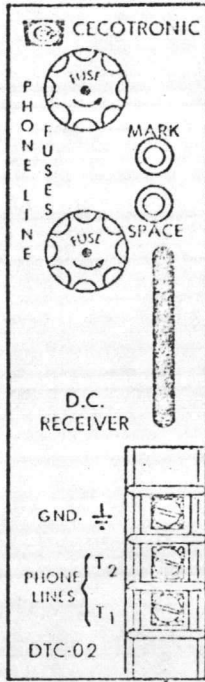
Input Sensitivity: 4 MA minimum for proper operation; 30 MA. maximum.

Fuse Required: 1 amp - Fast Acting
(Bussmann Manufacturing type AGC or equiv.)

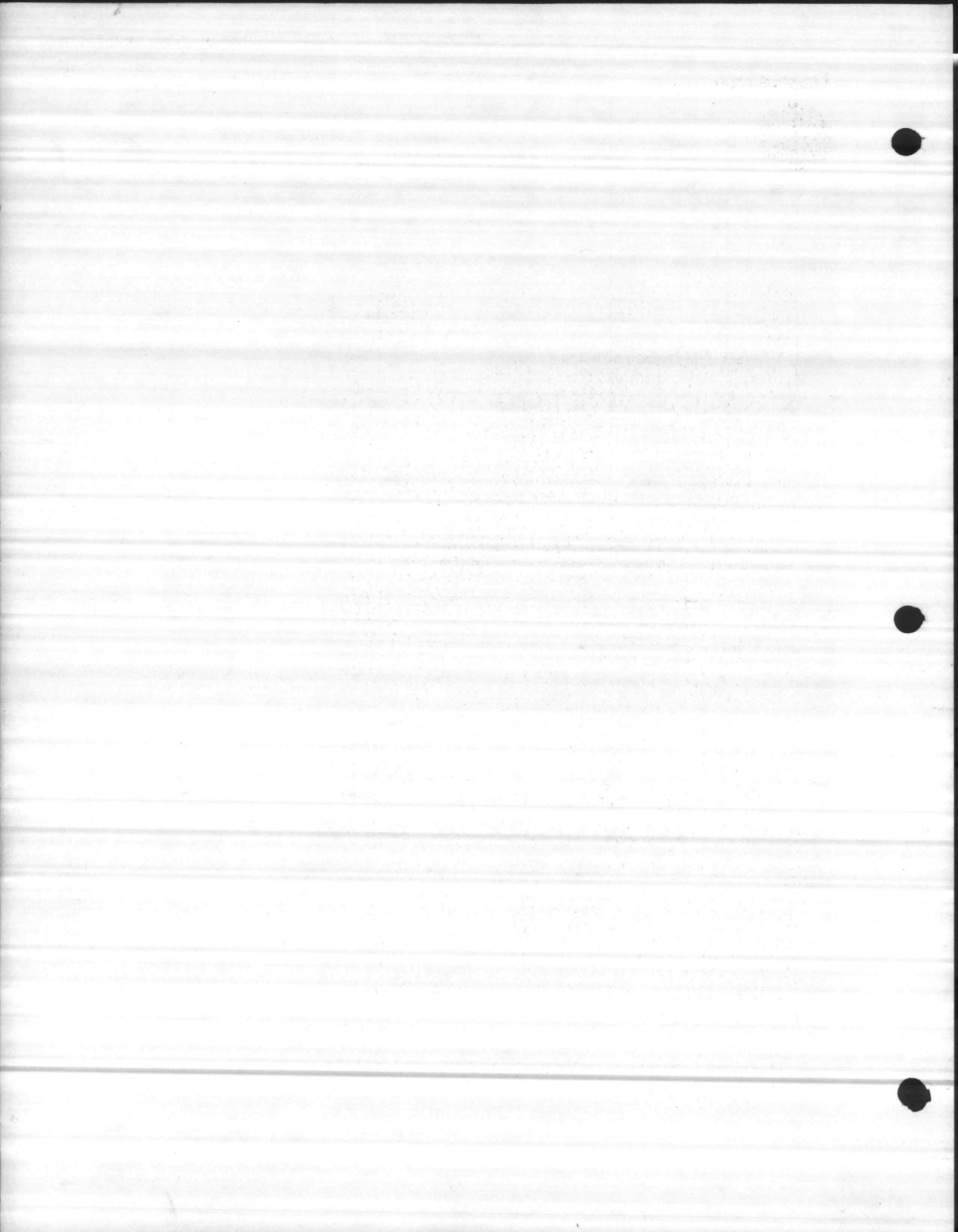
TITLE: TECHNICAL DATA DTC-02 P/N 600087-01		DRAWN	DESIGNED DGL	
	CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107	CHECKED DGL	PAGE 2 OF 3	DRAWING NO ES50061
				REV C



5 SPACES



<p>TITLE TECHNICAL DATA DTC-02 P/N 600087-01</p>	<p>DRAWN DGL</p>	<p>DESIGNED DGL</p>	
<p>CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107</p>	<p>CHECKED DGL</p>	<p>PAGE 3 OF 3</p>	<p>DRAWING NO. ES50061</p>



Westinghouse



Type W Control Centers

600 Volts Maximum



Application

Westinghouse, Type W control centers are custom designed assemblies of conveniently grouped control equipment primarily used for power distribution and associated control of motors. They contain all necessary bus, incoming line facilities and safety features to provide convenience and space and labor saving. These control centers are adaptable to changing conditions with a minimum of effort and a maximum of safety.

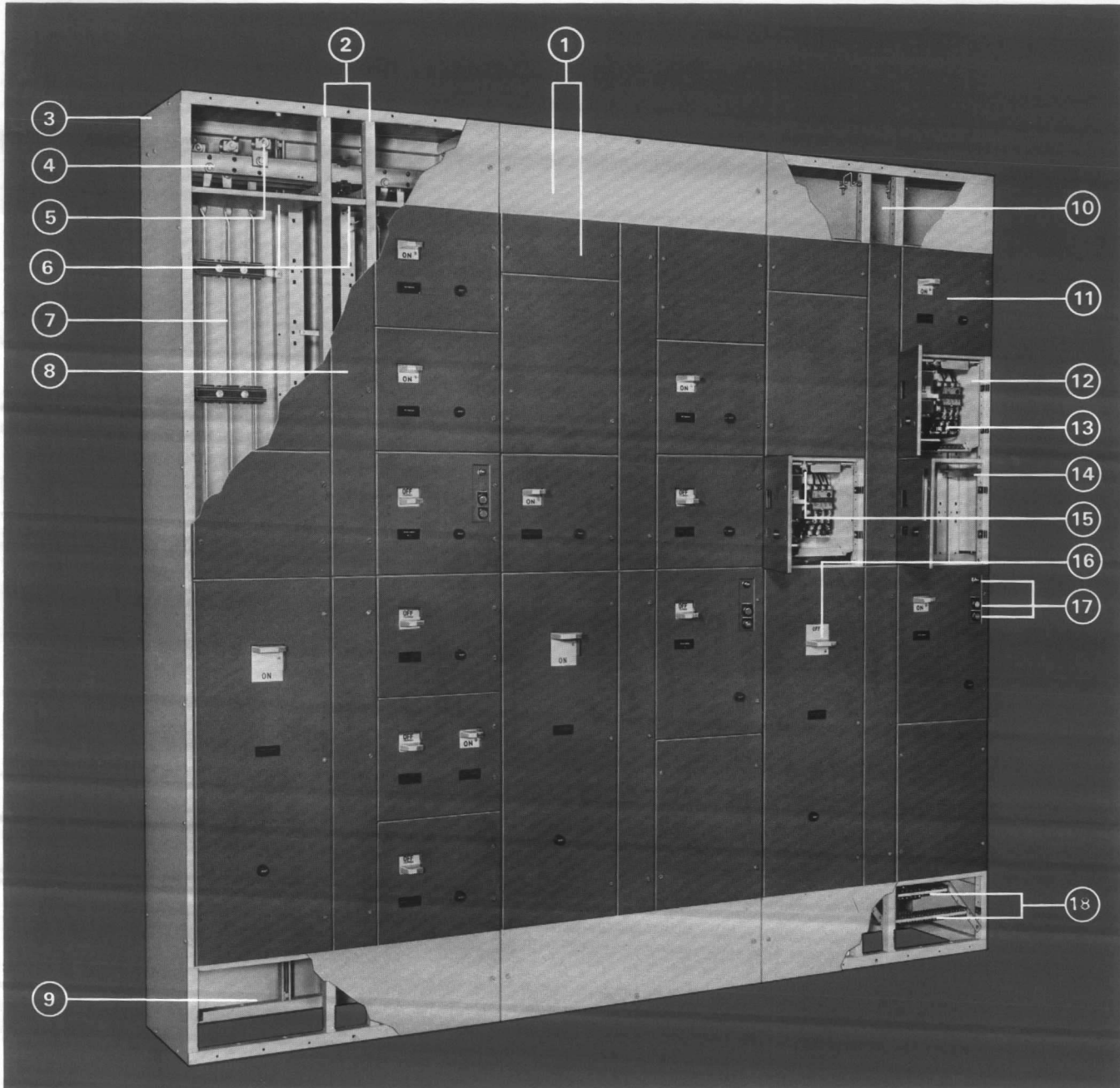
Features - Benefits

- Incremented structure width permits unlimited versatility for adding accessories requiring more or less width than used by standard compartments for housing drawout units.
- Structures are 90 inches high, with vertical compartments having 72 inches of unit space unitized in 6-inch increments providing maximum space for 15-inch deep front-mounted or 20-inch deep back-to-back mounted units. Full-depth vertical wireways provide optimum wiring space in reduced floor area and wiring convenience for economy of installation and maintenance.
- Modular design permits structure arrangement to be tailored to exactly meet any control requirements with a minimum of waste space. Vertical compartments are incremented for maximum space utilization and unit interchangeability.
- All parts and wiring including terminal blocks are front accessible. Vertical wireways are separate from control units providing safe and convenient access to wiring and conduits without de-energizing any equipment.
- Centralization of controls for an entire system in one compact group provides ease of maintenance and supervision by a minimum of authorized personnel.
- Design tested at the Westinghouse high power laboratory assures maximum protection for control equipment . . . engineered to minimize hazards to operating personnel.

Westinghouse



Design Features



1 Two-Tone Finish
An attractive two-tone effect is presented by the use of ASA-61 light gray enamel for structure parts and cover plates, and a harmonizing dark gray enamel for unit and wireway doors. All steel parts are thoroughly cleaned after fabrication, and given

a rust-inhibiting phosphatized coating before baked enamel finish is applied.

2 Versatile Structure
Structures are built in 4½ inch wide modules including 13½-inch wide vertical compartments for housing starters and 4½-inch

wide vertical wireways. For special conditions requiring more or less horizontal space, these may be varied in 4½-inch increments. Removable end sheets allow interior accessibility at the ends of the control center structure (see Figure 1). The structures can be assembled in configurations to fit individual space requirements.

Type W Control Centers

600 Volts Maximum

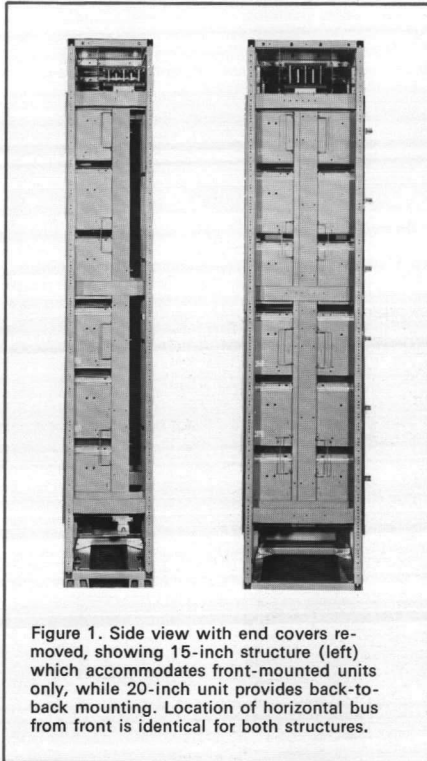


Figure 1. Side view with end covers removed, showing 15-inch structure (left) which accommodates front-mounted units only, while 20-inch unit provides back-to-back mounting. Location of horizontal bus from front is identical for both structures.

ing only if desired) a 20-inch deep structure is used. Both are free-standing structures. Horizontal bus in 15-inch and 20-inch deep structures are mounted the same distance from the front, so that combinations of the two structures can be front-aligned without structure modifications or bus transition (see Figure 1).

4 Horizontal Bus

A 600 A. main horizontal three-phase bus extends the complete length of each structure assembly. It is located near the top of the structure. Higher capacity main bus, up to 2500 amperes, can be supplied without structure modification if required. Bus is supported by non-tracking, glass-reinforced polyester insulators which are impervious to moisture and other adverse atmospheric operating conditions.

The bus assembly is braced to withstand fault currents of 22,000 rms symmetrical amperes. Additional bracing to withstand 42,000 rms amperes or higher can be added when the control center is connected to systems capable of producing faults of this magnitude. Where desired, vertical bus isolation barriers can be provided, which can be removed for bus inspection without disrupting service.

They are normally erected "in-line," but by the use of corner sections, they can be arranged in "L" or "U"-shaped assemblies.

3 Two Standard Structure Depths

Westinghouse Type W control centers are provided in two standard depth structures. For front-mounted units only, a 15-inch deep structure is available. For units mounted back-to-back (or for front-mount-

5 Incoming Cables

Incoming line cables entering from the top or bottom of the control center can be connected easily to solderless lugs at either a main breaker or the main bus. Typical arrangements are shown in Figure 4. Special incoming line arrangements including bus duct connections can be provided to suit specific requirements.

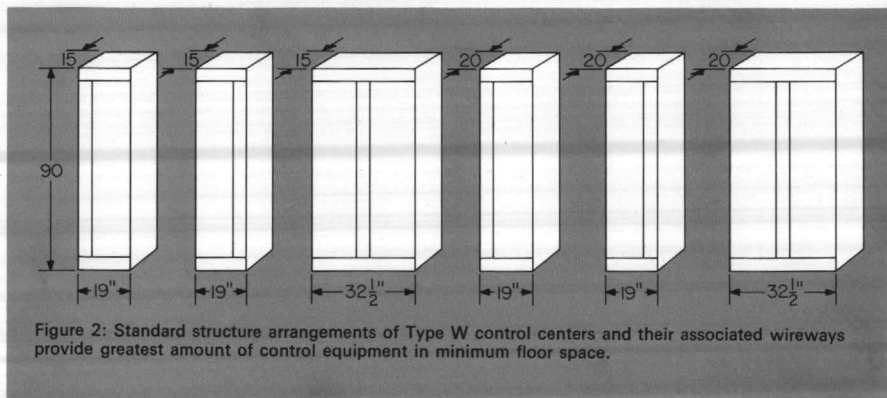


Figure 2: Standard structure arrangements of Type W control centers and their associated wireways provide greatest amount of control equipment in minimum floor space.

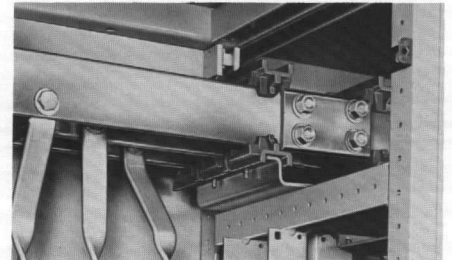


Figure 3. View of main horizontal bus showing connections to vertical bus. Photo also shows how bus is spliced between two standard control center shipping sections.

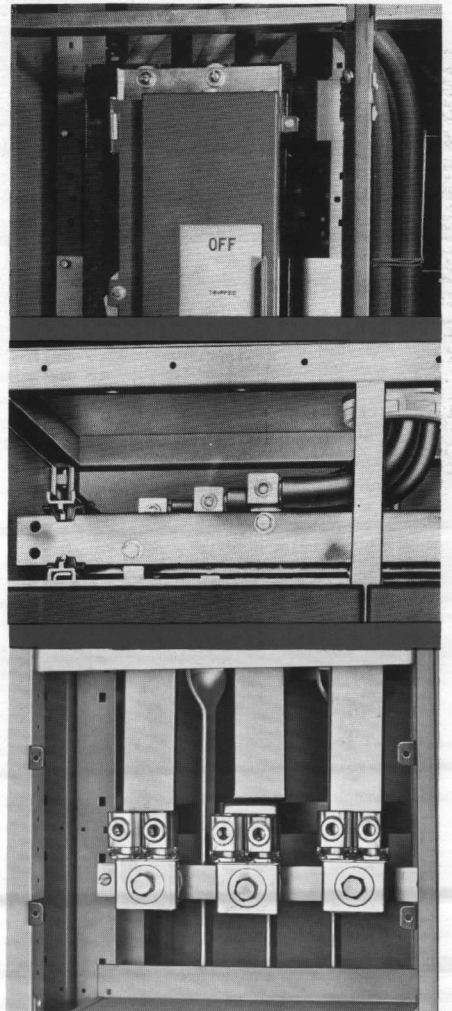


Figure 4. Standard incoming line arrangements: upper view shows cables entering a 600-ampere main breaker; center view shows main lugs located on the bus for cables up to 350 MCM; bottom view shows typical incoming line compartment for cables larger than 350 MCM.

Westinghouse



Design Features, Continued

6 Horizontal Bus Barrier

Full height, front removable, metal barriers isolate the horizontal bus and prevent accidental contact. Additional barriers isolate each vertical compartment and wireway from the horizontal bus.

7 Vertical Bus

For distribution of power from the main horizontal bus to each vertical compartment, a three-phase bus rated at 300 amperes minimum is provided. In 20-inch deep structures for back-to-back equipment this bus can be increased in capacity without structure modifications or additional bus supports. Vertical bus is braced by the same glass-reinforced polyester insulators used for the main bus. (see Figure 5).

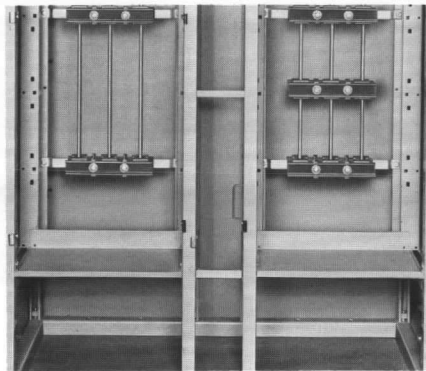


Figure 5: Vertical bus for control center, showing: at left, standard bracing for 22,000 rms symmetrical amperes; at right, additional bracing for 42,000 rms symmetrical amperes. View also shows full depth wireway with wiretie brackets and unobstructed bottom wiring space.

8 Full-Depth Wireways

Full depth vertical wireways are available in two types:

- Individual wireway for each vertical compartment.
- Common wireway serving two vertical compartments.

The standard 4½-inch wireway provides six inches internal width between adjacent starters. It extends from front to rear of the control center. Wireways are covered by two hinged doors, each secured by quarter turn fasteners. For back-to-back design, doors are provided on both the front and rear.

Since wiring access to individual units may enter from either side, a common wireway serves two vertical compartments. This provides the most compact arrangement while providing optimum wiring space. (see Figure 5).

9 Unobstructed Conduit Space

The open framework design provides maximum space for conduit entry at both the top and bottom of the structure.

At the bottom of each structure assembly the front-to-rear frame members are removable to provide maximum unrestricted conduit space the complete length of the Control Center to a height of 7½ inches. (see Figure 5).

10 Horizontal Wiring Trough

A nine-inch space is provided at the top and bottom of the structure for cross-panel wiring. A wiring trough is located at the top completely isolated from the horizontal bus. In back-to-back design a wiring trough on both front and rear is provided. (see Figure 6.)

11 Removable Doors

All unit doors have formed edges that provide rigidity, present finished appearance, and eliminate sharp corners which might cause injury. Doors are secured by indicating-type quarter-turn fasteners for quick and easy access. Hinges are removable (by removing one screw) as shown in Figure 8, to allow easy door removal when maximum working access is desired. Any door may be removed without disturbing adjacent doors. (see Figure 7.)

Cutouts are provided in the doors to allow projection of the operating handle and control devices when required. A bracket welded on the rear of the door mechanically interlocks it with the disconnecting device when it is in the "On" position. Since the doors are completely separated from all internal equipment, alignment is not critical.

A white core, black Micarta® nameplate is provided for circuit identification.

When required for dust-resistant applications, gasketing is provided around all openings.

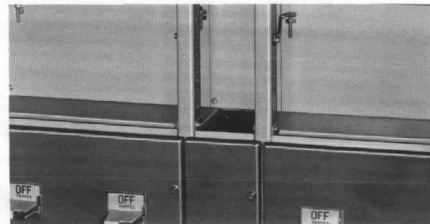


Figure 6: Upper wiring trough is located directly in front of, and serves as a barrier for the main horizontal bus.

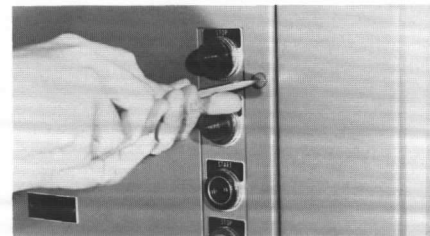


Figure 7: Quarter-turn fasteners (slot vertical-open, slot horizontal-closed) provide quick and easy access to starter units.

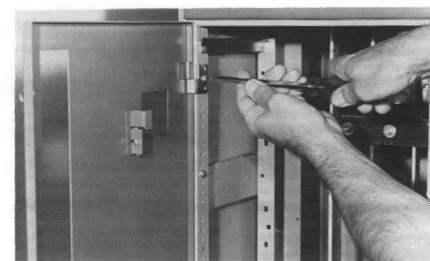


Figure 8: By removing the screw from the upper hinge, the door is easily removed without disturbing other units. Illustration shows guide rail, immediately above upper hinge.

12 Drawout Units

Drawout starter units with either circuit breaker or fusible disconnects are supplied for motor starting duty through NEMA size 5. Each is designed into basic modular heights of 6-inches, with the smallest unit 12-inches high. This allows each vertical compartment to house as many as six units. Feeder breaker or switch units of the same modular design can be intermixed with starters in any 72-inch high vertical compartment without any limitations.

Each drawout unit is completely isolated from adjacent units. The unit sides are closed except for necessary space near the bottom for wiring to enter either side from the vertical wireways. Free floating Magna-Grip™ plug-in stabs assembled into molded glass polyester bases are welded to

Type W Control Centers

600 Volts Maximum

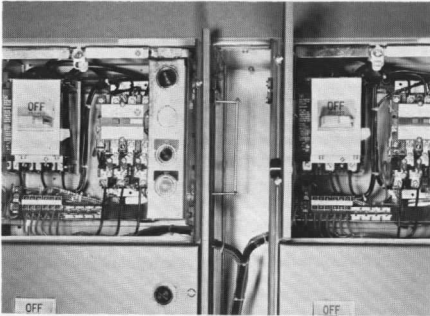


Figure 9: Typical drawout units for motor control, with type MCP Motor Circuit Protectors. View shows control and load wiring entering full-depth wireway.

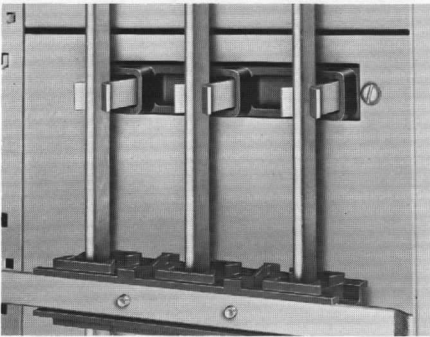


Figure 10: Magna-Grip plug-in stabs of draw-out unit in full connected position with vertical bus. No stab wiring extends into bus compartment.

cable connections extending inside each unit. No stab wiring extends outside its enclosure.

13 Starter Components

Each starter is equipped with a primary disconnecting device — either a Westinghouse type MCP motor circuit protector or a quick-make, quick-break visible-blade type DS switch combined with fusing facilities for use with current-limiting, rejection-type, NEMA class "J" fuses. Facilities for NEMA class "H" fuses may be provided, but in most cases will require a larger drawout unit. The total available short-circuit capacity of the system to which the control center is connected must be considered in properly applying fuses and breakers.

Both types of disconnects are externally operated by a handle mechanism which is mounted directly on the disconnect.

Standard linestarters are equipped with three-pole ambient compensated thermal overload relay assemblies with adjustable

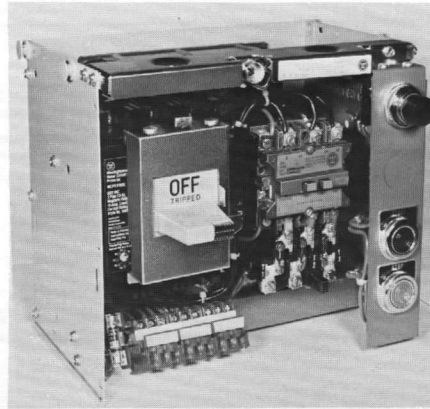


Figure 11: Typical starter unit (size 1) with type MCP Motor Circuit Protector. Unit shown is equipped with terminal blocks for NEMA type B or C construction, and with start-stop pushbuttons and indicating light.

hand or automatic resetting features. Hand resetting of all contacts is accomplished by a pushbutton through the door. Each line-starter is equipped with an internally wired interlock used for contactor seal-in. Extra interlocks can be supplied to meet any control requirement. When specified, control transformers with fused secondary can be supplied. All wiring is made with stranded thermoplastic-insulated wire rated 105°C. Power wiring is black and of adequate size to carry the maximum full load current for which the contactor is rated. Ac control wiring is red, and Dc control wiring is blue.

14 Guide Rails

Guide rails are secured to the structure and located on each side of the vertical compartment near the top of each unit space. These guides are used to support the unit as well as to align it properly with the bus. Shoulder pins on each side of the unit fit the guides and produce a minimum of friction resistance when connecting or disconnecting the stabs with the bus. A typical guide rail is shown in Figure 8.

15 Unit Latching and Removal

Each drawout unit is provided with a shrouded latch (screwdriver-operated) which serves a dual purpose: first, to assure full connected position of the unit to the bus and to hold it securely in the connected position; second, to assure full-disconnected position of the unit from the bus and to hold it securely in that position with padlocking facilities to assure a permanent in-place safe position during maintenance.

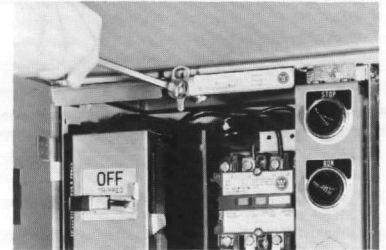


Figure 12: The quarter-turn latch can be used to hold the starter in the full disconnected position.

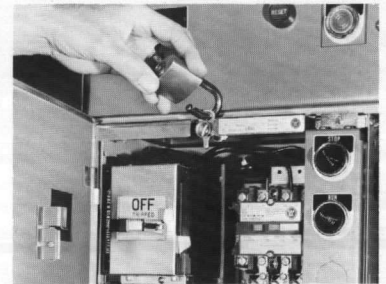


Figure 13: The starter may be padlocked in the disconnected position for safety of personnel.

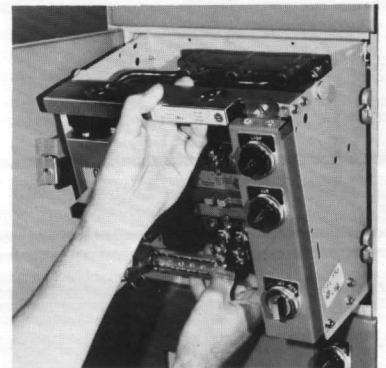


Figure 14: Starter unit is easily lifted out of its housing.

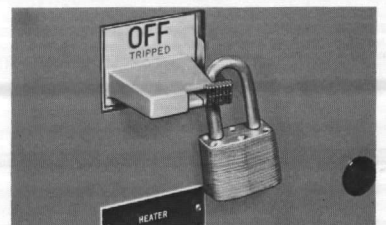


Figure 15: For safety of personnel, breaker handle may be locked in the "Off" position with one to three padlocks.

Westinghouse



Design Features, Continued

To open the unit door, the disconnect operating handle should be in the "Off" position. This releases the door interlock. At the top of each unit (beside the handle) a screwdriver operated quarter turn latch should be turned counter-clockwise to release it.

All wiring extending from the unit must be disconnected to allow it to be fully withdrawn. This can be accomplished with disconnect type terminal blocks if specified. A straight pull on the handle disengages the stabs and allows the unit to be pulled forward with its guides supporting it until it is ready for withdrawal. In this position the unit latch may be turned counter-clockwise to secure it for in-place servicing. It may be padlocked in this safety position.

16 Operating Mechanism

A three-position vertical-motion operating handle indicates "On," and "Off," and "Tripped" positions of the breaker. With the breaker in the "On" or "Tripped" position, the door is mechanically interlocked to prevent opening. A locking mechanism is also provided which makes it possible to lock the breaker in the "On" or "Off" position with up to three padlocks. Moving the breaker handle to the "Off" position releases the door interlock, and permits opening the door. With the door opened, the operation handle is held in the "Off" position to provide maximum safety for personnel. "Defeaters" are provided which make it possible for authorized personnel to open the door with the breaker closed, or to operate the breaker when the door is open.

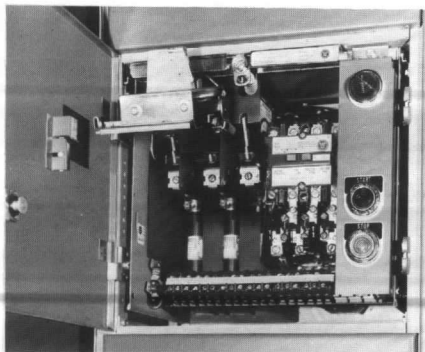


Figure 16: Hinged operating mechanism allows viewing of contacts of visible blade switches.

Operating mechanisms are built in three sizes with features that allow the largest breakers to be operated with the same ease as the smallest. Hinged mechanisms are provided over visible blade switches to allow viewing of the contacts.

17 Control Devices

Panels containing oil-tite pushbuttons, indicating lights or selector switches may be added to any drawout unit.

Devices can be factory wired or easily added to any unit in the field. For ease of installation, panels are hinged to provide simple access to rear connected terminals. Since the assemblies are mounted as a part of the unit, no hinged wiring is required and the entire starter assembly may be withdrawn with the control device assembly in tact.

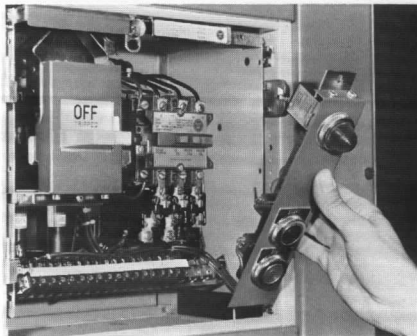


Figure 17: Panels for pushbuttons and indicating lights are hinged for easy access to terminals.

18 Terminal Blocks

Modular design terminal blocks are supplied in NEMA type B and C control center assemblies. High strength and insulating characteristics combined with solderless type terminals provide compactness with safety.

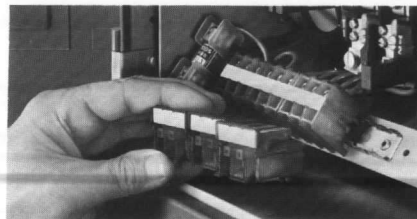


Figure 18: Optional plug-in type terminal blocks simplify connection and reconnection of control terminals.

Blocks are molded in three-circuit assemblies. They are designed to snap in their mounting channel for easy installation or re-arrangement without tools. Stationary type terminal blocks are supplied as standard. Plug-in types are optional.

Three circuit plug-in assemblies are interlocked to prevent incorrect insertion; however they may be individually disconnected for trouble shooting. Heat-treated copper alloy with silver plated stabs on every connection assure a long lasting, low resistance coupling.

Marking strips on both the stationary and plug-in portions of the block provide clear identification of wires when disconnected. All control terminals have a wire range of #22-#8 AWG. Load terminals for wires to #4 can be supplied in plug-in type and to #2 in fixed assemblies.

Master Terminal Blocks

For NEMA type C wiring, master terminal blocks of either fixed or plug-in type can be supplied at either the top or bottom of any vertical compartment. Unobstructed space is provided and all terminals are accessibly arranged to allow ease of installation without penalty to the 72" of unit space. The large vertical wireways allow cables entering from both the top and bottom to run directly to master terminal blocks without unit or structure interference.

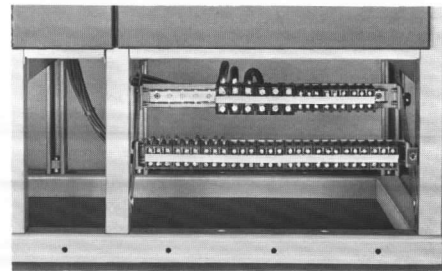


Figure 19: Master terminal blocks may be located either at the top or bottom of any vertical compartment.

Type W Control Centers

600 Volts Maximum

NEMA Classification

Class 1 Control Centers: These are essentially a mechanical grouping of combination motor control, feeder tap and/or other units arranged in a convenient assembly. They include connections from the common horizontal power bus to the units. They do not include interwiring or interlocking between units or to remotely mounted devices, nor do they include control system engineering. Diagrams of the individual units only and sketches showing the overall dimensions of the control center are supplied. When master terminal blocks are specified, a sketch showing general location of terminals is provided.

Class II Control Centers: These are basically the same as Class I, however, they are designed to form a complete control system. They include the necessary electrical interlocking and interwiring between units and interlocking provisions to remotely mounted devices. A connection diagram of the complete control assembly showing remote control devices illustrates the system operation, and sketches showing overall dimensions are provided. When master terminal blocks are specified the terminal arrangement and all wiring connections are shown on the diagram.

Type A includes no terminal blocks. Combination linestarters are factory wired and assembled in the structure in the most efficient arrangement. Auxiliary devices can be supplied, but no wiring external to the unit will be furnished. All feeder circuit breaker or fusible disconnect units are in this classification.

Type B essentially duplicates type A except that all control wires terminate at blocks near the bottom of each unit. Load terminals are all conveniently located adjacent to the control terminal blocks. Plug-in type terminal blocks for all control wiring and load wiring through size 2 can be supplied when specified.

Type C utilizes type B units. Factory assembly of control wiring and load wiring through size 3 is extended from the unit terminals to master terminal blocks located at the top or bottom of each vertical compartment.

Main or Feeder Protective Devices

A wide variety of protective devices are available to meet any system need. These include:

- Molded case circuit breakers, fixed or drawout, up to 3000 amperes – 200,000 AIC.
- Fusible switches up to 3000 amperes – 200,000 AIC.
- Power circuit breakers, fixed or drawout, up to 3000 amperes.
- Current limiting reactors up to 1600 amperes – 100,000 AIC.

Control Components

Components are all of Westinghouse manufacture, with reliability and superiority proved for control center application. Control units can be supplied for full voltage or reduced voltage starting of Ac and Dc motors.

Major components of starters consist of:

1. A primary disconnect device – either a type MCP motor circuit protector or a fusible DS switch. Refer to General Catalog Sections 29-300 and 29-400 for further information.

2. Type A/200 magnetic linestarter is designed to provide new standards of engineering quality and appearance, long life and reliability. In addition, these starters give a new concept in space savings, and new ease of installation and maintenance.

The overload relay assembly is separated from the contactor and can be supplied either with or without ambient compensating features. They are adjustable for close tripping calibration.

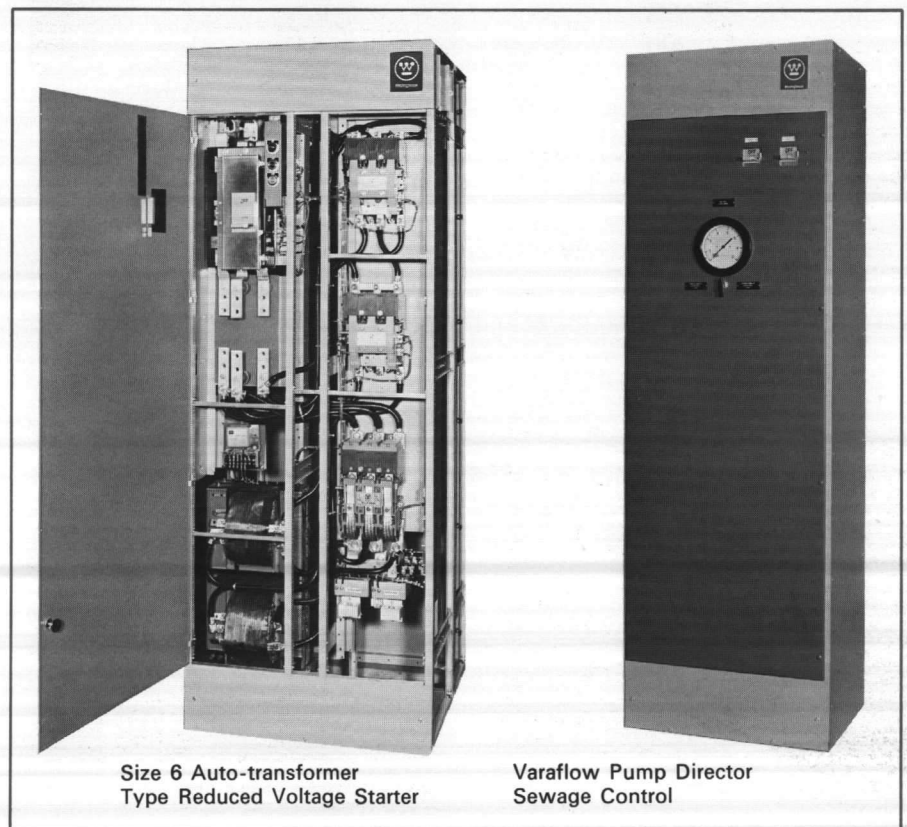
The coils are encapsulated, and are of the plug-in type. Catalog Section 8220 provides complete information.

3. Type L-56 electrical interlocks are available in snap-in blocks. Each may have independent normally open and normally closed contacts. No special tools are required for installation.

Further Information

Price List 12-120

Special Applications



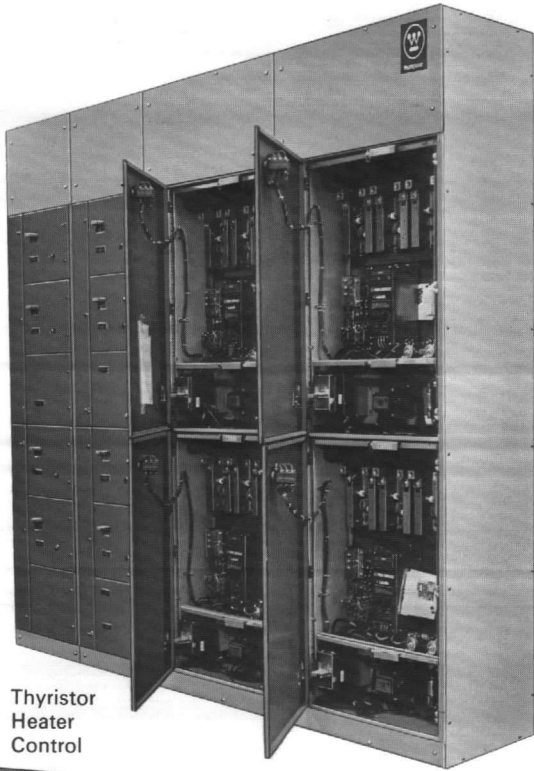
Size 6 Auto-transformer
Type Reduced Voltage Starter

Varaflow Pump Director
Sewage Control

Type W Control Centers

600 Volts Maximum

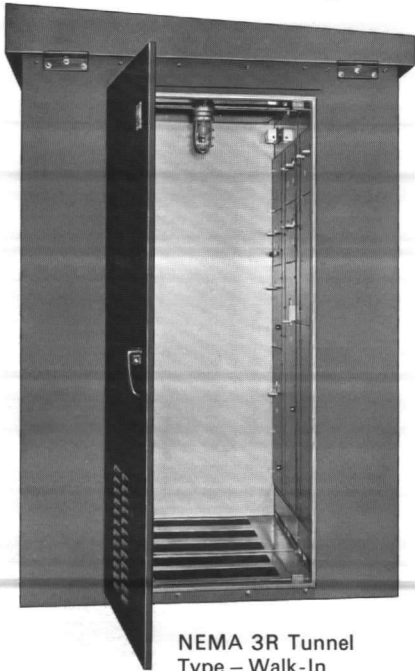
Special Applications, Continued



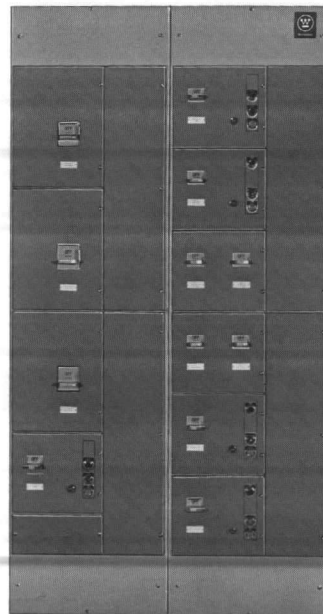
Thyristor
Heater
Control



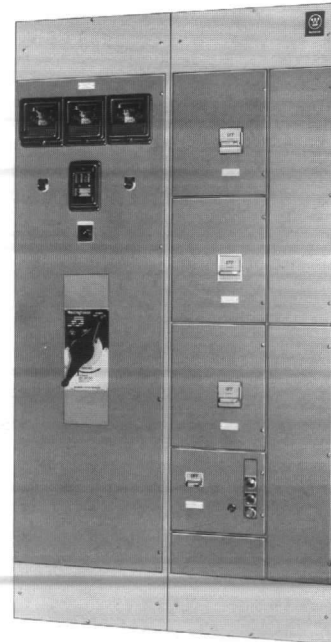
Lighting Panelboard with
Transformer and Feeder Breaker



NEMA 3R Tunnel
Type - Walk-In

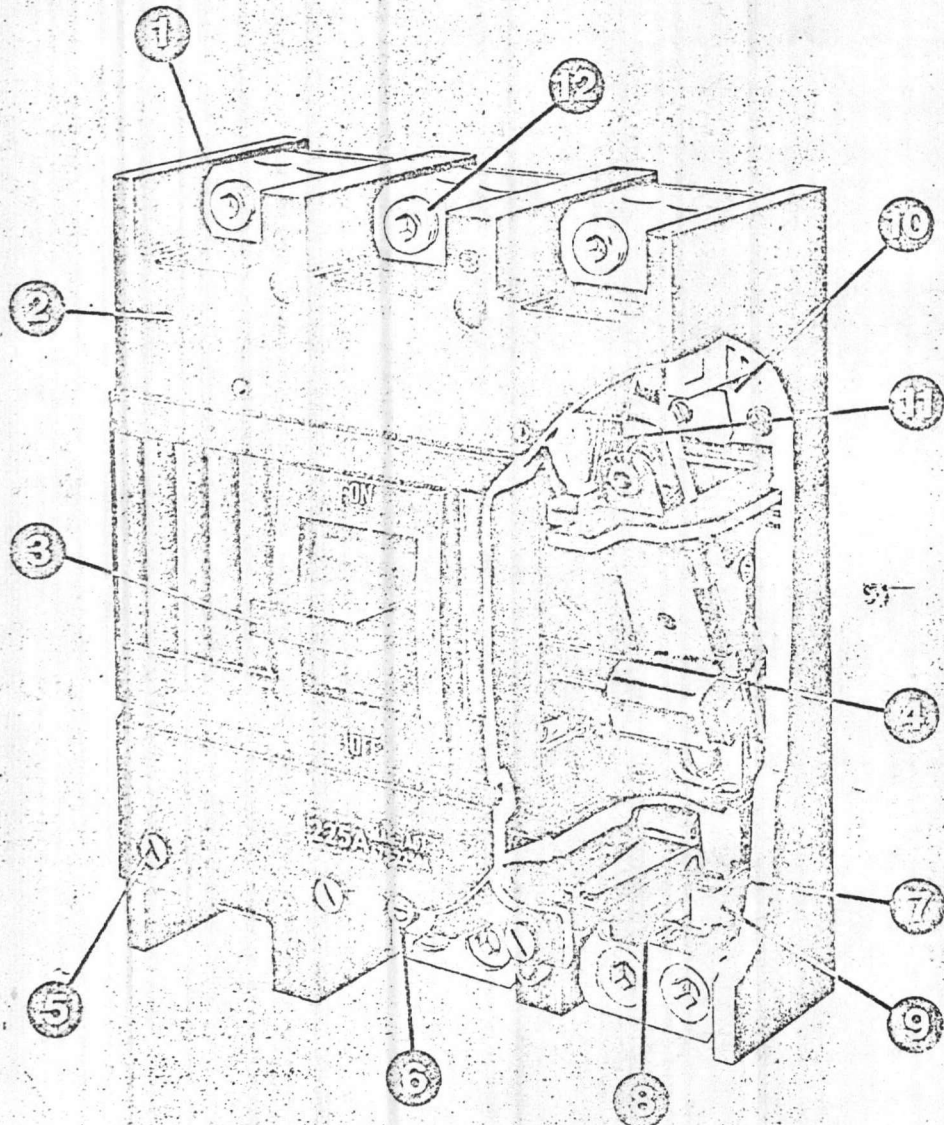


Oversized Wireway



Automatic Transfer Switch

Here Is The Inside Story



1. Just four basic frame sizes for 10 to 1200 amps. Easy to identify, easy to apply.

2. Molded case. Ruggedly constructed insulating material.

3. Trip indication is by handle position midway between ON and OFF. To reset the trip mechanism, move the handle to extreme OFF, then to ON position.

4. Quick-make, quick-break, trip-free mechanism minimizes arcing during breaker operation. Contacts cannot be "toasted" into position. Trip-free mechanism is independent of manual handle control. The breaker trips under short-circuit or overload, even though the operating handle is held in ON position.

5. Front-adjustable magnetic trip. Magnetic trip element provides instantaneous trip in event of short-circuit. Any current surge above the trip setting produces a magnetic field which instantly actuates the trip mechanism and opens the circuit.

6. VERIFIER™ "Twist-to-Trip" The Verifier "Twist-to-Trip" mechanically simulates overcurrent tripping through actuation of linkages not operated by the ON-OFF handle. Experience has shown that circuit breakers in industrial applications better maintain their original protective characteristics when regularly exercised. See Bulletin GED-4898.

7. Thermal trip provides protection against sustained overloads. A bi-metallic element reacts time-wise in inverse proportion to the current. If a circuit is overloaded, heat resulting from excessive current flow causes the bi-metal to bend, actuating the trip mechanism to open the circuit.

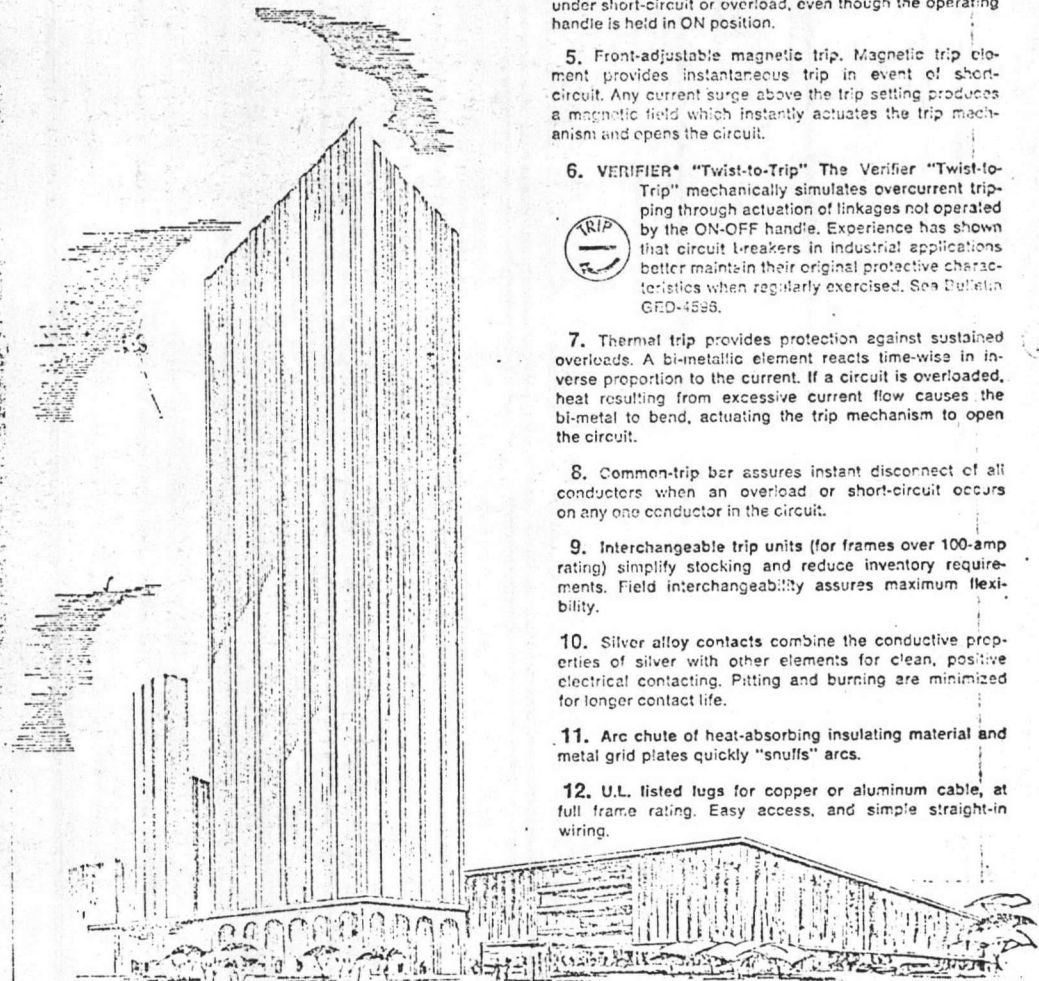
8. Common-trip bar assures instant disconnect of all conductors when an overload or short-circuit occurs on any one conductor in the circuit.

9. Interchangeable trip units (for frames over 100-amp rating) simplify stocking and reduce inventory requirements. Field interchangeability assures maximum flexibility.

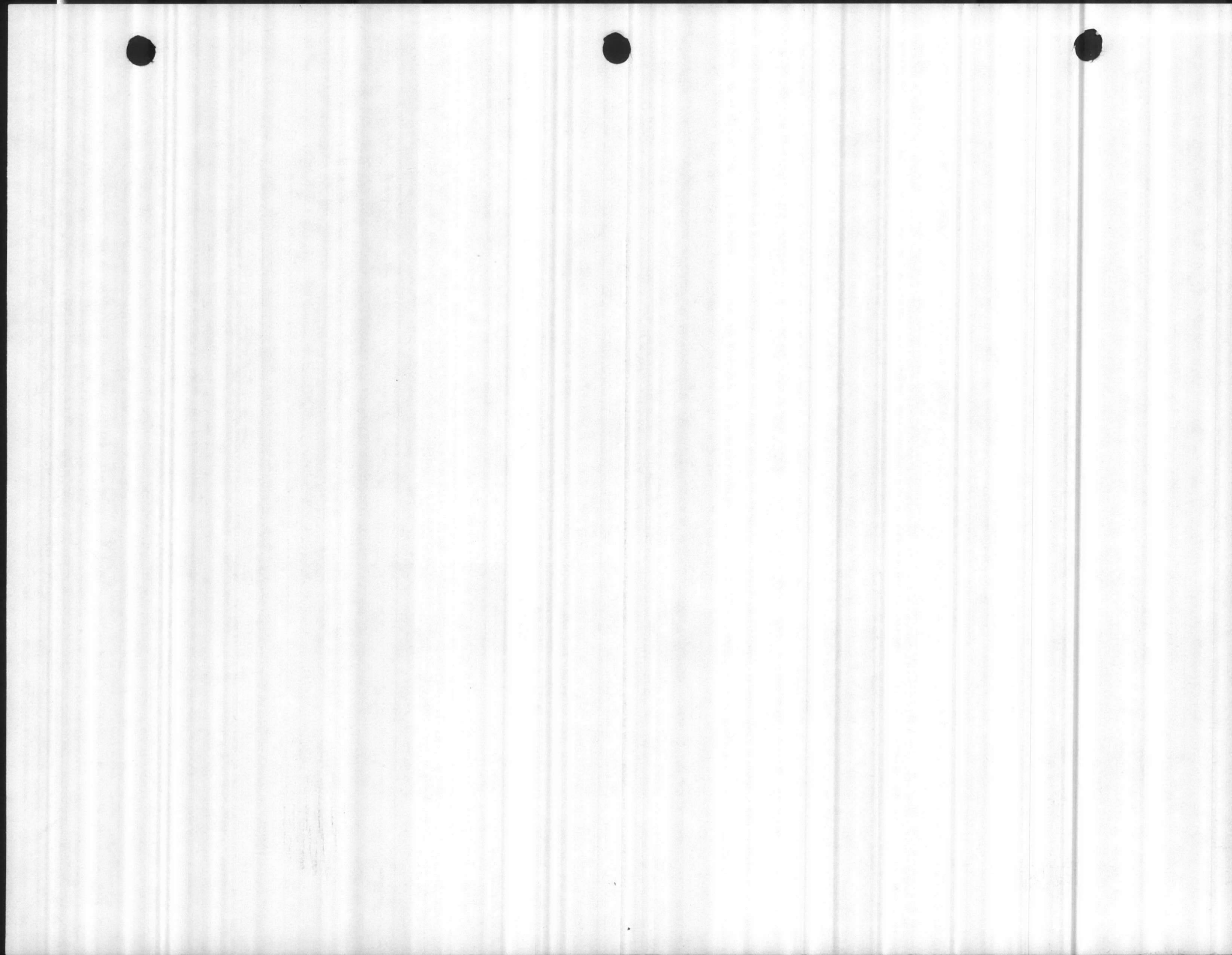
10. Silver alloy contacts combine the conductive properties of silver with other elements for clean, positive electrical contacting. Pitting and burning are minimized for longer contact life.

11. Arc chute of heat-absorbing insulating material and metal grid plates quickly "snuffs" arcs.

12. U.L. listed lugs for copper or aluminum cable, at full frame rating. Easy access, and simple straight-in wiring.



Trademark of General Electric Company





MOLDED-CASE CIRCUIT BREAKERS

Quick Selection Guide

Circuit Breaker Type	Ampere Rating	No. Poles	Maximum Voltage Rating		U/L Listed Interrupting Ratings—Symmetrical Rms Amperes							
					A-c Voltage				D-c Voltage			
			A-c	D-c	120/240	240	277	480	600	125	250	
Q 125	TQP	1	120/240		5000							
		2	120/240		5000							
	THQP	1	15-30			10,000						
		2	15-50			10,000						
	TQL, TQAL, TQB, TQC	1	5-70	120/240		5000 ①						
		2	5-125	120/240		5000 ①②						
		2	5-10	240			5000 ①②					
		3	5-10	240			5000 ①					
		1	15-70	120/240		10,000						
	* THQL, THQAL, THQB, THQC	2	15-70	120/240		10,000						
2		15-100	240			10,000						
3		15-100	240			10,000						
TXQL, ** TXQB, TXQC	1	15-30	120/240		65,000							
	2	15-30	120/240		65,000							
TQDL	125-200	2	120/240		10,000							
Q 225	TQD	2	125-225			10,000						
		3	125-225			10,000						
Q 400	TJD	2, 3	250-400	240	250	22,000					10,000	
		1	10-100	120	125	19,000 ①					5000 ②	
E 150	TEB	2	10-100	240	250		10,000 ③				5000	
		3	10-100	240	250		10,000 ③				5000	
		2, 3	3-150	600	250				22,000 25,000 ④			
TEO	TEO	1	10-100	277	125			14,000			10,000	
		2	10-100	480	250		18,000		14,000		10,000	
		3	15-100	480	250		18,000		14,000		10,000	
	2, 3	15-100	600	250		18,000		14,000	14,000	10,000		
	3	15-150	600	250		18,000		14,000	14,000	10,000		
	1	15-30	277	125			65,000			20,000 ⑤		
	2, 3	15-100	600	250		65,000		25,000	18,000	20,000 ⑤	20,000 ⑤	
THED	THED	3	15-150	600	250		65,000		25,000	18,000	20,000 ⑤	
		2, 3	15-150	600	250		65,000		25,000	18,000	20,000 ⑤	
		3	15-150	600	250		65,000		25,000	18,000	20,000 ⑤	
F 225	TFC ⑥	2, 3	225	600	250				22,000 25,000			
		2	70-225	600	250		25,000		22,000		10,000	
		3	70-225	600	250		25,000		22,000		10,000	
THFX	THFX	2	70-225	600	250		65,000		25,000		20,000 ⑦	
		3	70-225	600	250		65,000		25,000		20,000 ⑦	
		3	70-225	600	250		65,000		25,000		20,000 ⑦	
J 600	TJC ⑧	2, 3	400-600	600	250				22,000 25,000			
		2	125-400	600	250		42,000		30,000		10,000	
	TJJ, TJK4	TJJ, TJK4	3	125-400	600	250		42,000		30,000		10,000
			2	250-600	600	250		42,000		30,000		10,000
	THJK4	THJK4	2	125-400	600	250		42,000		30,000		10,000
3			125-400	600	250		42,000		30,000		10,000	
K 1200	TKC ⑧	2, 3	800-1200	600	250				22,000 25,000			
		2	300-800	600	250		42,000		30,000		10,000	
	TKM8	TKM8	3	300-800	600	250		42,000		30,000		10,000
			2, 3	600-1200	600	250		42,000		30,000		10,000
	THKM8	THKM8	2	300-800	600	250		65,000		35,000		20,000 ⑨
			3	300-800	600	250		65,000		35,000		20,000 ⑨
	THKM12	THKM12	2	600-1200	600	250		65,000		35,000		20,000 ⑨
3			600-1200	600	250		65,000		35,000		20,000 ⑨	
TRI-BREAK®	T81	2	15-100	600			200,000 ⑩		200,000 ⑩	200,000 ⑩	Refer to Company	
		3	15-100	600			200,000 ⑩		200,000 ⑩	200,000 ⑩	Refer to Company	
	T84, T8C4	T84, T8C4	2	125-400	600			200,000		200,000	200,000	Refer to Company
			3	125-400	600			200,000		200,000	200,000	Refer to Company
T86, T8C6	T86, T8C6	2	300-600	600			200,000 ⑩		200,000 ⑩	200,000 ⑩	Refer to Company	
		3	300-600	600			200,000 ⑩		200,000 ⑩	200,000 ⑩	Refer to Company	
T88, T8C8	T88, T8C8	2	600-800	600			200,000 ⑩		200,000 ⑩	200,000 ⑩	Refer to Company	
		3	600-800	600			200,000 ⑩		200,000 ⑩	200,000 ⑩	Refer to Company	
POWER-BREAK*	TPS	2, 3	600-4000	600			85,000		65,000	50,000	40,000	
		2, 3	600-4000	600			200,000		100,000	85,000	40,000	

① 5-amp, 3000 amp IC, not U/L listed.

② 10-amp not U/L listed.

③ U/L listing pending.

④ D-c interrupting ratings above 10,000 amperes not U/L listed.

* Trade-mark of General Electric Company.

⑤ Not U/L listed. Interrupting ratings based on NEMA test procedures.

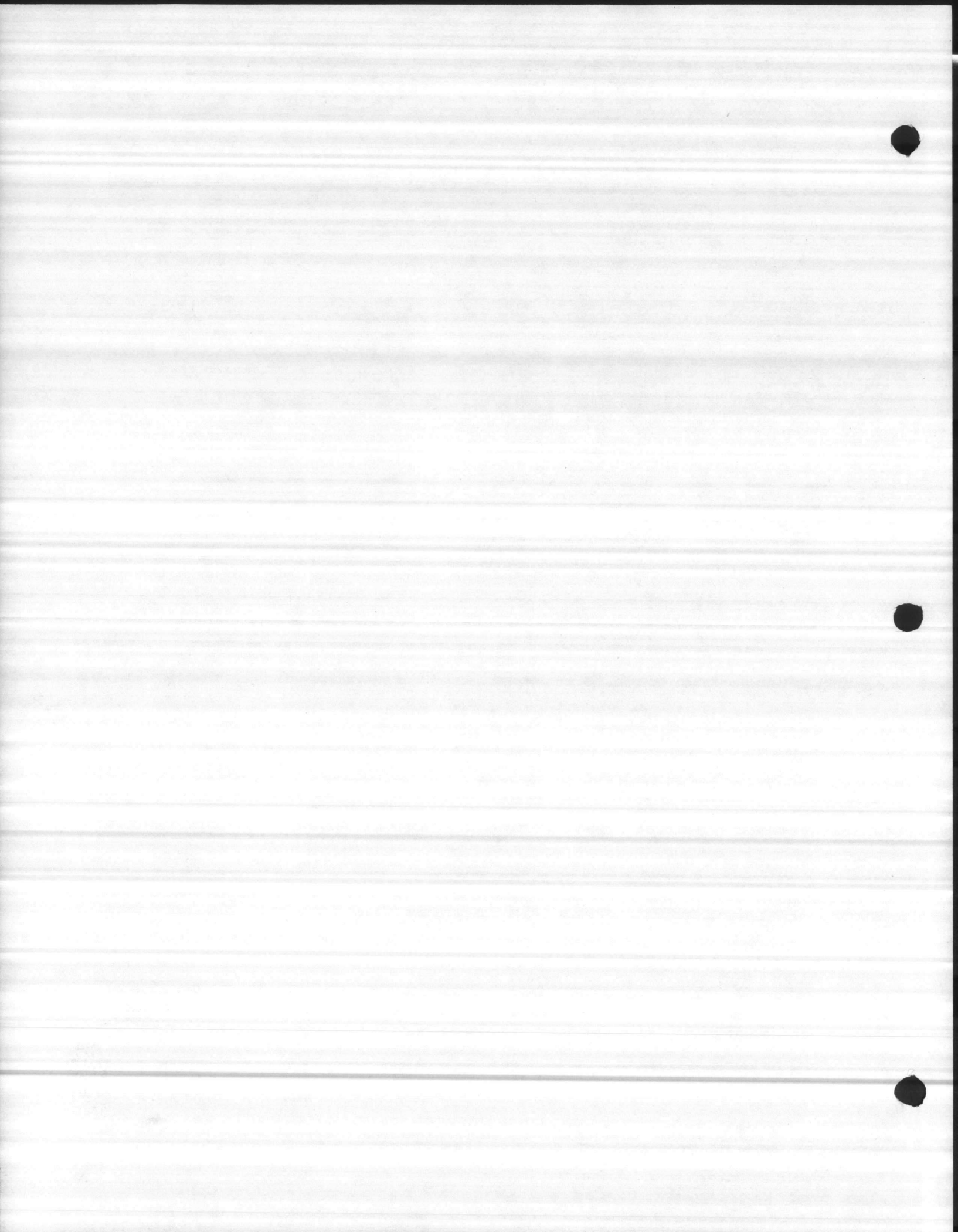
⑥ IC combination rating in GE "7700 Line" motor control equipment per NEMA ICS2-322. Not U/L listed.

⑦ 10,000 amp IC, for breakers over 100 amperes.

* THHQL 100-125 ampere @ 22,000 AIC also available, see page 4.

** TXQL 3-Pole also available, see page 4.

CC003



The Thyrite Secondary Arrester

For safe and low-cost protection of a-c secondary distribution systems rated 175-650 volts

ASSURES SERVICE CONTINUITY

The General Electric Thyrite secondary arrester is specifically designed to protect utility and industrial installations and equipment in the 175-650 volt range from overvoltages caused by lightning discharges. It is available for both single- and three-phase application.

Among utility applications which provide ideal installations for this protector are:

- Exposed secondary circuits
- Watthour meters
- Service entrances
- Station auxiliary equipment and circuits

Among industrial applications are:

- Exposed power circuits between buildings
- Service entrances
- Motors and control circuits
- Computing machines or other vulnerable electronic equipment

A-c rotating machine protection yields proven benefits to both utilities and industrial power users. The installation of a Thyrite arrester will provide dependable protection against lightning

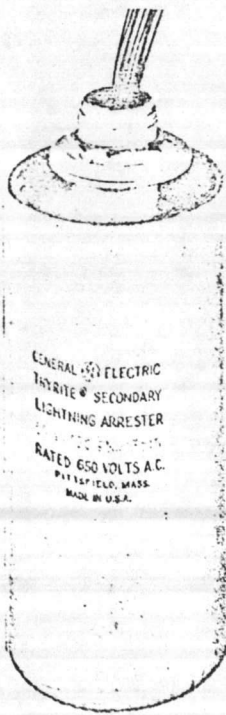


FIG. 7 Thyrite arrester model 9L15BCC003 designed for indoor mounting to knockout hole of meter or switchbox.

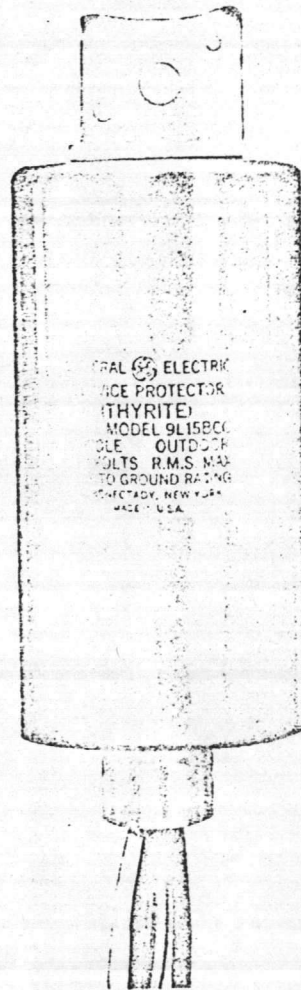
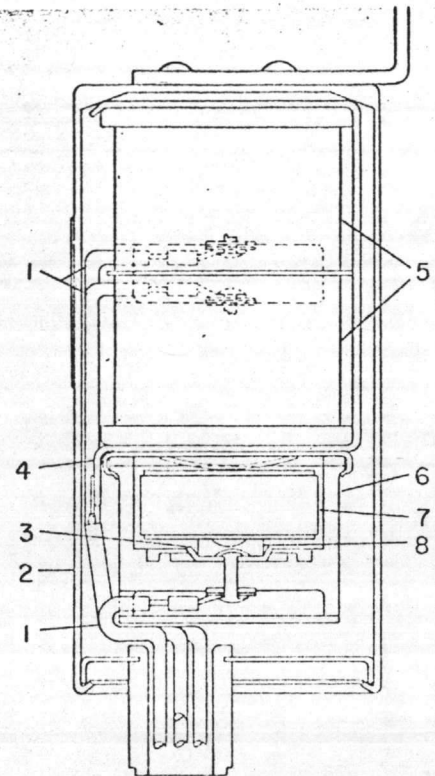


FIG. 8 Thyrite arrester 9L15BCC008 three-pole, with bracket for separate mounting, and cross-section of arrester single-pole assembly



NOMENCLATURE

- | | |
|---------------------|--------------------|
| 1. Line Lead | 5. Single Pole |
| 2. Aluminum Can | Arrester Units |
| 3. Brass Electrodes | 6. Textolite* Case |
| upper & lower | 7. Thyrite Disk |
| 4. Ground Lead | 8. Ceramic Spacer |

showing serrated gap electrodes and Thyrite valve disk.

damage to the major insulation of A-C rotating equipment. In addition to the arrester, a Pyranol* protective capacitor†, rated 650-volts, should also be installed. The capacitor reduces the rate of rise of surge overvoltage and provides the necessary protection to the turn insulation of a-c rotating machines.

GIVES DEPENDABLE PROTECTION

The Thyrite secondary arrester utilizes newly improved construction features and moisture proofing to provide unexcelled performance and efficiency. It is recommended for indoor or outdoor in-

* Reg. Trademark of General Electric Co.

† For description refer to publication GEC-1558.

stallation on single- or three-phase a-c secondary services and power circuits.

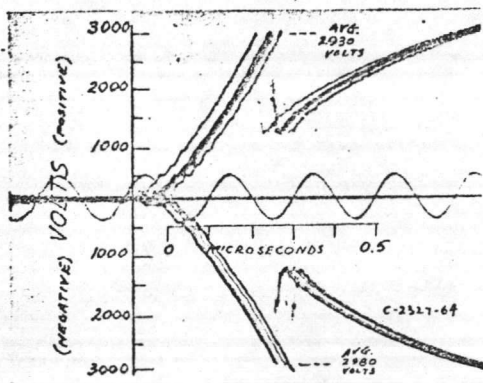
The arrester is available as a single-, double-, or three-pole device. Each single-pole protective element, see Figure 8, consists of a series gap and a Thyrite valve disk. One, two, or three of these individually sealed assemblies are placed inside an aluminum housing. This provides self-contained units for single-, double-, or three-pole protection.

The gap in each single-pole element is formed by a ceramic spacer which separates the two brass electrodes. One electrode is serrated to prevent arcing from "bridging" the gap and grounding the line.

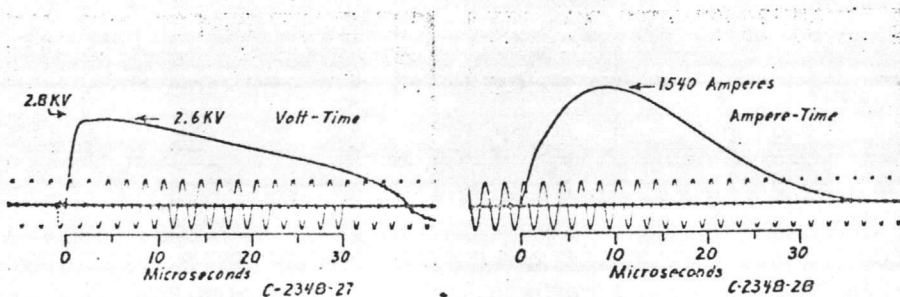
* Reg. Trademark of General Electric Co. for molding compounds



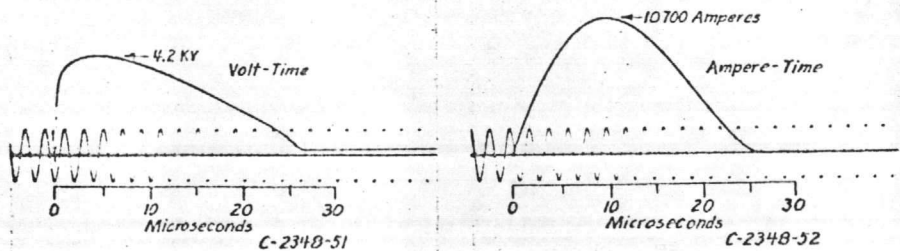
Protective Characteristics



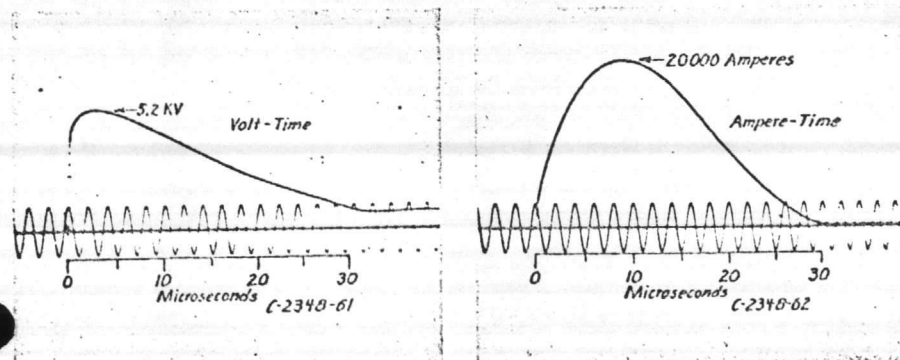
(a) Oscillograms showing repeated volt-time sparkovers of the Thyrite Arrester using impulse waves of both positive and negative polarities.



(b) The average impulse sparkover voltage is about 2.8-kv crest and the average discharge voltage is 2.6-kv crest for 1500-ampere impulse discharge current.



(c) Discharge voltage is 4.2 kv at 10,700-amperes 8 x 20 μs impulse discharge current.



(d) Discharge is 5.2 kv at 20,000-ampere 8 x 20 μs impulse discharge current.

FIG. 9 Cathode-ray oscillograms showing complete impulse-protective characteristics of Thyrite arresters, single-, double-, or three-pole units for 175-650-volt circuits.

The gap is in series with a Thyrite valve disk. The Thyrite valve disk is the most efficient valve element offered for withstanding multiple lightning strokes and long duration discharges. These features are of primary importance for continuous safe operation.

PROVIDES ALL-WEATHER PROTECTION

The 650-volt Thyrite arrester, Fig. 8, is housed in a watertight aluminum housing that will not rust or corrode. Line leads (black) and the ground lead (white) are brought out through the housing cover. All leads are weather and oil resistant insulated Flamamol* wire.

EASY TO INSTALL

Versatile mounting has been designed into G-E Thyrite arresters to permit installations which offer the highest degree of safe, efficient operation. The arrester should be installed as close as possible to the protected equipment, and the lowest ground resistance possible should be provided. A threaded conduit nipple or a galvanized steel bracket is provided for easy mounting.

Knockout-hole mounting provides a complete metal-clad tamper-proof installation. Both line and ground connections are made within the enclosure. The threaded conduit nipple is inserted through the knockout-hole on a meter case, connection, switch, or fuse box. The arrester is secured by tightening the lock nuts on the threaded conduit on either side of the knockout-hole. Circular washers permit installations through knock-out holes ranging in size from 3/4 to 1 1/4 I.P.S.

Figure 7 shows a three-pole Thyrite arrester with a threaded conduit for knockout-hole mounting. Dimensions are shown in Figure 10. For the protection of a-c rotating machinery, Pyranol capacitors for knockout-hole mounting are also available.

Bracket mounting provides for separate installations at or near the equipment to be protected. See Figure 8. The Thyrite arrester is most effective when installed close to the device or appliances to be protected from lightning damage. The arrester can be installed at the point where exposed secondary or service conductors enter the service conduit cap. Figure 11 gives dimensions for a bracket mounted arrester. For the protection of a-c rotating machinery, bracket mounted Pyranol capacitors are also available.

* Reg. Trademark of General Electric Co. for wire



Home Lightning Protector

Listed by Underwriters' Laboratories (UL)

DESCRIPTION

The Home Lightning Protector is designed to prevent lightning surges (entering through the wiring) from damaging electrical wiring and appliances. The Protector is a sturdy, weatherproof, service-proven device that immediately drains lightning surges harmlessly to ground. Installed at either the weatherhead or service-entrance box, the Protector discharges a surge in a fraction of a second. It will perform this protective function over and over again, without any maintenance required, possessing the same long-life valve-type characteristics obtainable in higher-voltage distribution arresters.

The Protector is a two-pole, three-wire device designed primarily for single-phase 120/240-volt three-wire grounded neutral service. It can also be applied to protect three-phase circuits where the line-to-ground 60 Hertz voltage does not exceed 175 volts. Connection diagrams are included on the inside of each carton.

WHERE TO USE

Farmers—whose livelihood depends on milking machines, incubators, coolers, submersible pumps, and other electrical equipment.

Suburbanites—with considerable dependency on (and investment in) electrical appliances of all sorts.

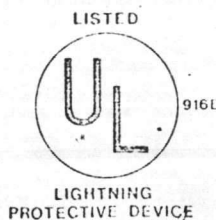
Rural Homeowners—often far from fire-fighting equipment, and repair facilities.

Everyone—with electrical equipment exposed to the destructive lightning surges that can enter through directly-connected overhead secondary power lines.

FEATURES

The General Electric Home Lightning Protector

- can prevent costly appliance repair bills
- can help assure uninterrupted electrical service
- is the only device of its kind with a 10-year unit replacement guarantee



PRICES AND DATA

Protective Equipment Products-P(032)

Circuit Rating Volts	Protector Max Permissible Line-to-ground Voltage Rms	Protector Model No.	Net Wt Each in Oz.	Std Package
120/240 Ground Neutral	175	9L15DCB002	6	24 Units

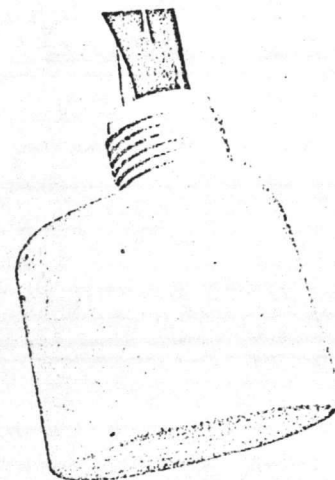
PERFORMANCE CHARACTERISTICS*

Protector Rating (Volts Rms)	Impulse Sparkover Voltage 10K μ sec KV crest	IR Discharge Voltage KV Crest (10 x 20 Microsecond Current Wave)		
		At 1500 Amp	At 5000 Amp	At 10,000 Amp
0-175	2	1.0	1.2	1.4

* Average values.

Revised since Mar. 20, 1972 issue.

PM 700, 701, 702, 711-714, 721-723, 731-737

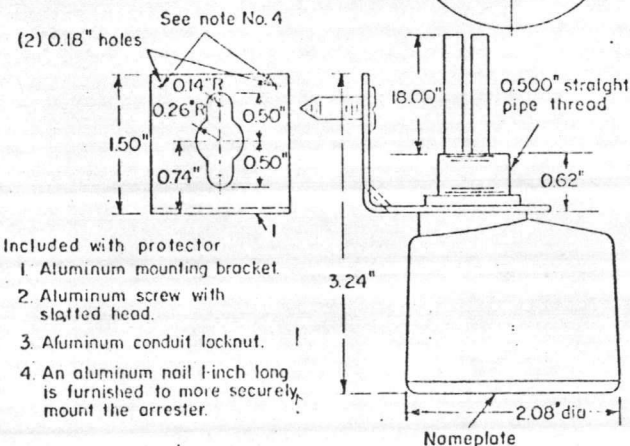


(Photo 1219173)

Fig. 1. Home Lightning Protector. Hardware (not shown) is included in carton and detailed below.

Note - Service protector may be mounted either side up - with bracket. It may be suspended by its leads or mounted in knockouts in load center or fuse boxes.

All leads are tinned copper
 (2) black leads No. 14 AWG (line)
 (1) white lead No. 14 AWG (ground)



- Included with protector
1. Aluminum mounting bracket.
 2. Aluminum screw with staffed head.
 3. Aluminum conduit locknut.
 4. An aluminum nail finch long is furnished to more securely mount the arrester.

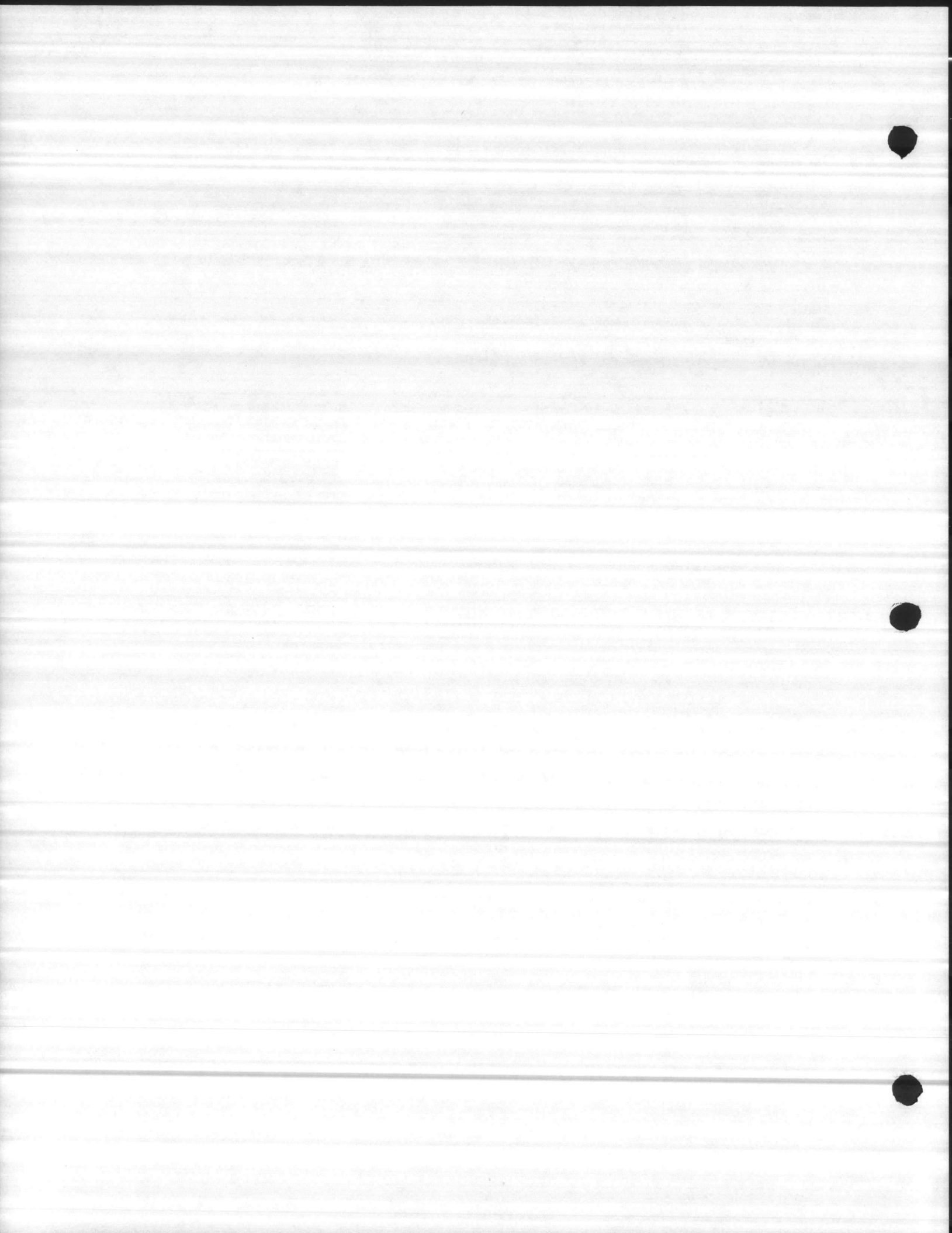
Fig. 2. Model No. 9L15RCB002 Home Lightning Protector

NOTE: Minimum order quantity is one (1) standard package containing twenty-four (24) units. Orders will be accepted for shipment from factory stock in lots of one or more standard packages only. Orders for less than standard package quantities should be referred to local distributors.

PUBLICATIONS: (Use latest issue)
 Descriptive Bulletin.....GED-4835

Prices and data subject to change without notice






GENERAL ELECTRIC



AB De-ion[®] Circuit Breakers

Types, Dimensions, Ratings,
Accessories and modifications

Standard Breakers

Quicklag [®] P	Quicklag [®] B	Quicklag [®] C	CA	DA
				
1, 2, 3 Poles 10-100 Amps @40°C	1, 2, 3 Poles 10-100 Amps @40°C	1, 2, 3 Poles 10-100 Amps @40°C	2, 3 Poles 125-225 Amps @40°C	2, 3 Poles [ⓐ] 250-600 Amps @40°C

Dimensions, Inches, 3 Pole Breakers

H	W	D	H	W	D	H	W	D	H	W	D	H	W	D
3	3	2 $\frac{1}{2}$	2 $\frac{1}{2}$	3	2 $\frac{1}{2}$	3 $\frac{1}{2}$	3	2 $\frac{1}{2}$	6	4	2 $\frac{1}{2}$	10	5	4 $\frac{1}{2}$

ⓐ Ratings I.C. Ratings Shown 5000 are Symmetrical; Ratings Shown 5000 are Asymmetrical

120/240, 240 Volts Max. Amps I. C. 120/240 Volts: 5000 and 10,000 120/240 Volts: 5000 and 10,000 240 Volts: 10,000 and 10,000	120/240, 240 Volts Max. Amps I. C. 120/240 Volts: 5000 120/240 Volts: 5000 240 Volts: 10,000 and 10,000	120/240, 240 Volts Max. Amps I. C. 120/240 Volts: 5000 and 10,000 120/240 Volts: 5000 and 10,000 240 Volts: 10,000 and 10,000	240 Volts Max. Amps I. C. 10,000 and 10,000	240 Volts Max. Amps I. C. 25,000 and 22,000
---	---	---	---	---

Dc Ratings[ⓑ]

.....	250 Volts 10,000 Amps I. C.
-------	-------	-------	-------	--------------------------------

Accessories and Modifications[ⓐ] See Pages 33-38 for Prices and Description

Moisture-Fungus Treatment Handle Lock Devices	Moisture-Fungus Treatment Handle Lock Devices	Moisture-Fungus Treatment Handle Lock Devices	Moisture-Fungus Treatment Handle Lock Devices	Shunt Trip Undervoltage Trip Auxiliary Switch Alarm Switch Mechanical Interlock Center Studs Rear Connecting Studs Ground Current Limiter Moisture-Fungus Treatment Motor Operator Enclosure Handle Mech. Parallel Connections Handle Lock Devices
--	--	--	--	--

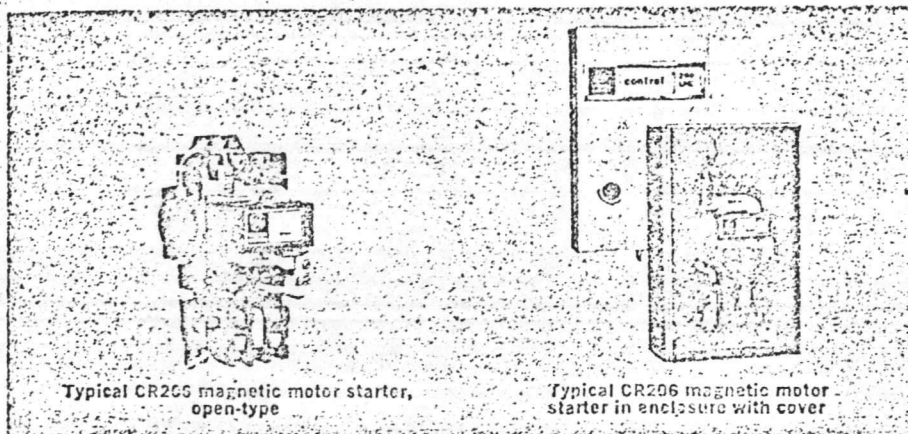
ⓐ Not Underwriters' Laboratories, Inc. listed.
 ⓑ Underwriters' Laboratories, Inc. listed.
 ⓐ 2-pole unit supplied in 3-pole frame



FULL VOLTAGE NON-REVERSING MAGNETIC MOTOR STARTERS

200 Hp Max., NEMA Sizes 00-5, 600 Volts Max., 60 Hertz Max.

CR 206
CR 106



Typical CR206 magnetic motor starter, open-type

Typical CR206 magnetic motor starter in enclosure with cover

PRICING INFORMATION—List price includes holding interlock but does not include overload heaters. Heaters should be specified and ordered as a separate item at \$3.00 ea. 60-106. Order one heater for 2-pole starters, and two or three heaters for 3-pole starters. Three pole, 200-Line starters, Sizes 00-4 can provide 3-leg overload protection by installing the selected three heaters. Three pole, 100-Line starters, listed in table (Type 4 enclosed), are two overload forms; refer to page 66 for information on 3-leg protection.

For factory installed modifications refer to page 63.

CR206 FORMS	CR106 FORMS	CR206 FORMS
00	01	02
01	02	03
02	03	04
03	04	05
04	05	06
05	06	07
06	07	08
07	08	09
08	09	10
09	10	11
10	11	12
11	12	13
12	13	14
13	14	15
14	15	16
15	16	17
16	17	18
17	18	19
18	19	20
19	20	21
20	21	22
21	22	23
22	23	24
23	24	25
24	25	26
25	26	27
26	27	28
27	28	29
28	29	30
29	30	31
30	31	32
31	32	33
32	33	34
33	34	35
34	35	36
35	36	37
36	37	38
37	38	39
38	39	40
39	40	41
40	41	42
41	42	43
42	43	44
43	44	45
44	45	46
45	46	47
46	47	48
47	48	49
48	49	50
49	50	51
50	51	52
51	52	53
52	53	54
53	54	55
54	55	56
55	56	57
56	57	58
57	58	59
58	59	60
59	60	61
60	61	62
61	62	63
62	63	64
63	64	65
64	65	66
65	66	67
66	67	68
67	68	69
68	69	70
69	70	71
70	71	72
71	72	73
72	73	74
73	74	75
74	75	76
75	76	77
76	77	78
77	78	79
78	79	80
79	80	81
80	81	82
81	82	83
82	83	84
83	84	85
84	85	86
85	86	87
86	87	88
87	88	89
88	89	90
89	90	91
90	91	92
91	92	93
92	93	94
93	94	95
94	95	96
95	96	97
96	97	98
97	98	99
98	99	100

SINGLE-PHASE, 2-POLE

CR206 FORMS	CR106 FORMS	CR206 FORMS
00	01	02
01	02	03
02	03	04
03	04	05
04	05	06
05	06	07
06	07	08
07	08	09
08	09	10
09	10	11
10	11	12
11	12	13
12	13	14
13	14	15
14	15	16
15	16	17
16	17	18
17	18	19
18	19	20
19	20	21
20	21	22
21	22	23
22	23	24
23	24	25
24	25	26
25	26	27
26	27	28
27	28	29
28	29	30
29	30	31
30	31	32
31	32	33
32	33	34
33	34	35
34	35	36
35	36	37
36	37	38
37	38	39
38	39	40
39	40	41
40	41	42
41	42	43
42	43	44
43	44	45
44	45	46
45	46	47
46	47	48
47	48	49
48	49	50
49	50	51
50	51	52
51	52	53
52	53	54
53	54	55
54	55	56
55	56	57
56	57	58
57	58	59
58	59	60
59	60	61
60	61	62
61	62	63
62	63	64
63	64	65
64	65	66
65	66	67
66	67	68
67	68	69
68	69	70
69	70	71
70	71	72
71	72	73
72	73	74
73	74	75
74	75	76
75	76	77
76	77	78
77	78	79
78	79	80
79	80	81
80	81	82
81	82	83
82	83	84
83	84	85
84	85	86
85	86	87
86	87	88
87	88	89
88	89	90
89	90	91
90	91	92
91	92	93
92	93	94
93	94	95
94	95	96
95	96	97
96	97	98
97	98	99
98	99	100

2- AND 3-PHASE, 3-POLE

CR206 FORMS	CR106 FORMS	CR206 FORMS
00	01	02
01	02	03
02	03	04
03	04	05
04	05	06
05	06	07
06	07	08
07	08	09
08	09	10
09	10	11
10	11	12
11	12	13
12	13	14
13	14	15
14	15	16
15	16	17
16	17	18
17	18	19
18	19	20
19	20	21
20	21	22
21	22	23
22	23	24
23	24	25
24	25	26
25	26	27
26	27	28
27	28	29
28	29	30
29	30	31
30	31	32
31	32	33
32	33	34
33	34	35
34	35	36
35	36	37
36	37	38
37	38	39
38	39	40
39	40	41
40	41	42
41	42	43
42	43	44
43	44	45
44	45	46
45	46	47
46	47	48
47	48	49
48	49	50
49	50	51
50	51	52
51	52	53
52	53	54
53	54	55
54	55	56
55	56	57
56	57	58
57	58	59
58	59	60
59	60	61
60	61	62
61	62	63
62	63	64
63	64	65
64	65	66
65	66	67
66	67	68
67	68	69
68	69	70
69	70	71
70	71	72
71	72	73
72	73	74
73	74	75
74	75	76
75	76	77
76	77	78
77	78	79
78	79	80
79	80	81
80	81	82
81	82	83
82	83	84
83	84	85
84	85	86
85	86	87
86	87	88
87	88	89
88	89	90
89	90	91
90	91	92
91	92	93
92	93	94
93	94	95
94	95	96
95	96	97
96	97	98
97	98	99
98	99	100

2-PHASE, 4-POLE forms are available. Contact your nearest GE Sales Office for pricing and ordering information.
 * Motor full-load current should not exceed ampere rating of enclosed contactor listed by NEMA size on page 25.
 ** See coil suffix table.
 † Size 5 nomenclature shown applies to 60 or 50 hertz forms only.
 ‡ External reset not included on standard listed forms.
 NOTE: Plastic insert cards for use in identification panel of enclosure cover are available. Package of 100 CR206 X147A—\$20.00/Pkg. GO-106
 Refer to page 70 for 300 volt 50 hertz ratings.

COIL SUFFIX

Indicates voltage and frequency of operating coils

Select catalog suffix number in accordance with line voltage using table below. (Do not apply to forms with a control transformer.)

**Coil Suffix Table (use where double asterisk appears in nomenclature.)

Frequency (Hertz)	115V	200/208V	230V	460V	575V	600V
60	02	23	03†	04	05	06
Frequency (Hertz)	110V	220V	380V	440V	550V	600V
50	07	08	04	09	10	11

Use 22 for dual-rated 120V, 60 Hz/110V, 50 Hz coil

† Units are individually boxed and "Poly-Pocket" six per carton as standard.

APPLICATION

General Electric's 200-Line of magnetic motor starters may be used for starting full voltage, non-reversing, single speed AC motors up to 200 horsepower, 600 volts maximum, providing protection to the motor against running or stalled overloads.

Their compact size and ease of wiring make them especially suitable for motor control centers, custom-type control panels, and switchgear equipment.

FEATURES

- New block type overload relay gives greater application flexibility with either two-leg or three-leg protection.
- Contactor and block-type overload relay mount on integral baseplate.
- Improved auxiliary contacts carry heavy pilot-duty ratings.
- Manual contact operation check is built into overload relay.
- Attractive, new split-case type enclosure has electrocoated, two-tone finish.
- Shrouded reset in cover.

ORDERING DIRECTIONS

1. Specify starter by complete CR number. Add coil suffix number in place of double asterisk as selected from coil suffix table on this page.

Example: CR206C102 is a size 1 starter with 115 volt 60 Hz coil and in Type 1 General Purpose enclosure.

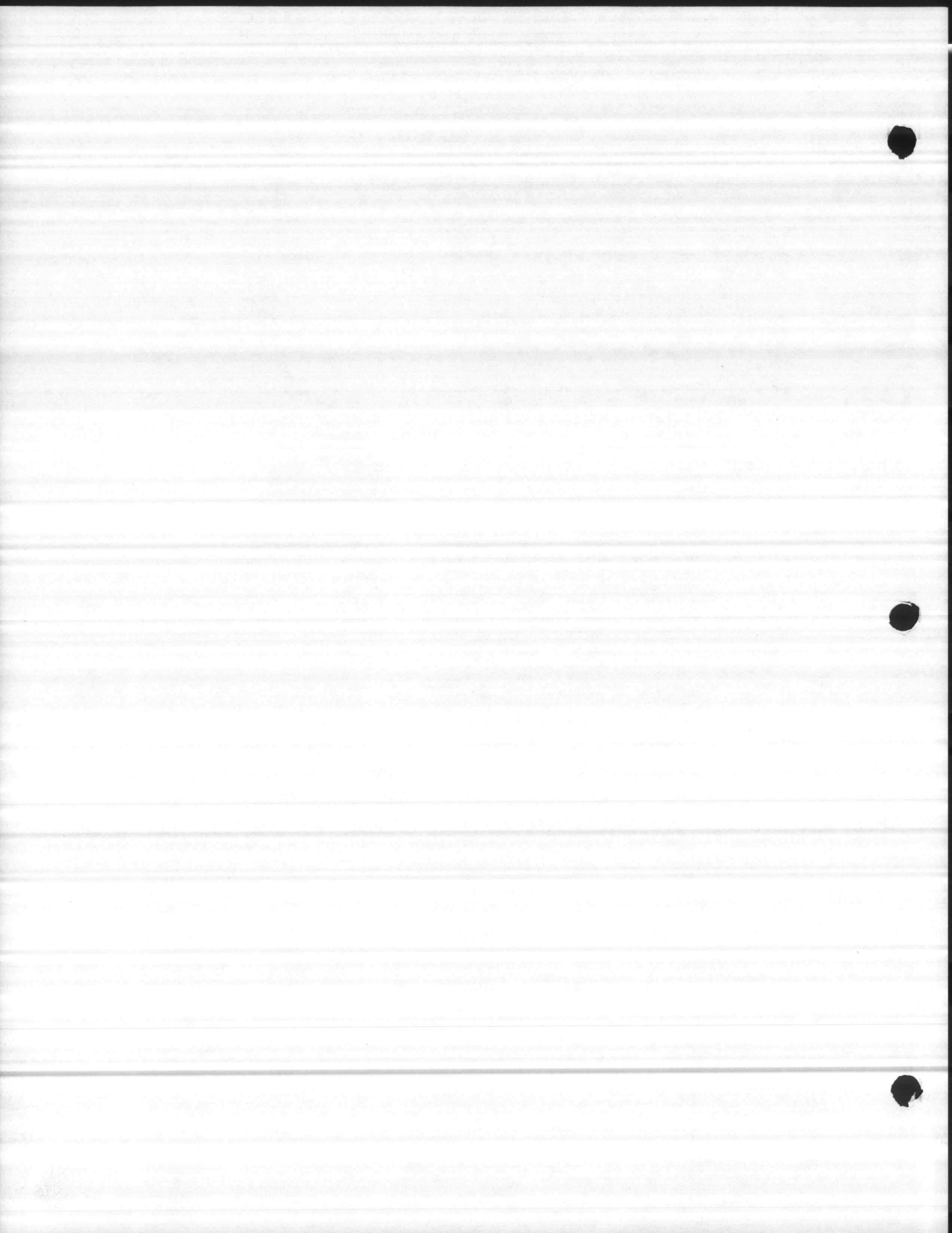
2. The final letter of the CR number denotes extra auxiliary contacts (sometimes referred to as auxiliary interlocks). Order the desired extra auxiliary contacts by replacing the final letter from first column of auxiliary interlock table (see page 67).

Example: CR206C102AAB is size 1 starter with one extra auxiliary contact, normally open.

3. For continuous rated motors with a service factor of 1.15 to 1.25 select the heater with maximum motor amps equal to or immediately greater than the actual full load current taken directly from the nameplate of motor. Order heater by complete CR number from appropriate heater table on page 65 for 200-Line devices.

4. Order special features or forms not listed by complete description using a listed form as reference.

Example: Similar to CR206C1** except with 460/115 volt control power transformer and red indicating light in cover



REV.	CO. NO.	DATE	DESCR	CHK.	APP.
1	1605	11-21-70	NEW RELAYS		EX
2	1613	1-27-73	FOR CO		

THREE PHASE

THREE PHASE

NEMA SIZES 00, 0, AND 1

NEMA SIZE 3

MIN. SETTING (amperes)	NOM. SETTING (amperes)	MAX. SETTING (amperes)	OVERLOAD HEATER CATALOG NUMBER
0.41	0.45	0.50	CR123C0.54A
0.44	0.49	0.54	CR123C0.60A
0.48	0.53	0.58	CR123C0.66A
0.53	0.59	0.65	CR123C0.71A
0.59	0.65	0.72	CR123C0.75A
0.69	0.76	0.84	CR123C0.87A
0.75	0.84	0.92	CR123C0.97A
0.84	0.93	1.02	CR123C1.09A
0.94	1.04	1.14	CR123C1.18A
1.03	1.15	1.27	CR123C1.31A
1.14	1.27	1.40	CR123C1.48A
1.25	1.39	1.53	CR123C1.63A
1.40	1.55	1.71	CR123C1.84A
1.56	1.73	1.90	CR123C1.96A
1.70	1.89	2.08	CR123C2.20A
1.85	2.05	2.26	CR123C2.39A
2.05	2.28	2.51	CR123C2.58A
2.22	2.47	2.72	CR123C3.01A
2.51	2.79	3.07	CR123C3.26A
2.93	3.31	3.64	CR123C3.56A
3.33	3.70	4.07	CR123C3.79A
3.65	4.06	4.47	CR123C4.19A
4.02	4.47	4.92	CR123C4.66A
4.46	4.95	5.45	CR123C5.26A
4.94	5.49	6.04	CR123C5.92A
5.32	5.91	6.50	CR123C6.30A
5.82	6.47	7.12	CR123C6.55A
6.48	7.20	7.92	CR123C7.78A
7.40	8.22	9.04	CR123C8.57A
7.85	8.72	9.59	CR123C9.55A
8.70	9.67	10.6	CR123C10.4B
9.36	10.4	11.4	CR123C11.3B
9.90	11.0	12.1	CR123C12.5B
11.2	12.4	13.6	CR123C13.7B
11.9	13.2	14.5	CR123C15.1B
13.9	15.4	16.9	CR123C16.3B
15.4	17.1	18.8	CR123C18.0B
16.3	18.1	19.9	CR123C19.8B
18.0	20.0	22.0	CR123C21.4B
19.4	21.5	23.7	CR123C22.8B
20.3	22.5	24.3	CR123C25.0B
21.5	23.9	26.3	CR123C27.3B
23.7	26.3	28.9	CR123C30.3B
24.3	27.0	29.7	CR123C33.0B

NEMA SIZE 2

5.27	5.85	6.44	CR123C6.30A
5.82	6.47	7.12	CR123C6.92A
6.62	7.35	8.09	CR123C7.78A
7.25	8.06	8.87	CR123C8.67A
8.13	9.03	9.93	CR123C9.55A
8.65	9.61	10.6	CR123C10.4B
9.45	10.5	11.6	CR123C11.3B
10.4	11.6	12.8	CR123C12.5B
11.3	12.5	13.8	CR123C13.7B
12.2	13.6	15.0	CR123C15.1B
15.0	16.7	18.4	CR123C16.3B
16.1	17.9	19.7	CR123C18.0B
16.8	18.7	20.6	CR123C19.8B
18.4	20.4	22.4	CR123C21.4B
20.4	22.7	25.0	CR123C22.8B
22.2	24.7	27.2	CR123C25.0B
23.7	26.3	28.9	CR123C27.3B
26.6	29.5	32.5	CR123C30.3B
30.2	33.5	36.9	CR123C33.0B
34.0	37.8	41.6	CR123C36.6B
37.7	41.9	46.1	CR123C40.0B
38.9	43.2	47.5	CR123C44.0B
40.5	45.0	49.5	CR123C46.0B

MIN. SETTING (amperes)	NOM. SETTING (amperes)	MAX. SETTING (amperes)	OVERLOAD HEATER CATALOG NUMBER
17.4	19.3	21.2	CR123F23.3B
19.9	22.1	24.3	CR123F24.3B
21.1	23.4	25.7	CR123F27.0B
24.3	27.0	29.7	CR123F30.0B
26.2	29.1	32.0	CR123F32.7B
29.5	32.8	36.1	CR123F35.7B
31.5	35.0	38.5	CR123F39.5B
33.8	37.6	41.4	CR123F43.0B
38.9	43.2	47.5	CR123F48.7B
43.0	47.7	52.5	CR123F56.7B
48.3	53.7	59.1	CR123F61.4B
51.8	57.5	63.3	CR123F65.8B
55.4	61.6	67.8	CR123F71.9B
63.2	70.2	77.2	CR123F77.2B
66.3	73.7	81.1	CR123F84.8B
72.5	80.6	88.7	CR123F91.4B
81.0	90.0	99.0	CR123F104C

NEMA SIZE 4

29.9	33.2	36.5	CR123F35.7B
31.6	35.1	38.6	CR123F39.5B
34.1	37.9	41.7	CR123F43.0B
41.4	46.0	50.6	CR123F48.7B
44.9	49.9	54.9	CR123F56.7B
50.0	55.6	61.7	CR123F61.4B
53.3	59.2	65.1	CR123F65.8B
55.7	61.9	68.1	CR123F71.9B
64.4	71.6	78.8	CR123F77.2B
66.5	73.9	81.3	CR123F84.8B
74.2	82.4	90.6	CR123F91.4B
85.7	95.2	104.7	CR123F104C
89.9	99.9	109.9	CR123F114C
94.5	105.0	115.5	CR123F118C
101.7	113.0	124.3	CR123F133C
111.6	124.0	136.4	CR123F149C
119.9	133.0	146.3	CR123F161C

NEMA SIZE 5

64.5	71.7	78.9	CR123C3.56A
71.9	79.9	87.9	CR123C3.79A
79.8	88.7	97.6	CR123C4.19A
86.3	95.9	105.5	CR123C4.66A
94.5	105.0	115.5	CR123C5.26A
103.5	115.0	126.5	CR123C5.92A
111.6	124.0	136.4	CR123C6.30A
120.6	134.4	147.4	CR123C6.95A
135.0	150.0	165.0	CR123C7.78A
146.7	163.0	179.3	CR123C8.67A
161.1	179.0	196.9	CR123C9.55A
174.6	194.0	213.4	CR123C10.4B
193.5	215.0	236.5	CR123C11.3B
207.0	230.0	253.0	CR123C12.5B
228.6	254.0	279.4	CR123C13.7B
243.0	270.0	297.0	CR123C15.1B

SINGLE PHASE

NEMA SIZES 00, 0, AND 1

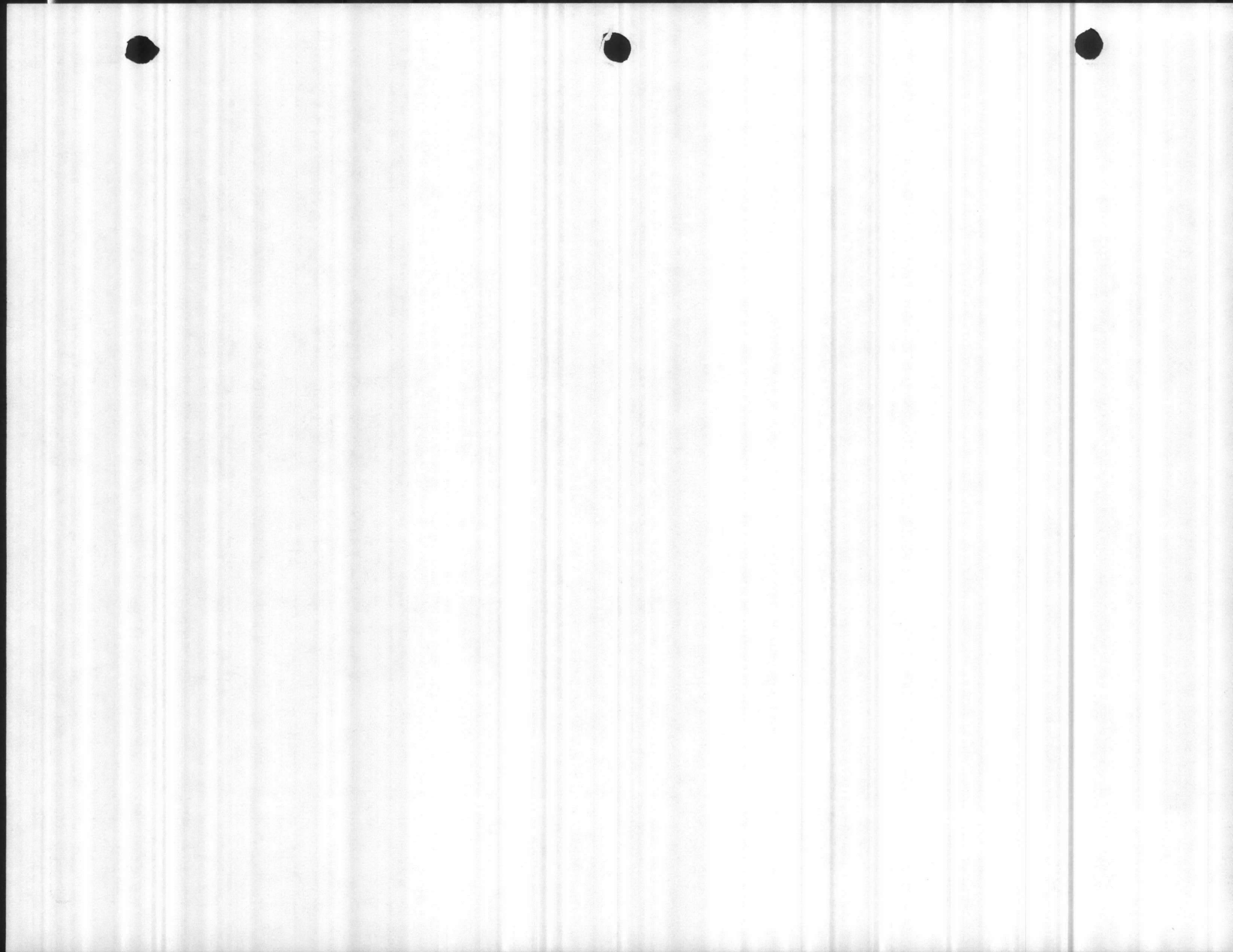
MIN. SETTING (amperes)	NOM. SETTING (amperes)	MAX. SETTING (amperes)	OVERLOAD HEATER CATALOG NUMBER
0.43	0.48	0.53	CR123C0.54A
0.50	0.55	0.61	CR123C0.60A
0.51	0.57	0.63	CR123C0.66A
0.59	0.65	0.72	CR123C0.71A
0.62	0.69	0.76	CR123C0.75A
0.75	0.83	0.91	CR123C0.87A
0.87	0.97	1.07	CR123C0.97A
0.93	1.03	1.13	CR123C1.09A
1.00	1.12	1.23	CR123C1.18A
1.13	1.26	1.39	CR123C1.31A
1.26	1.40	1.54	CR123C1.48A
1.31	1.46	1.61	CR123C1.63A
1.47	1.63	1.79	CR123C1.84A
1.61	1.79	1.97	CR123C1.96A
1.77	1.97	2.17	CR123C2.20A
2.03	2.25	2.48	CR123C2.39A
2.19	2.43	2.67	CR123C2.58A
2.34	2.60	2.86	CR123C3.01A
2.66	2.96	3.26	CR123C3.26A
3.21	3.57	3.93	CR123C3.56A
3.47	3.86	4.25	CR123C3.79A
3.99	4.43	4.85	CR123C4.19A
4.38	4.87	5.36	CR123C4.66A
4.83	5.37	5.91	CR123C5.26A
5.39	5.99	6.59	CR123C5.92A
5.75	6.39	7.03	CR123C6.30A
6.18	6.87	7.56	CR123C6.95A
6.94	7.71	8.46	CR123C7.78A
7.85	8.72	9.59	CR123C8.67A
8.55	9.50	10.5	CR123C9.55A
9.45	10.5	11.6	CR123C10.4B
10.5	11.7	12.9	CR123C11.3B
11.0	12.2	13.4	CR123C12.5B
12.2	13.5	14.9	CR123C13.7B
13.6	15.1	16.6	CR123C15.1B
15.8	17.5	19.3	CR123C16.3B
17.0	18.9	20.8	CR123C18.0B
18.7	20.8	22.9	CR123C19.8B
20.2	22.4	24.6	CR123C21.4B
23.0	25.5	28.1	CR123C22.8B
23.6	26.2	28.8	CR123C25.0B
24.3	27.0	29.7	CR123C27.3B

NEMA SIZE 1P

12.8	14.2	15.6	CR123C15.1B
15.6	17.3	19.0	CR123C16.3B
16.8	18.7	20.6	CR123C18.0B
18.5	20.6	22.7	CR123C19.8B
20.3	22.5	24.8	CR123C21.4B
22.2	24.7	27.2	CR123C22.8B
23.0	25.5	28.1	CR123C25.0B
24.0	26.7	29.4	CR123C27.3B
25.1	27.9	30.7	CR123C30.3B
28.9	32.1	35.3	CR123C33.0B
32.4	36.0	39.6	CR123C36.6B

1. OVERLOAD RELAY ADJUSTMENT KNOB SHOULD BE SET TO THE ACTUAL OR NAMEPLATE FULL LOAD CURRENT, USING AS A GUIDE THE CENTER AND END-POINT VALUES, GIVEN IN THE TABLE FOR THE HEATER USED. TRIP ADJUSTMENT KNOB IS TURNED CLOCKWISE TO DECREASE TRIP CURRENT, AND COUNTER-CLOCKWISE TO INCREASE TRIP CURRENT.


TITLE: OVERLOAD HEATER SELECTION TABLE FOR GENERAL ELECTRIC CR206 MOTOR STARTERS STANDARD TRIP HEATERS		MATERIAL: _____	
SHOP CRD-15726	JOB NAME Jackson 000 DC	FINISH: _____	
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107			
TOLERANCES UNLESS OTHERWISE SPECIFIED: TWO PLACE DEC. & 3RD. THREE PLACE DEC. & 999. FRACTIONS & 1/64 ANGULAR	DO NOT SCALE	DESIGNED DRAWN CHECKED	DRAWING NO. ES50040



PANEL MOUNTING—Front Flange Case—P824FF*, P847FF, P845FF & V845FF

Case: Drawn Steel, Black
Ring: Drawn Brass, Chrome Plated,
 Press Fit
Tube: Phosphor Bronze
Socket: Brass

Movement: Brass, Bronze Bushed (824 Model)
Pointer: Aluminum
Accuracy: 3-2-3%
Lens (Crystal): Heavy Bevel Edge Glass 2½" &
 3½" Sizes, Heavy Flat Glass 2" Size

FIGURE NUMBER & CONNECTION	SIZE and RANGES			ILLUSTRATION
	2"	2½"	3½"	
*P824FF ¼" LBM			30 thru 1000 psi	
P847FF ¼" LBM	30 thru 600 psi			
P845FF ⅛" CBM	15 thru 600 psi	15 thru 600 psi		
P845FF ¼" CBM			30 thru 200 psi	
V845FF ⅛" CBM	30"	30"		
V845FF ¼" CBM			30"	

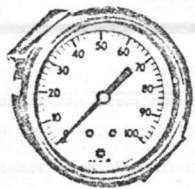
*Case: Cast Brass, Chrome Plated
 *Ring: Brass, Chrome Plated, Threaded

*Tube: Phosphor Bronze to and
 Incl. 600 psi
 Beryllium Copper—1000 psi

PANEL MOUNTING—U-Clamp Case—P844U & P846U

Case: Drawn Steel, Black
Ring: Brass, Chrome Plated, Press Fit
Tube: Phosphor Bronze
Socket: Brass

Movement: Brass
Pointer: Aluminum
Accuracy: 3-2-3%
Lens (Crystal): Heavy Bevel Edge Glass 2½" &
 3½" Sizes, Heavy Flat Glass 2" Size

FIGURE NUMBER and CONNECTION	SIZE and RANGES			ILLUSTRATION
	2"	2½"	3½"	
P844U ⅛" CBM	15 thru 600 psi	15 thru 600 psi		
P844U ¼" CBM			15 thru 200 psi	
V844U ⅛" CBM	30"	30"		
V844U ¼" CBM			30"	
P846U ⅛" LBM	15 thru 600 psi			



MARSHALLTOWN
IOWA, U.S.A.
MFG. INC.

DRAWN STEEL CASE DIAPHRAGM

Gauges

Drawn Steel Case

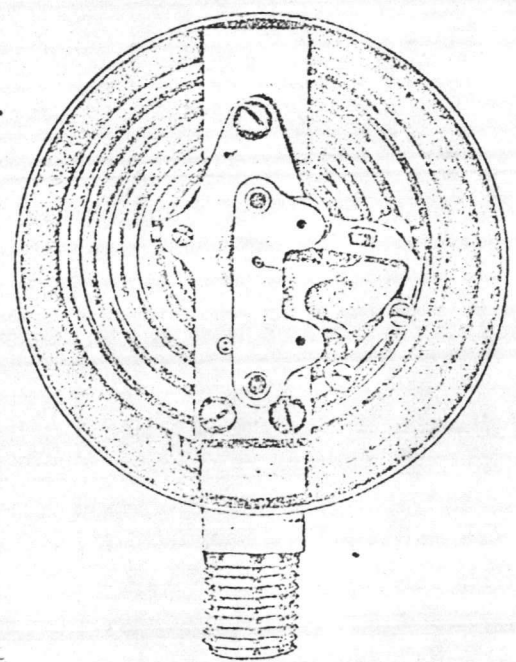


Fig. No. 83

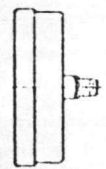


Fig. No. 83C

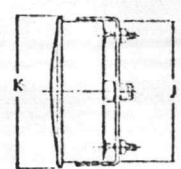


Fig. No. 83B

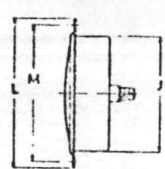


Fig. No. 83D

SIZE	J	K	L	M
2 1/2	2 1/2	2 3/8	3 1/2	3" B.C., 3 - 1/4 Holes
3 1/2	3 2/3	4	4 3/8	4 1/4" B.C., 3 - 3/16 Holes

USAGE—For the measurement of pressure or vacuum between 10 pounds per sq. in. and 10 inches of water—a range where a Bourdon tube gauge is not practical.

DIAL SIZES—2 1/2", 3 1/2" and 4 1/2".

CASE—Drawn steel - phosphatized for rust resistance and finished in oven baked black enamel.

RING—Same as above.

DIAPHRAGM—Phosphor bronze.

MOVEMENT—Brass - Independent mounting.

ACCURACY—Except as noted, within 1% of total scale range in middle half of scale - 2% elsewhere. Ranges under 30 inches of water or equivalent - within 1% in middle half of scale - 3% elsewhere.

FIG. NO. 83

1/4" male bottom connection is standard. 1/8" male bottom connection can be furnished on the 2 1/2" size only when specified.

FIG. NO. 83R
(Not Illustrated)

A retard diaphragm gauge made in the 2 1/2" size only and in the one standard dial graduation - 0 to 15 ounces with 1/4 ounce graduations and retarded to 5 pounds. 1/4" bottom connection is standard.

VARIATIONS

FIG. NO. 83C

1/4" male center back connection is standard on all sizes.

FIG. NO. 83B

Flush mounted type with U-clamp and studs for clamping to panel. 1/4" male center back connection is standard. Plastic crystal is standard. Fig. No. 83B not available in 4 1/2" size.

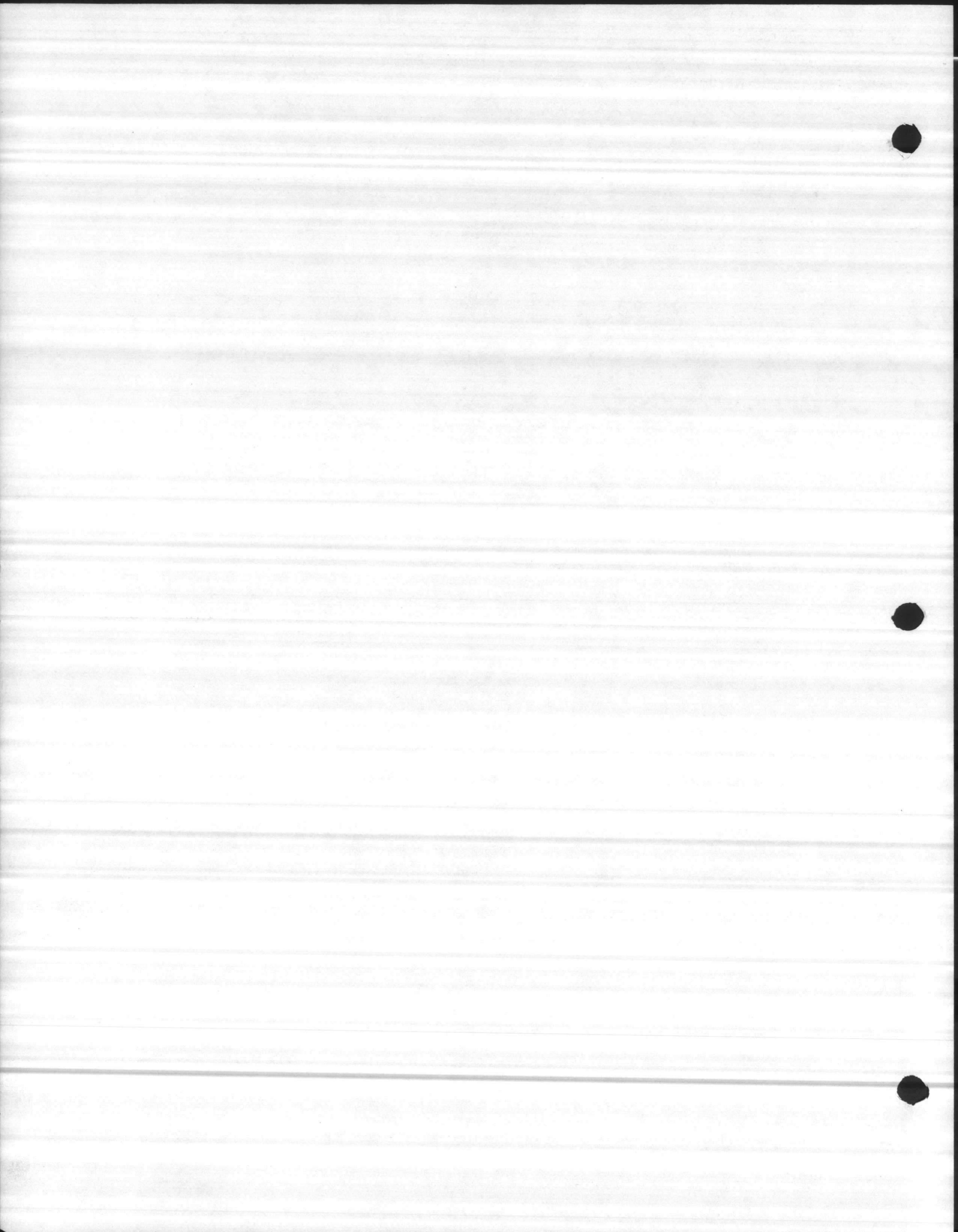
FIG. NO. 83D

Flush mounted type with front flange having three mounting holes for fastening to the panel. 1/4" male center back connection is standard. Plastic crystal is standard. Fig. No. 83D not available in 4 1/2" size.

STANDARD DIALS

	Single Scale								Dual Scale						
	Ounces Per Sq. In. or Inches of Water (Pressure or Vacuum)								Lbs. Per Sq. Inch						
	10	15	30	60	100	160	200	300	3*	5	10	Ox. In.	Ox. In.		
Total Range	2	3	5	10	10	20	20	30	1/2	1	2	2	5	4	5
Figure Intervals	1/8	1/4	1/2	1	2	2	2	5	1/16	1/16	1/8	1/2	1	1/2	1
Smallest Sub-Division	*2 1/2" size only														

These dials are also available within capacity limits of the gauges for graduating in millimeters of mercury, centimeters of water and inches of mercury. Compound gauges made to order in 2 1/2" and 3 1/2" sizes.



DIALCO

PILOT LIGHTS

FOR INDICATION AUTOMATION MINIATURE APPLICATION

(Illustrations of pilot lights are approx. actual size)

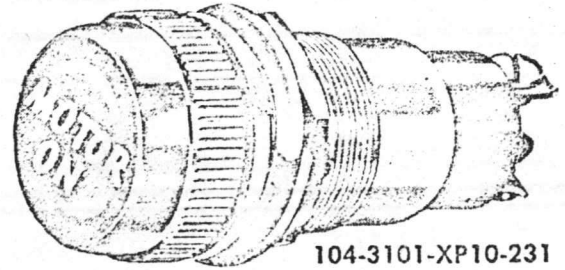
OIL-TIGHT INDICATOR LIGHTS

OIL-TIGHT • WATER TIGHT • DUST TIGHT

For HEAVY DUTY Industrial Applications

Exceptionally Rugged

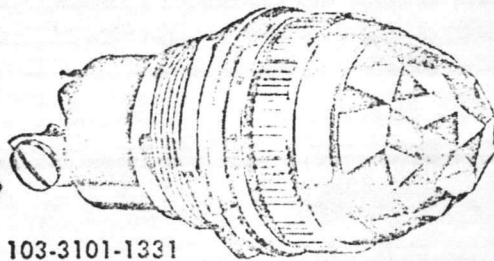
Designed for severe vibration conditions



104-3101-XP10-231

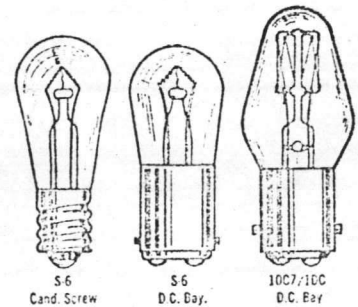
For Mounting in 1" Clearance Hole

FEATURES: Unlike the usual bulky Oil-Tight units, Dialco's assemblies have compact, streamlined design. Important construction features include: One-piece solid brass mounting bushing . . . Fully gasketed with oil-proof gaskets . . . All gaskets retained — no loss of seal . . . Has solid brass knurled lens holder with gasketed lens . . . High impact phenolic insulation . . . Have rugged terminals of the binding screw type . . . An Oil-Tight Adaptor Set (Cat. No. 1316-L) is available for mounting any 1" assembly in 1-3/16" clearance hole.



103-3101-1331

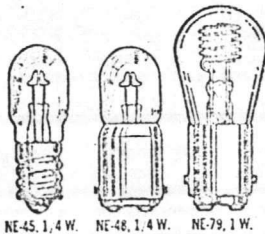
Three Lens Types: The permanently oil-tight lens cap can be had with a choice of 3 permanent-color glass Lenses: Omnidirectional Torpedo Faceted, Dome, or Flat Lens. The flat lens can be used with *discs* inserted behind the lens to deliver specific messages. This is a significant safety feature in motor controlled equipment. Seven lens colors are available. For complete specifications, refer to Form L-200A.



3 types of Incandescent Lamps may be used: Especially recommended is the 10C7/10C lamp which is designed to WITHSTAND SEVERE VIBRATION and SHOCK. (Lamps shown approx. 2/3 actual size).

The complete Dialco line of Oil-Tight Indicator Lights includes units for mounting in 11/16", 13/16", 1", 1-3/16", 1-1/2", and 1-5/8" mounting clearance holes. Lamps accommodated include incandescent and neon lamps of the screw base and bayonet base types.

(Lamps shown approx. 55% actual size)



NE-45, 1.4W. NE-48, 1.4W. NE-79, 1.1W.

These 3 types of Neon Lamps may be used. NE-45 has candelabra screw base; NE-48 and NE-79 have double contact bayonet bases.

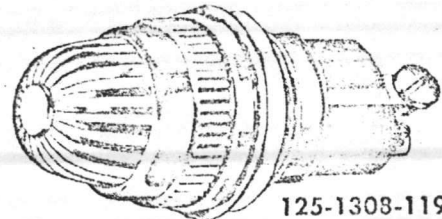
With Built-in Resistor for Neon Glow Lamps

U.S. Patent No. 2,421,321

Mount in 1" Clearance Hole: Units for use with the NE-48 and NE-79 Neon Lamp have the resistors "built-in" as an integral part of the unit for use on voltages up to 250V. The resistance value is selected to obtain the desired performance on supply voltage with the proper balance between lamp life and brightness. The best choice will be recommended for any set of conditions . . . Assemblies using the NE-45 Candelabra Screw Base Lamp have the required resistor built into the base of the lamp.

For Mounting in 11/16" Clearance Hole

Assemblies for use with the NE-51 Neon Glow Lamp have "built-in" resistors, an exclusive Dialco feature. Similar units are usable with low voltage incandescent lamps. Stovepipe lenses are recommended. They may be *fluted*, *frosted back* or *unfrosted*. White lenses are translucent and are always furnished unfrosted. 7 lens colors are available. Binding screw or soldering terminals may be specified. For complete details, refer to Form L-200A.

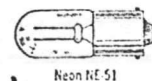


125-1308-1191

ORDER COMPLETE WITH LAMPS so that you will be assured of receiving the pilot lights and correct lamps at one time, ready for immediate use.

SAMPLES ON REQUEST AT ONCE — NO CHARGE

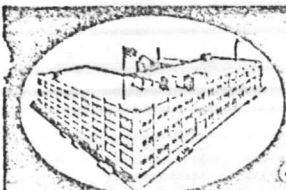
Designed to accommodate T-314 bulb with miniature bayonet base. Specify NE-51 for neon glow; or T-314 for incandescent. With incandescent specify voltage required up to 55V.



Neon NE-51



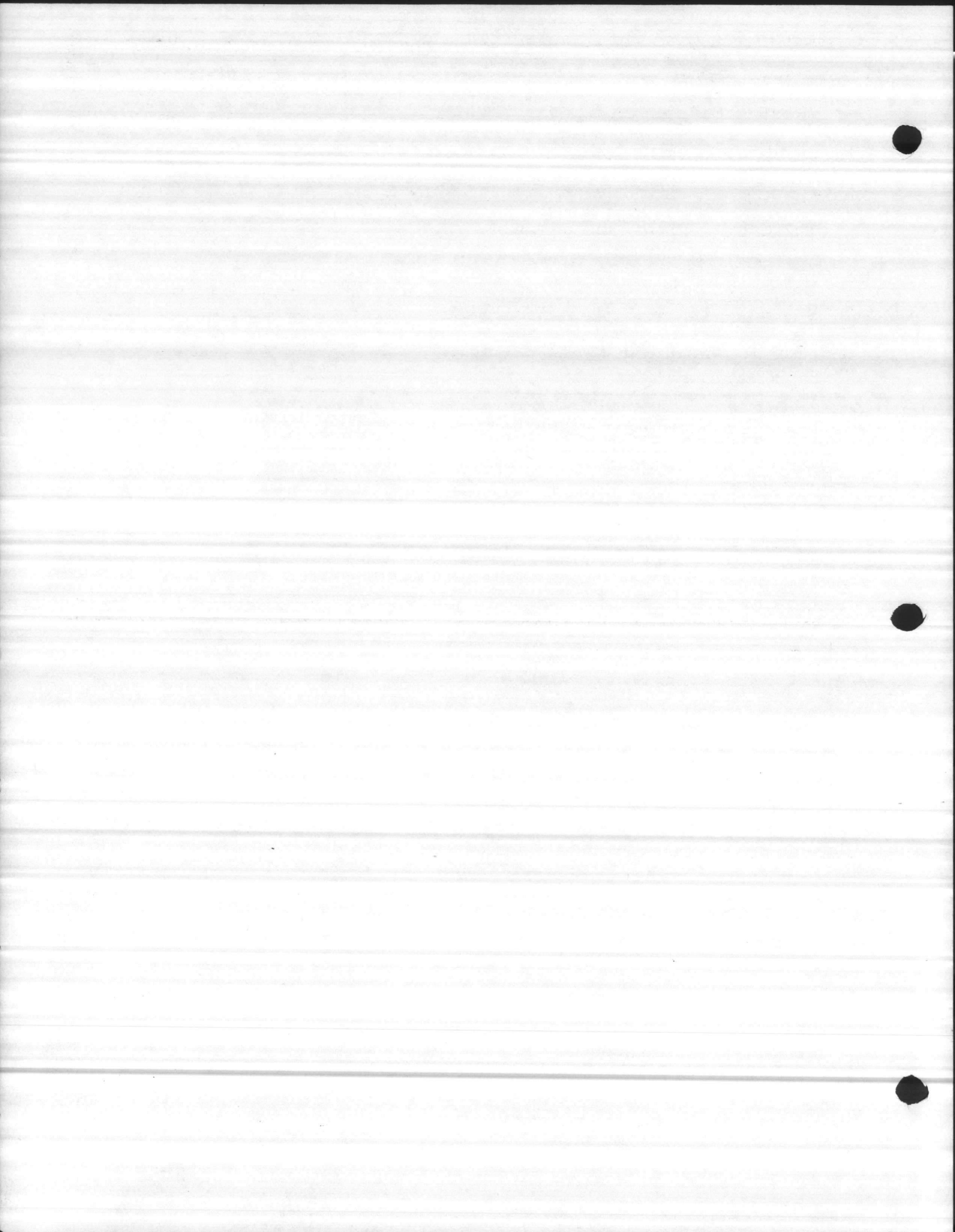
T-314 Incandescent



DIAL LIGHT CORPORATION

60 STEWART AVE. BROOKLYN 37, N.Y.

HYACINTH 7-7600



PILOT LIGHTS

DIALCO

FOR INDICATION AUTOMATION MINIATURIZATION

(Illustrations are approx. actual size)

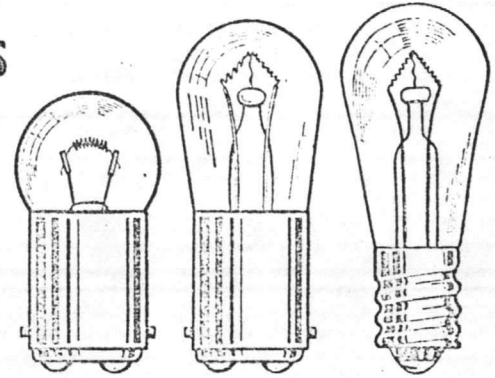
ASSEMBLIES for INCANDESCENT LAMPS

(with double contact bayonet or candelabra screw bases)

For Mounting in 1" Clearance Hole

FEATURES: DIALCO makes the most extensive line of 1" enclosed assemblies for large incandescent lamps. 3 such styles of lamps are shown here together with 4 typical units. These units are available with Screw Terminals, Soldering Terminals, or Quick Connect Terminals (will mate with standard solderless female connectors) ... There are 3 ways of attaching the lens caps: Screw-on Caps, Friction Caps, or Bayonet Caps. 8 glass lens types are available. Plastic lenses are not recommended because of the high degree of heat that incandescent lamps generate.

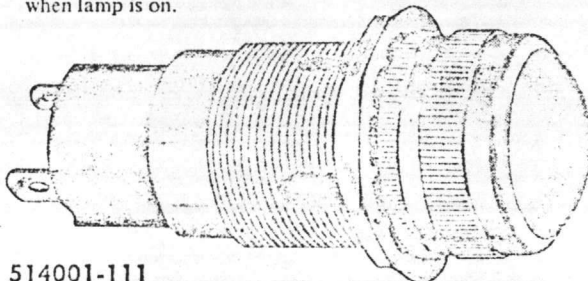
Optional features include: Split Lockwasher may be substituted for internal-tooth type ... Units with Screw-on Caps may be made *watertight* on face of panel ... A *disc* is inserted in back of lens when it is desired to have a word, numeral, or symbol appear when lamp is on.



G-6 D.C. Bay.
(32V. max.) -

S-6
D.C. Bay.

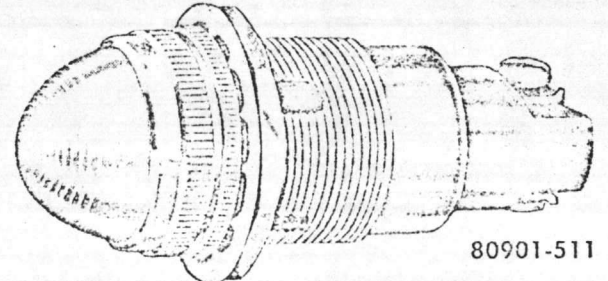
S-6
Cand. Screw



514001-111

Assembly with Screw Cap, Convex Lens, and Soldering Terminals. Similar units available with Quick Connect Terminals.

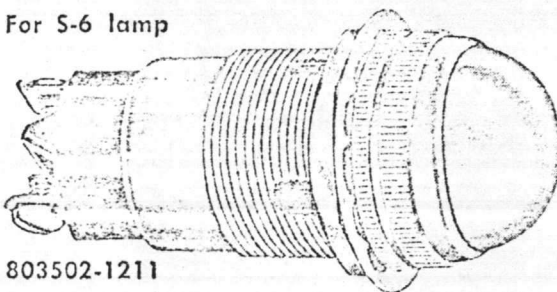
Typical assemblies for use with candelabra screw base incandescent lamps



80901-511

Assembly with Screw Cap, Torpedo Lens, and Screw Terminals in side position. Similar units available with screw terminals in protruding position.

For 5-6 lamp



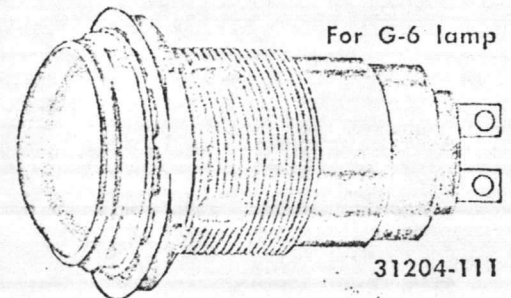
803502-1211

Assembly with Screw Cap, Dome Lens, and Screw Terminals. Terminals may be specified as *fixed* type or *movable* type.

Typical assemblies for use with double contact bayonet base incandescent lamps



75W., 125V.

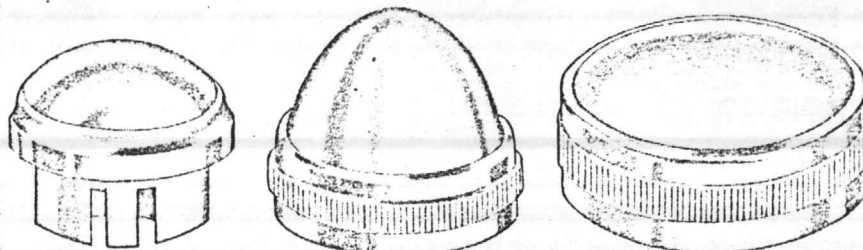


For G-6 lamp

31204-111

Assembly with Friction Cap, Convex Lens, and Soldering Terminals. 2 other types of soldering terminals are *fixed* or *movable*.

LENS COLORS: Seven lens colors are available as described on opposite page.



Convex Lens
Friction Fit

Large Torpedo Lens
Screw-on Type

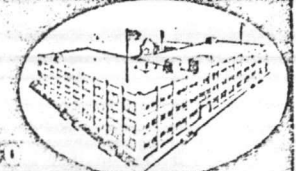
Large Convex Lens
Screw-on Type

ORDER COMPLETE WITH LAMPS so that you will be assured of receiving the pilot lights and correct lamps at one time.

LENS CAPS: These 3 lens caps are also available for use with any of the assemblies shown on these 2 pages.

**SAMPLES ON REQUEST
AT ONCE—NO CHARGE**

Formerly Manufacturer of Pilot Lights
DIALIGHT CORPORATION
60 STEWART AVE. BROOKLYN 37, N.Y. C. BRANCHES 7/600





Using de-rated bulb for increased life:

V_1 = Bulb Design Voltage

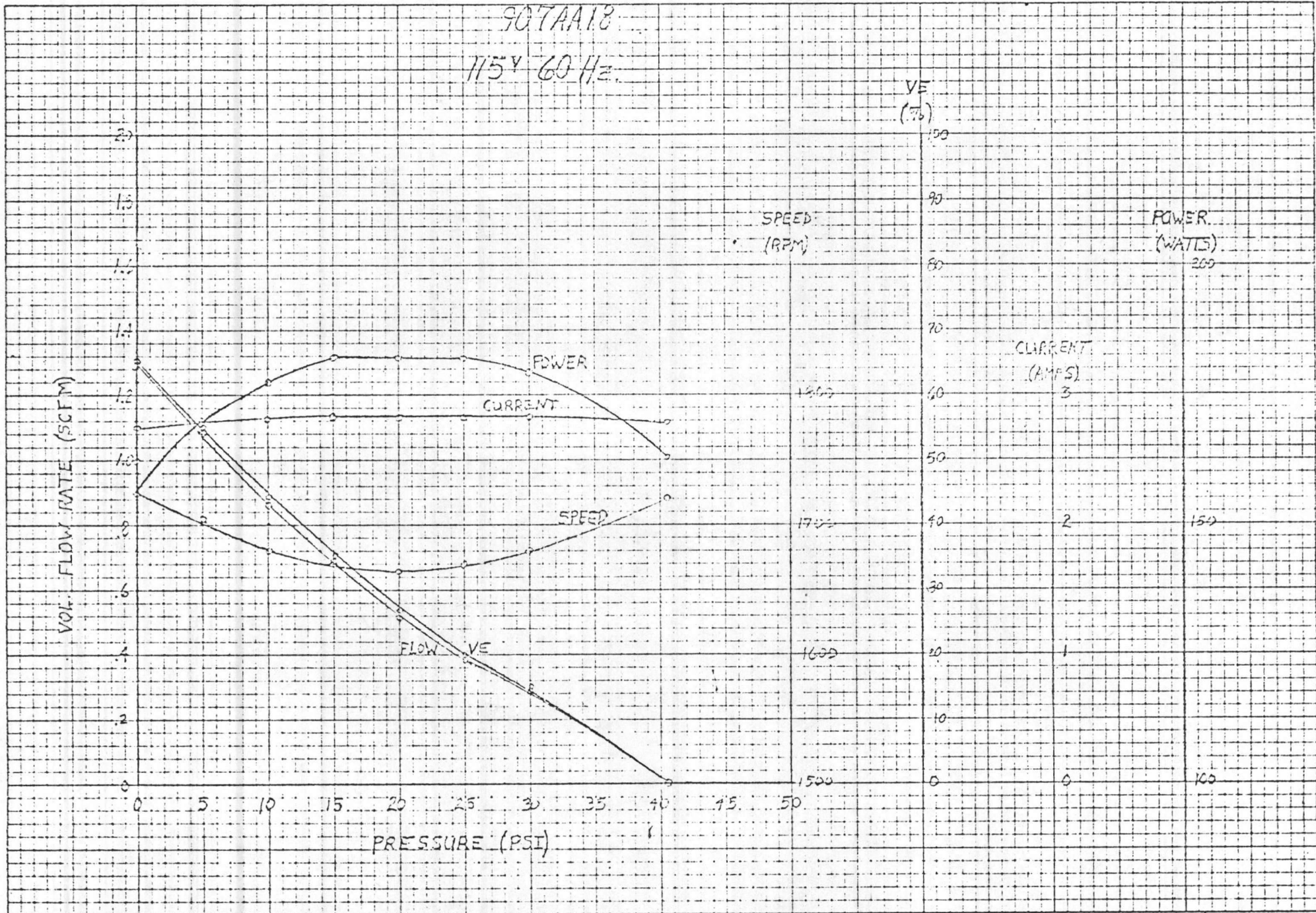
V = Applied Voltage

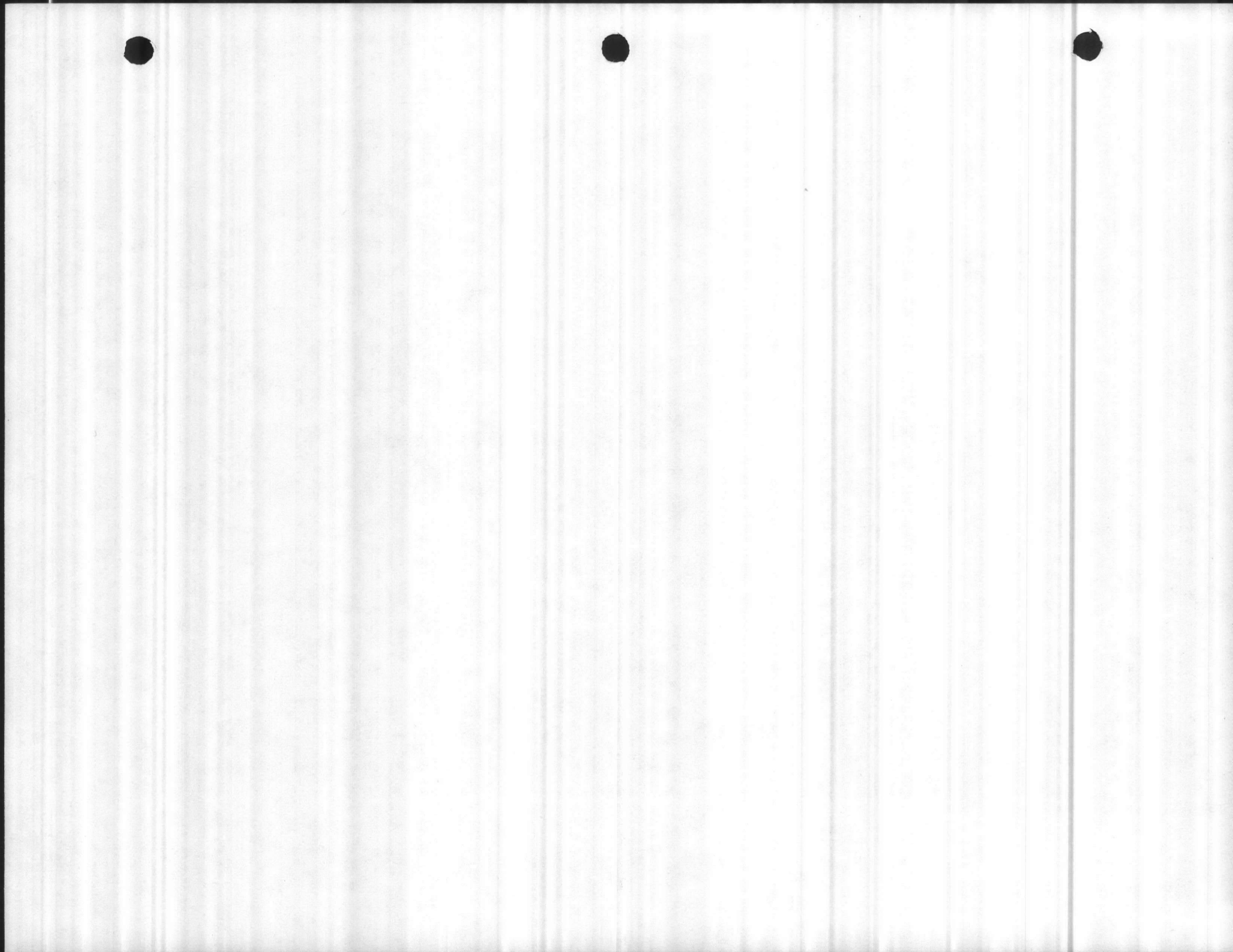
$$\begin{aligned}\text{Re-rated life} &= \left(\frac{V_1}{V}\right)^{12} \times \text{Life @ Design Volts} \\ &= \left(\frac{155}{115}\right)^{12} \times 1500 \text{ Hrs.} \\ &= 53,913 \text{ Hrs.}\end{aligned}$$

$$\begin{aligned}\text{Re-rated Candlepower} &= \left(\frac{V}{V_1}\right)^{3.5} \times \text{M.S.C.P. @ Design Volts} \\ &= \left(\frac{115}{155}\right)^{3.5} \times \text{M.S.C.P. @ Design Volts} \\ &= .35 \times \text{M.S.C.P. @ Design Volts} \\ &= 35\% \text{ of M.S.C.P. @ Design Volts}\end{aligned}$$



907AA18
115V 60 Hz.







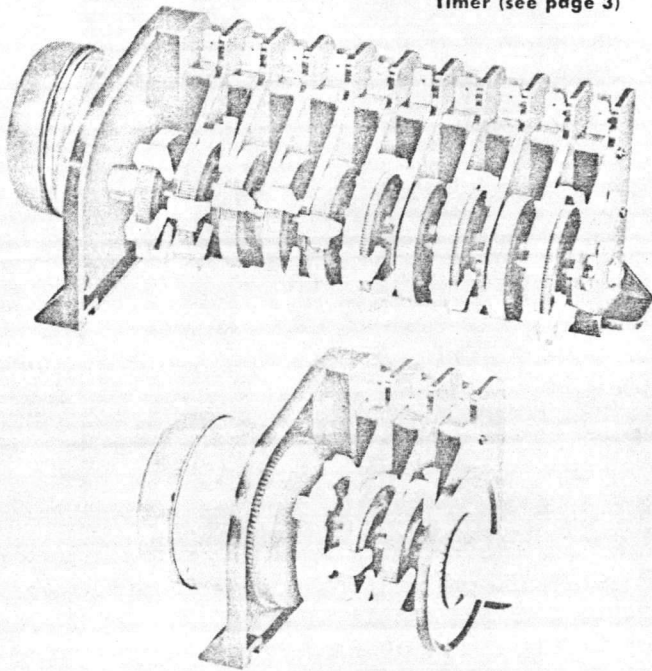
BULLETIN 345
TIME/MODULE
TM SERIES

A COMMERCIAL PRODUCT

BULLETIN 345

SPECIFICATIONS

Much more than the
 Conventional Repeat Cycle
 Timer (see page 3)



TM Series Modular Timer

DESCRIPTION

The TM repeat cycle timer is constructed of precision molded plastic parts, utilizing the latest injection molding techniques. The motor bracket and switch plates are injection molded phenolic plastic, cams and gears are acetal, and actuators and tabs are injection molded molybdenum disulfide filled nylon which provides lifetime lubrication. The modular design of this timer permits easy expansion of the number of circuits on the timer. Standard timer sizes are one through ten single pole, double throw switches. Each additional switch adds one-half inch to the length of the timer. A 10:1 gear reduction module and a dial-knob module are available as optional features. (See page 2 for details.) The only "hardware" used in construction of the TM timer is the motor, switches and one screw with lock washer and hex nut.

OPERATION

The TM repeat cycle timer uses a unique switching mechanism rather than the conventional "hill and dale" type cam. This unique mechanism uses a "rise tab" and a "drop tab" mounted on a serrated wheel, an actuator, and a S.P.D.T. switch. The actuator maintains the position of the switch as it is depressed by the "drop tab" and remains down until picked up by the "rise tab." Switch closures are adjustable from 5% to 95% of the time cycle. Additional tabs may be purchased to "build" special cam configurations. Combination "rise/drop tabs" may be used for pulsed outputs.

180 degree cam segments are also available and will provide conventional 50/50 adjustable cam configuration. Switch closures are adjustable from 2% to 98% of the time cycle.

The clutch module (standard unless specified) enables the cams to be manually rotated forward through the time cycle. This is convenient when making initial cam settings.

Time Cycles

SYMBOL	TIME CYCLE	SYMBOL	TIME CYCLE
01	* 6 sec.	14	20 min.
02	*10 sec.	15	30 min.
03	*15 sec.	16	60 min.
04	*30 sec.	17	100 min.
05	*60 sec.	18	120 min.
06	*90 sec.	19	150 min.
07	120 sec.	20	3 hr.
08	150 sec.	21	5 hr.
09	3 min.	22	6 hr.
10	5 min.	23	10 hr.
11	6 min.	24	20 hr.
12	10 min.	25	30 hr.
13	15 min.	26	60 hr.

*Consult factory for number of circuits available with standard motor.

Voltage and Frequency

VOLTAGE	FREQUENCY	SYMBOL
120	60	A6
120	50	A5
240	60	B6
240	60	B5

Contact Ratings

125/250 VAC — 10 amperes; 1/3 H.P.
 125 VDC — 1/2 amperes.
 250 VDC — 1/4 amperes.

Available Circuits

1 thru 10 S.P.D.T. switches.

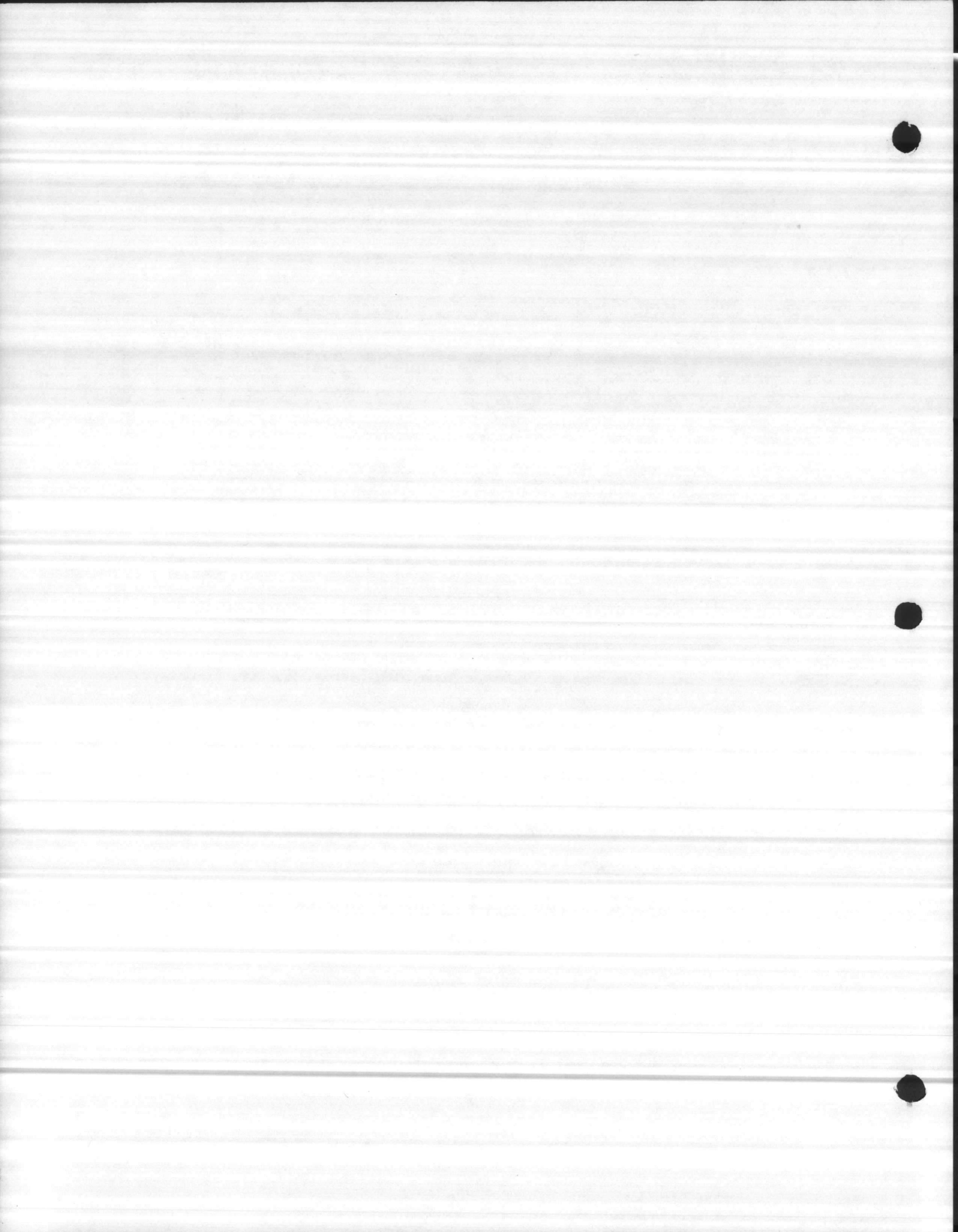
Repeat Accuracy

Cam shaft speed is synchronous to the power supply.

Dimensions and Options

See page 4.

GW Eagle Signal
 a systems division of
 GULF + WESTERN INDUSTRIES, INC.



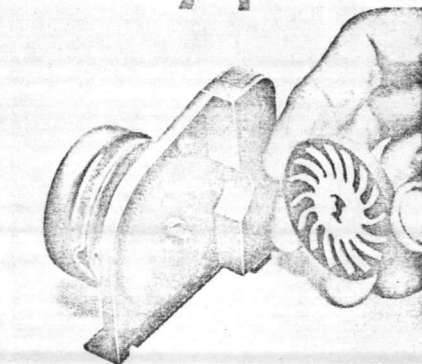
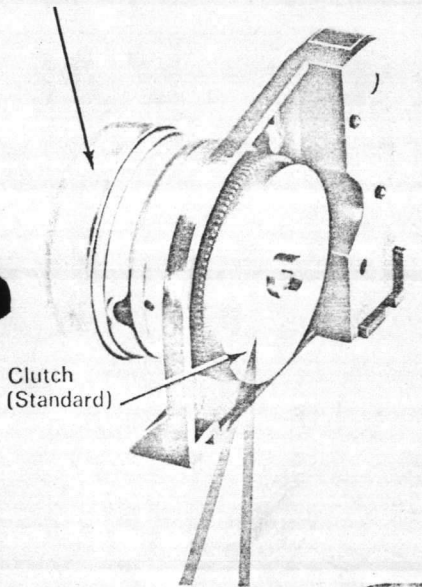
This is the New Eagle TIME/MODULE

The T/M is a highly flexible repeat cycle cam timer (without a camshaft). It is designed from 4 basic modules, precision molded to interlock easily with the other offering a selection of time ranges and operating characteristics offering versatility limited only by the imagination of the user.

The T/M is expandable to 10 control modules (2) or gear reduction modules (3).

MODULE NO. 1 — DRIVE MODULE

Unidirectional and Reversing Synchronous Motors available in 26 standard time ranges each (from 6 sec. to 60 hours). Reversing motor requires no external relays for operation and offers virtually infinite operational selection.

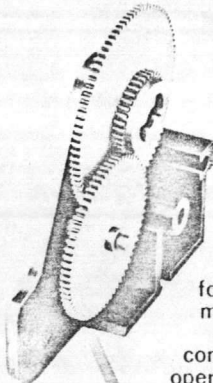


A close look at the unique T/M clutch that simplifies cam setting. Used in conjunction with the optional percentage dial (Module No. 4) the timer may be set readily to any % reference desired.

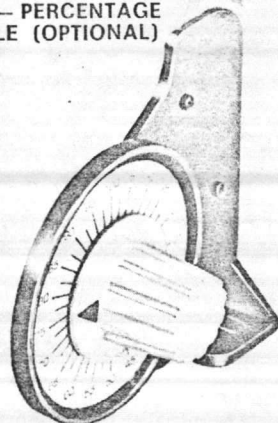
MODULE 3 — 10/1 GEAR REDUCTION MODULE

Replace any control module as required for your application. (Incorporated in Timer on front page.)

Provides multiple cycle lengths from a common motor drive. As many as four reduction modules may be used in a given arrangement. The last control module could be operating at a 10,000 to 1 ratio with the drive motor.

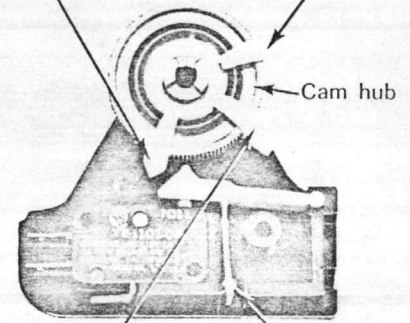


MODULE 4 — PERCENTAGE DIAL MODULE (OPTIONAL)



MODULE 2 — CONTROL MODULE WITH INDIVIDUAL RISE/DROP TABS

Drop cam segment and Rise cam segment (Maximum 20 per circuit)

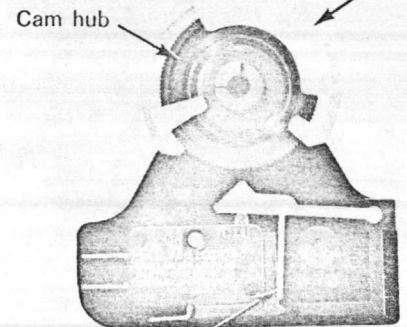


Rise/Drop Cam segment (Maximum 15 per circuit)

Cam follower with latch for positive switch action.

CONTROL MODULE WITH ADJUSTABLE 50/50 CAM.

50/50 cams



Cam follower without latch (may also be used with series of rise cams above).

One switch closure per revolution. Min. closure 2%; Max. 48%.



It's flexible, It's versatile

The T/M Timer is fundamentally a repeat cycle timer. Its use, as such, is more than warranted by the low cost, long life construction and its easy-to-use flexibility.

... But, there's more than meets the eye in its unique design. Inherent in the T/M's physical design are functional characteristics and control opportunities never before offered in a simple and inexpensive repeat cycle timer.

That's why we call it the TIME/MODULE!

There can be many occasions when a call to your Eagle Representative (or the factory) will help you confirm your use of this timer and save you hundreds of dollars in unnecessary circuit components and offer you a clean, dependable circuit design in a minimum of space.

The two most important modules that will offer you all this versatility are:

Module 1 The Drive Module, offering a choice of reversing motors in 26 standard time ranges.

Module 3 The Gear Reduction Module, offering multiple speed operation from a common drive motor.

Reversing action and gear reduction, applied individually or in combination, offer many very useable variations. Since the gear reduction module is readily understandable, we will go into some detail regarding the use of the Reversing Motor Drive Module only.

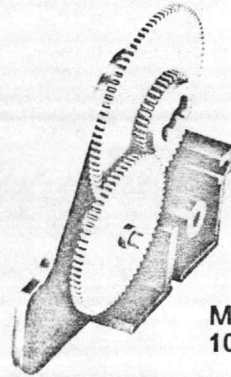
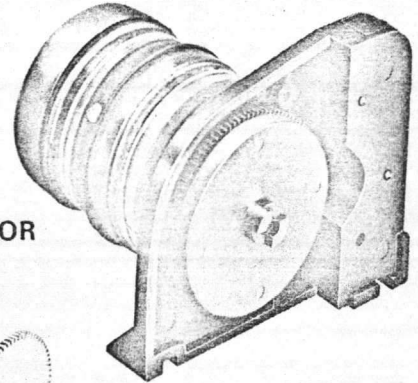
Graphically, in Chart 1, the difference between uni-directional and reversing action is functionally defined. While the unidirectional motor simply rotates 360° in 60 seconds, you have 342 useable degrees with the reversing motor and since it returns each cycle to its origin you have 684°. Using the 60 second motor, this offers you 114 sec. or any portion thereof. The three reversing diagrams on the right of Chart 1 illustrate this on a quadrant basis.

Applying this advantage to Chart 2 we begin to see the added versatility available. This diagram is divided into 3 sections: (1) the conventional bar timing chart on the left (2) a typical wiring diagram on the right and (3) the reversing timing chart in the center. Referring to the wiring diagram, control module 1 becomes the motor control eliminating the need for external relays. This is possible because of the positive "push-pull" switch action of the individual rise-drop cam segments, leaving 9 maximum individual control modules for load circuits (5 only shown).

The motor control terminals now offer selection for plugging your control modules. By studying the center timing chart in relation to the gated loads, you'll discover many advantageous combinations.

The new Time/Module is virtually limited only by your imagination. It is also a low cost and dependable repeat cycle timer.

MODULE 1 WITH REVERSING MOTOR



MODULE 3 10/1 GEAR REDUCTION

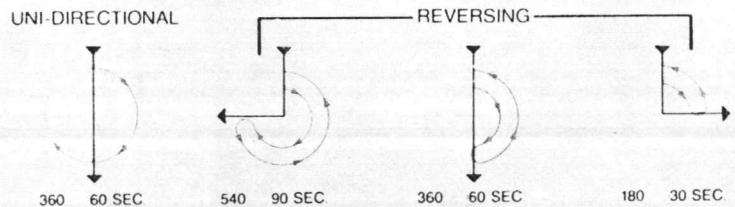
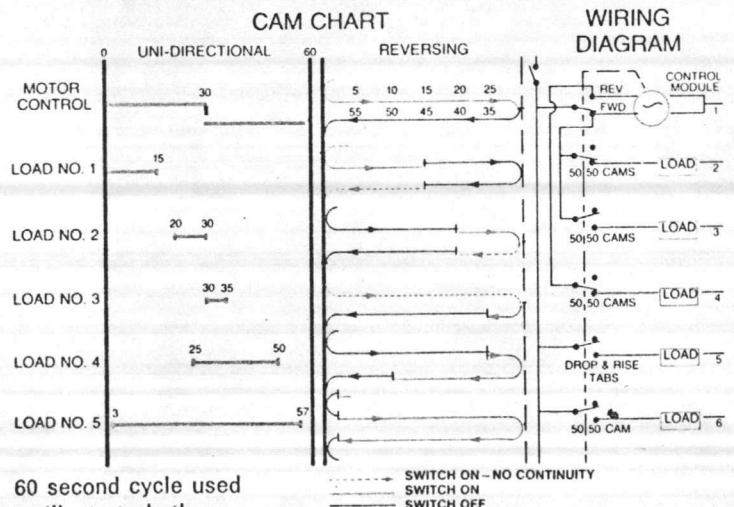


CHART 1

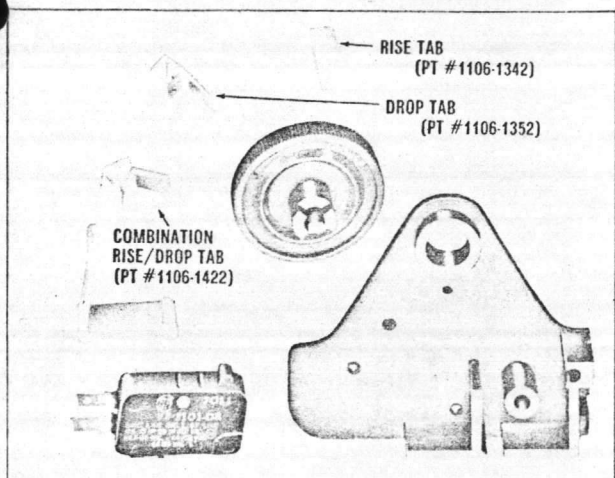


60 second cycle used to illustrate both chart 1 and chart 2.

CHART 2

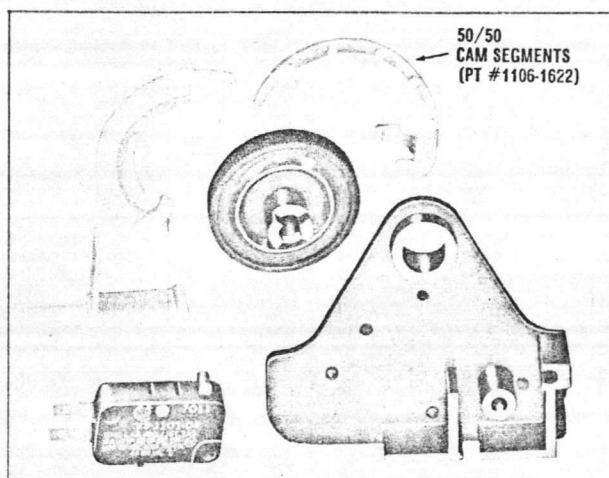


"EASY ADD" CIRCUIT MODULES



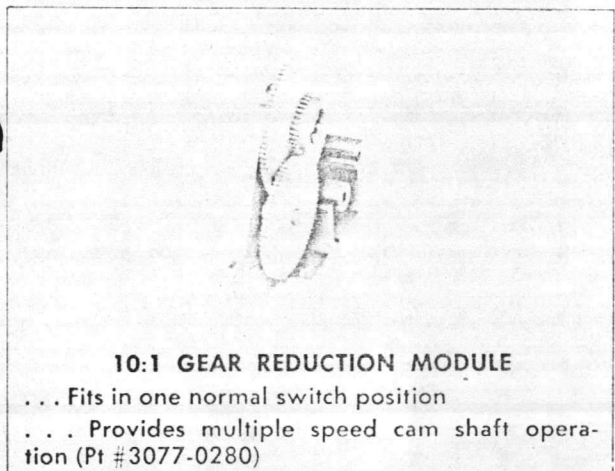
RISE/DROP TYPE SWITCH MODULE
 Pt #3077-0300

(Includes only 1 — Rise Tab and 1 — Drop Tab)
 Additional Tabs available in quantities of 25.



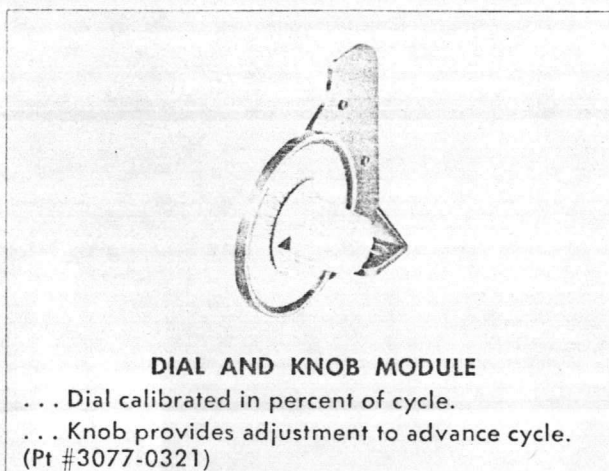
CONVENTIONAL CAM TYPE SWITCH MODULE
 Pt #3077-0310

OPTIONAL FEATURES May be added on or changed at any time.



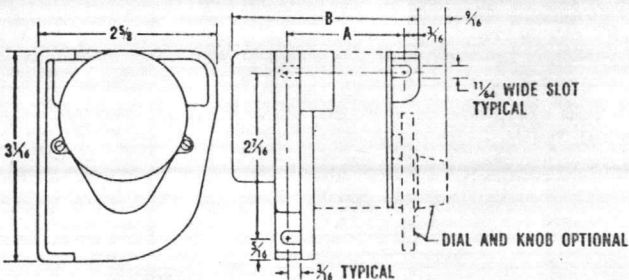
10:1 GEAR REDUCTION MODULE

... Fits in one normal switch position
 ... Provides multiple speed cam shaft operation (Pt #3077-0280)



DIAL AND KNOB MODULE

... Dial calibrated in percent of cycle.
 ... Knob provides adjustment to advance cycle. (Pt #3077-0321)



TM TIMER ORDER INFORMATION CHART

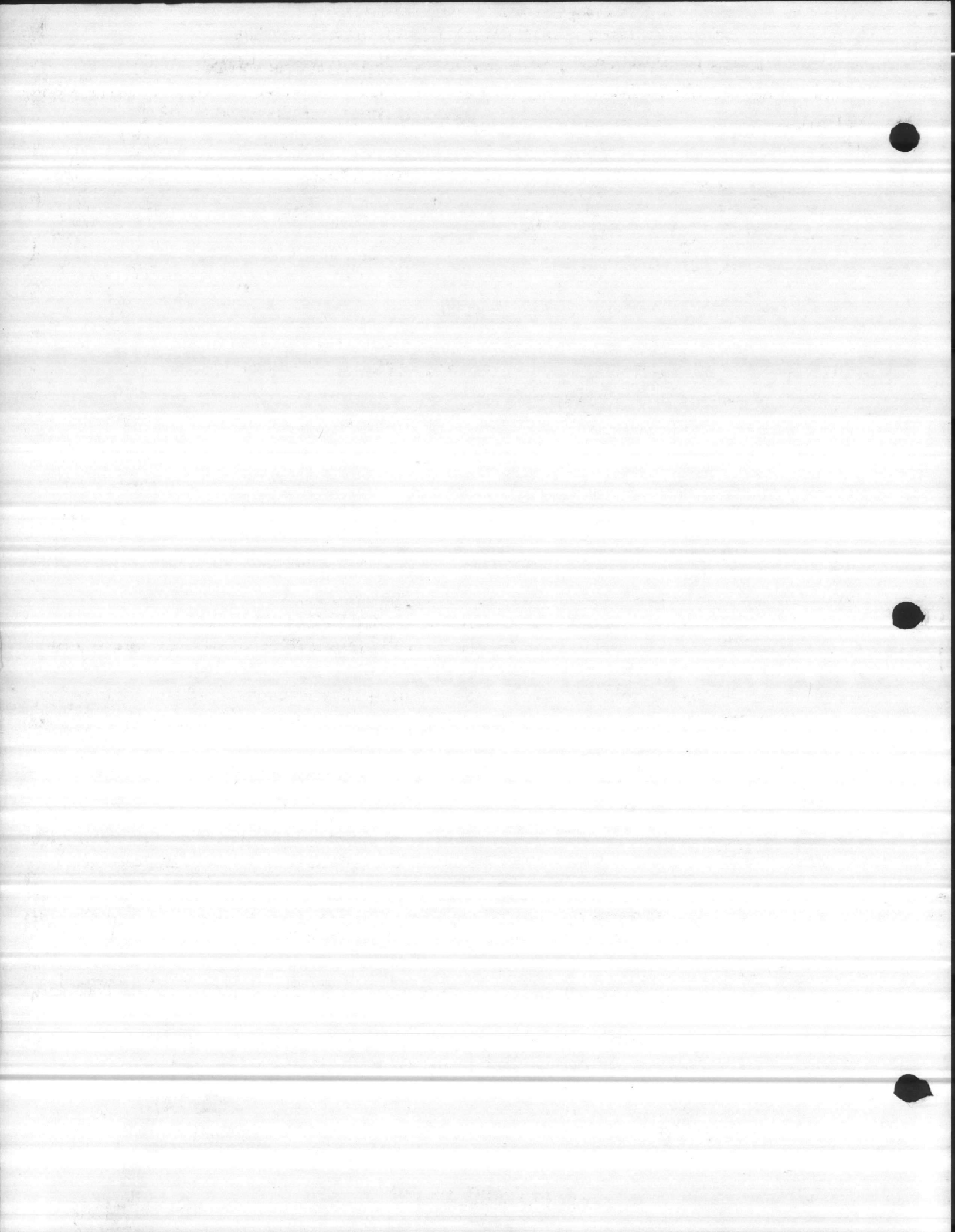
STANDARD TIMER PRICES		VOLTAGE & FREQUENCY		FEATURES	
Number of Switches	Number of Switches	120 Volts	240 Volts	Symbol	Description
1	6			00	Standard Timer with one way clutch, one rise and one drop tab per cam.
2	7			01	Without dial or knob.
3	8			02	With dial (100%) & knob.
4	9			03	Two adjustable 180° cam segments per cam.
5	10			04	Factory set cams.
				05	Special cams.
				06	Model 50 or Model 56 Motor Drive.
				07	No Clutch.
				08	Reversible Motor Drive.
				09	10:1 Gear Reduction Module.

TIME CYCLES							
Symbol	Time Cycle	Symbol	Time Cycle	Symbol	Time Cycle	Symbol	Time Cycle
01	6 sec.	08	150 sec.	15	30 min.	22	6 hr.
02	10 sec.	09	3 min.	16	60 min.	23	10 hr.
03	15 sec.	10	5 min.	17	100 min.	24	20 hr.
04	30 sec.	11	6 min.	18	120 min.	25	30 hr.
05	60 sec.	12	10 min.	19	150 min.	26	60 hr.
06	90 sec.	13	15 min.	20	3 hr.		
07	120 sec.	14	20 min.	21	5 hr.		

DIMENSIONS										
NO. CKTS.	1	2	3	4	5	6	7	8	9	10
A	1 3/8	1 3/8	2 3/8	2 7/8	3 3/8	3 7/8	4 3/8	4 7/8	5 3/8	5 7/8
B*	2 25/32	3 5/32	3 25/32	4 5/32	4 25/32	5 5/32	5 25/32	6 5/32	6 25/32	7 5/32

NOTE:
 For Eagle Model 56 Motor add 3/8"
 For Hansen Rev. or Dual Motor add 5/8"
 For Hansen Style "K" motor 3 hr., 6 hr. 30 hr., or 60 hr. add 1/4"
 Dimensional — TM repeat cycle timers — 1 to 10 circuits.

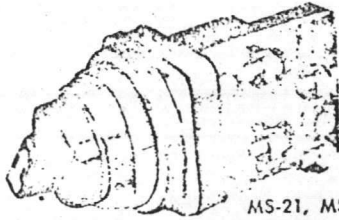
GW Eagle Signal
 a systems division of
GULF + WESTERN INDUSTRIES, INC.
 736 Federal/Davenport, Iowa 52803



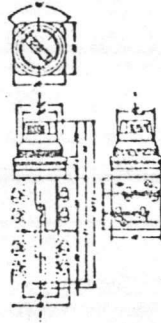
MS-2, MS-3, MST-2, MST-3, MSK-2, MSK-3, MSPA-2, MSPA-3
STANDARD "M" SERIES (30 mm) for 1-7/32" mounting holes

MS-SELECTOR

(2 and 3 positions)

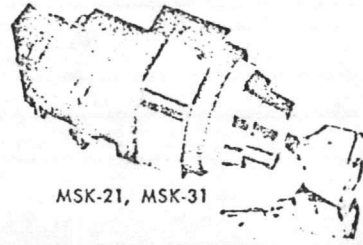


MS-21, MS-31

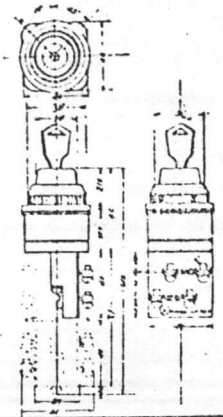


MSK-SELECTOR WITH KEY

(2 and 3 positions)

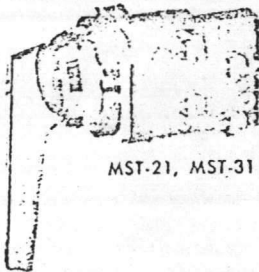


MSK-21, MSK-31

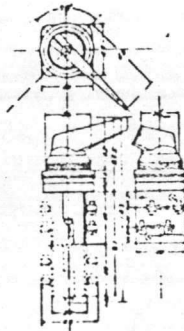


MST-SELECTOR WITH HANDLE

(2 and 3 positions)

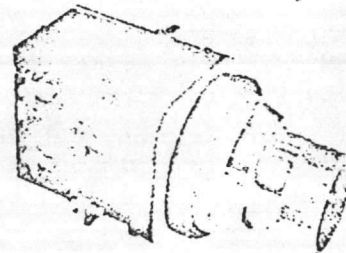


MST-21, MST-31

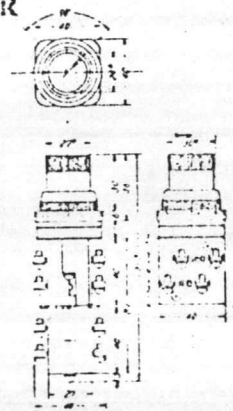


MSPA-PUSH SWITCH SELECTOR

(2 and 3 positions)



MSPA-21, MSPA-31



Operate 2 Separate Ckts with 1 Button

MSPA22—2 position for selecting left or right contact block
 MSPA32—3 position for selecting left or right and also operate both units simultaneously.

OCK

CONTACT ARRANGEMENTS

SELECTOR SWITCH (two positions)			1NO 1NC		2NO 2NC		3NO 3NC		4NO 4NC	
			left	right	left	right	left	right	left	right
	left									
	right									

SELECTOR SWITCH (three positions)			Number of Unit			
			1	2	3	4
	left					
	middle					
	right					

The following combinations are possible:

- Number of Unit
- 1 and 1, 1 and 2, 1 and 3, 1 and 4,
 - 2 and 2, 2 and 3, 2 and 4,
 - 3 and 3, 3 and 4,
 - 4 and 4.



QUALITY OF MATERIAL

Metallic part	Zinc die cast (Plated with copper first, plated with nickel, finished with chrome.)
Conductive part	Brass (Plated with nickel)
Nonconductive part	Iron (Plated with copper first, then plated with nickel.)
Contact Point	Pure Silver
Spring	Spring Steel
Rubber	Oilproof Rubber (Acidproof, alkalinity proof)
The other parts	Phenol resin, Acrylic acid resin

STANDARD OF SWITCH

Contact Point	600 volt, 2 amp, AC; 250 volt, 6 amp, AC
Contact Point Construction	1-no or 1-nc to 6-no and 6-nc
Contact resistance	not beyond 50M Ω
Isolation pressure	1500 v AC/1 minute
Isolation resistance	500 v 50M Ω over
Power of actions of switch	1a-1b 1.1Kg (2.4lbs) 2a-2b 1.7Kg (3.6lbs) 4a-4b 2.1Kg (4.6lbs) 6a-6b 3.4Kg (7.4lbs)
Weight (approx.)	130g (4.5 ounces)
Diameter of hole for fixing	31mm (1-7/32")
Thickness of using panel	under 6mm

FEATURES OF THE MARUYASU OILTIGHT LINE

1. Easy to install: Ring and Gasket connection to panel.
Easy to connect: Wire holders on terminals and visible contacts.
2. Entirely interchangeable: All measurements are equal.
3. Contact Block parts are all interchangeable.
4. Easy and Reliable operation.
5. Operator is separately airtight from the Contact Block, and is oilproof, waterproof and dust proof.
6. A large selection of Operators and Contact Block assemblies for all types of operations and applications.
7. Beautiful style and construction.
8. By engraving letters or marks on the surface of the button or lens, a name plate becomes unnecessary.
9. Easy lamp replacement on all pilot lights.
10. By the use of waterproof rubber, the Push to Test (Illuminated Push Switch) and Indicating Pilot work as oilproof and dustproof.







A-c Rated — Slow-Make, Slow-Break

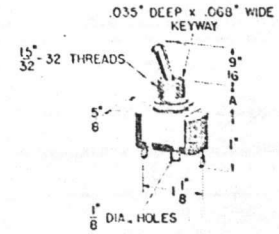
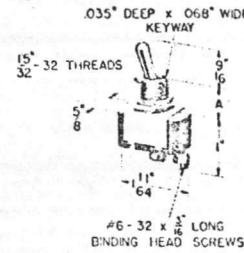
WHEN ORDERING SPECIFY

• Catalog Number

DESCRIPTION

These slow-make, slow-break, A-c rated switches feature a rocker type contact mechanism similar to that employed in the widely used Cutler-Hammer aircraft type switches. The movable contact is actuated by a compression spring which provides positive contact pressure in the closed position and firmly positions the contactor in the open position.

Solder lug, screw and spade terminals are large and firmly riveted to the rear of the base with adequate spacing provided to facilitate wiring and to reduce possibility of electrical creepage. Spade terminals are 1/4 inch. On plug-in type switches, connection is made by plugging wires into 5/64 inch square holes provided in base. Exposed metal parts are bright nickel plated (except 8320 which is zinc with aluminum ball). Terminal screws (where applicable) and mounting hardware are furnished unassembled. All switches with the exception of the 7610 through 7619 series and the 8320 are furnished with a hexagon locknut and knurled facenut. The 7610 - 7619 series are supplied with a hexagon locknut and a hexagon facenut, and the 8320 is supplied with two hexagon facenuts.



Cat. Nos. 7500, 7506-07, 7580, 7583, & 7584 w/screw terminals (base dim. same for 7501 and for solder lug terminal versions of above switches.

Cat. Nos. 7503 and 7505 (7502 and 7504 same except w/screw terminals)

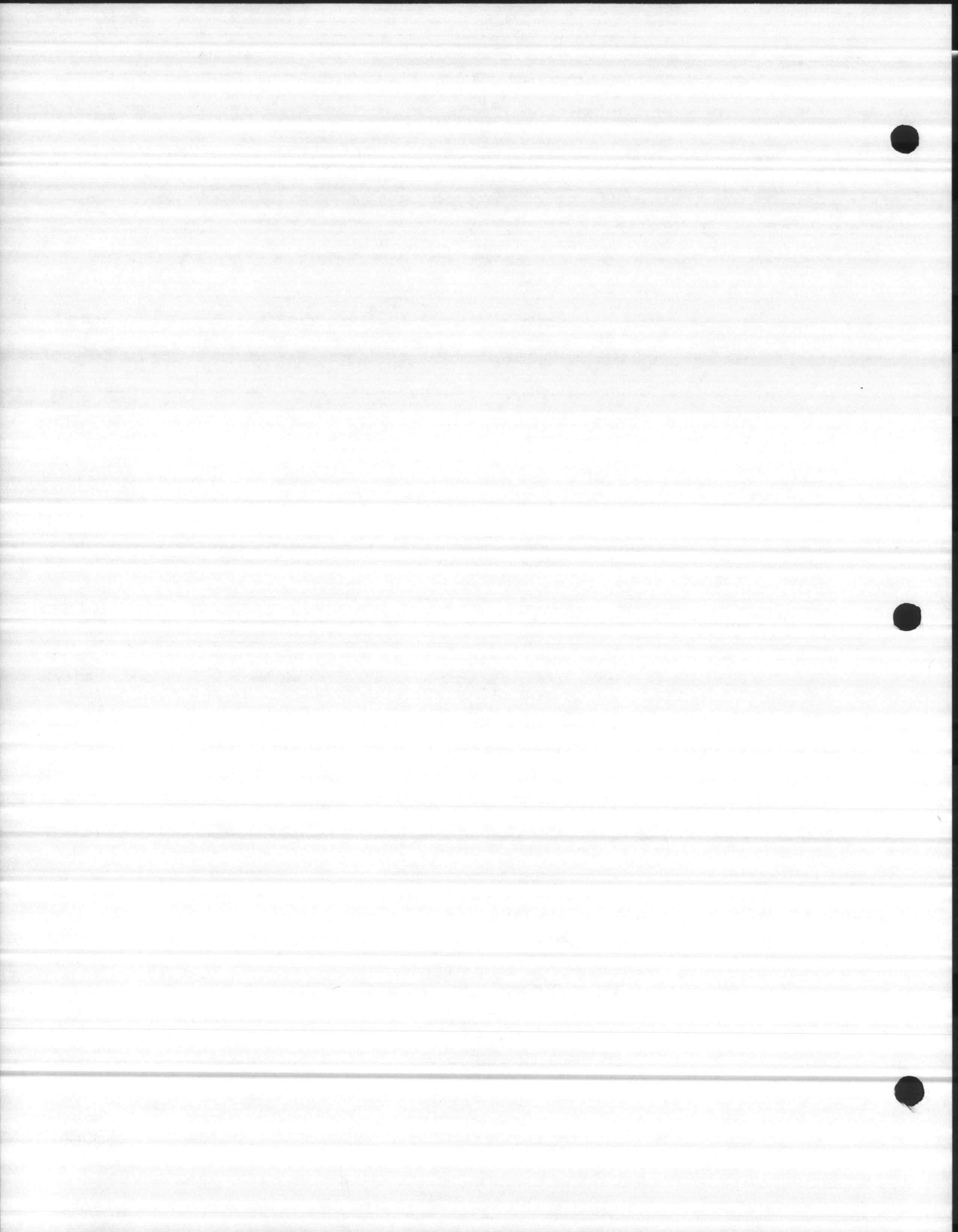
SELECTION TABLE (Items shown in Bold Face Type are normally stocked)

Nominal Ratings		Operation	Circuit Arrangement			Bushing Length Dim. "A" (Inches)	Lever Length (Inches)	Type of Terminals								
Amperes			A	B	C			Screw		Solder Lug		Spade (.250)		Plug-In		
125V. A-c	250V. A-c							Catalog Number	List Price	Catalog Number	List Price	Catalog Number	List Price	Catalog Number	List Price	
6	3	.....	Maintained	ON	NONE	OFF	11/32	9/16	7500K5	1.24	7500K7	1.07	7500K9	1.07	7516K1	1.02
				ON	OFF	ON	11/32	9/16	7501K5	1.42	7501K7	1.16	7501K9	1.16	7516K5	1.02
				ON	NONE	ON	11/32	9/16	7502K5	1.42	7502K7	1.16	7502K9	1.16	7516K3	1.02
				OFF	NONE	ON*	11/32	9/16	7503K5	1.68	7503K7	1.50	7503K9	1.50	7516K7	1.02
				ON	NONE	OFF*	11/32	9/16	7504K5	1.68	7504K7	1.50	7504K9	1.50	7516K9	1.02
				ON	NONE	ON*	11/32	9/16	7505K5	2.27	7505K7	1.63	7505K9	1.63	7516K5	1.02
			Momentary	ON	OFF	ON*	11/32	9/16	7506K5	2.27	7506K7	1.63	7506K9	1.63	7516K3	1.02
				ON	OFF	ON	11/32	9/16	7507K5	2.27	7507K7	1.63	7507K9	1.63	7516K7	1.02
				ON	NONE	OFF	11/32	9/16	7508K5	1.42	7508K7	1.24	7508K9	1.24	7516K9	1.02
				ON	OFF	ON	11/32	9/16	7509K5	1.67	7509K7	1.42	7509K9	1.42	7516K5	1.02
				ON	NONE	ON	11/32	9/16	7510K5	1.92	7510K7	1.63	7510K9	1.63	7516K3	1.02
				ON	NONE	ON	11/32	9/16	7511K5	1.67	7511K7	1.42	7511K9	1.42	7516K7	1.02
15	10	3/4	Maintained	ON	NONE	OFF	11/32	9/16	7500K16	1.42	7500K12	1.24	7500K14	1.24	7516K1	1.18
				ON	OFF	ON	11/32	9/16	7501K16	1.67	7501K12	1.42	7501K14	1.42	7516K5	1.02
				ON	NONE	ON	11/32	9/16	7502K16	1.67	7502K12	1.42	7502K14	1.42	7516K3	1.02
				OFF	NONE	ON*	11/32	9/16	7503K16	1.92	7503K12	1.63	7503K14	1.63	7516K7	1.02
				ON	NONE	OFF*	11/32	9/16	7504K16	1.92	7504K12	1.63	7504K14	1.63	7516K9	1.02
				ON	NONE	ON*	11/32	9/16	7505K16	2.17	7505K12	1.90	7505K14	1.90	7516K5	1.02
			Momentary	*ON	OFF	ON*	11/32	9/16	7506K16	2.17	7506K12	1.90	7506K14	1.90	7516K3	1.02
				ON	OFF	ON*	11/32	9/16	7507K16	2.17	7507K12	1.90	7507K14	1.90	7516K7	1.02
				ON	NONE	OFF	11/32	9/16	7508K16	1.42	7508K12	1.24	7508K14	1.24	7516K9	1.02
				ON	OFF	ON	11/32	9/16	7509K16	1.67	7509K12	1.42	7509K14	1.42	7516K5	1.02
				ON	NONE	ON	11/32	9/16	7510K16	1.92	7510K12	1.63	7510K14	1.63	7516K3	1.02
				ON	NONE	ON	11/32	9/16	7511K16	1.67	7511K12	1.42	7511K14	1.42	7516K7	1.02
.....	10	1/2	Momentary	OFF	NONE	ON*	11/32	9/16	7508K2	1.86	7508K1	1.68	7508K5	1.68	7516K1	1.18
				ON	NONE	OFF*	11/32	9/16	7507K2	1.86	7507K1	1.68	7507K5	1.68	7516K5	1.02
				ON	OFF	ON*	11/32	9/16	7509K4	2.17	7509K3	1.90	7509K7	1.90	7516K3	1.02
				ON	OFF	ON	11/32	9/16	7505K3	2.17	7505K4	1.90	7505K6	1.90	7516K7	1.02
				ON	NONE	ON*	11/32	9/16	7510K6	2.17	7510K4	1.90	7510K8	1.90	7516K9	1.02
				ON	NONE	ON*	11/32	9/16	7511K6	2.17	7511K4	1.90	7511K8	1.90	7516K5	1.02
.....	25	.....	Maint.	ON	NONE	OFF	11/32	9/16	7516K2	2.49	7516K1	2.17	7516K5	2.15	7516K3	1.02
				ON	OFF	ON	11/32	9/16	7516K3	2.17	7516K4	1.90	7516K6	1.90	7516K7	1.02
1	3/4	.....	Main- tained	ON	OFF	ON	15/32	11/16	7556K11	2.92	7556K10	2.76	7556K13	3.40	7556K12	3.40
				ON	OFF	ON	15/32	11/16	7556K11	2.92	7556K10	2.76	7556K13	3.40	7556K12	3.40

*Momentary contact

See foot notes next page.

Unless otherwise noted, all switches above are U.L. and C.S.A. listed.



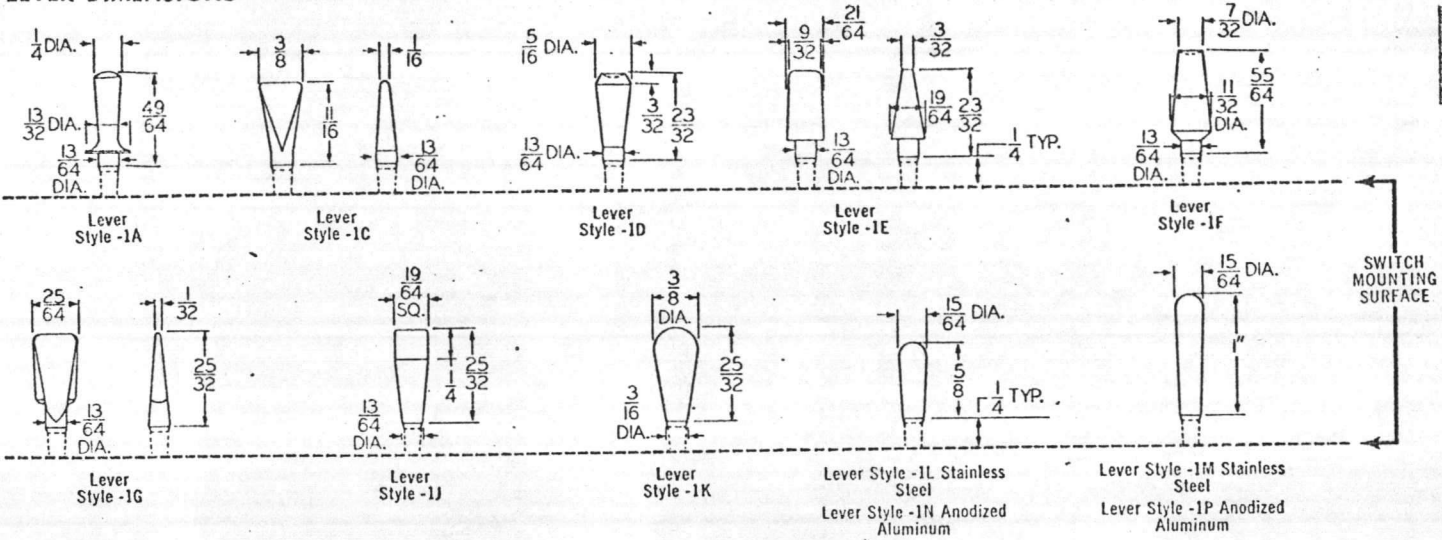


8/2/71

COMMERCIAL TOGGLE SWITCHES

A-c and D-c — Toggle Operated Precision Snap Switch Assemblies

LEVER DIMENSIONS



A-c and D-c Flush Mounted

WHEN ORDERING SPECIFY

• Catalog Number

DESCRIPTION

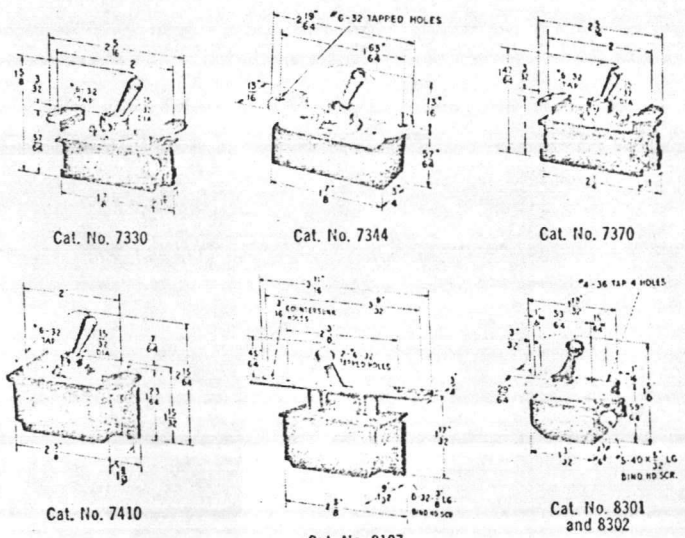
Flush mounted A-c & D-c switches are provided with tapped holes for sub-panel mounting. In addition, the 8187K5 and K6, and the 8197K4 are provided with countersunk mounting holes spaced for O.B.M. (Outlet Box Mounting). Metal parts visible when switch is mounted are bright nickel plated on 7330, 7344 and 7410. Catalog numbers 8301, 8302, 8187 and 8197 have a flat zinc lever with an aluminum ball.

On the plug-in switch, 7344, connections are made by plugging the wire into the switch body. Plug-in holes will accept #16, #18 or #20 tin dipped stranded wire leads skinned 3/8 inch. Release holes, which are provided for wire removal, are sized to accept an .052 inch maximum diameter tool.

Catalog number 8197 is of semi-dust tight construction.

OPTIONAL FEATURES

- D.T., 3 way or 2 circuit without "Off" position — 7330, 7344, 7370
- 1 P.S.T. (parallel contacts). Terminals at diagonally opposite corners — 7330, 7370, 7410, 8187, 8197
- Solid silver contacts — 7330, 7344, 7370, 7410, 8187, 8197
- Momentary contacts N.C. — 8301
- Terminal screws furnished assembled
- Wire clamps on terminal screws
- Screw terminals located at rear — 7370



- Wire leads in place of screw terminals — 8301, 8302
- Bussing terminals (rear terminal construction only) — 7370
- Enveloping insulator — 8301, 8302, 7330, 7370
- Semi-dust tight — 7370
- Special marking

SELECTION TABLE (Items shown in Bold Face Type are normally stocked)

Nominal Ratings A-c, D-c				Poles and Throw	Mounting	Contact Operation	Features	Type of Terminals			
Amperes		Horsepower						Screw		Plug-In	
125V.	250V.	125V.	250V.				Catalog Number	List Price	Catalog Number	List Price	
ONE POLE											
6	3	...	...	1 P.S.T.	Flush 2S	Momentary Maintained	Flat lever w/ ball Flat lever w/ ball	8301K5 8302K5	\$2.02 1.69	..... .....
TWO POLE											
10 16 20	5 8 10	1/2 1 1 1/2	1/2 3/4 1	2 P.S.T.	Flush 2S	Maintained	On-Off Tool Switch	7330K2 7370K2	2.37 4.08	7344K2	
.....	20	1-1/2	2	2 P.S.T.	Flush 2S	Maintained	On-Off Tool Switch On-Off Tool Switch — Semi D.T.	7410K4 8197K5	5.49 6.82	..... .....
.....	20	1-1/2	2	2 P.S.T.	O.B.M.	Maintained	On-Off Tool Switch On-Off Tool Switch — w/lock ears On-Off Tool Switch — semi D.T.	8187K5 K6 8197K4	6.02 6.45 6.82	..... ..... .....

1 For Quantity Discount, refer to your authorized Distributor or local Cutler-Hammer Sales Office.
 2 Also rated 1 Hp at 250V. A-c.

3 Also rated 1-1/2 Hp at 250V. D-c.
 4 Unmarked rating.
 5 For pricing refer to your local Cutler-Hammer Sales Office.

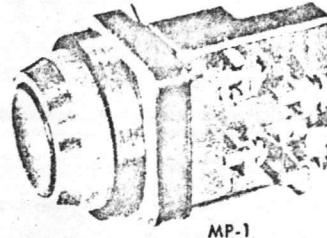
DISCOUNT SCHEDULE 25CD-1

Unless noted otherwise, all switches above are U.L. and C.S.A. listed.

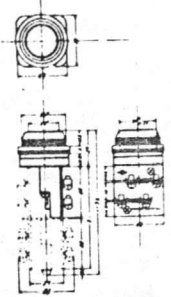
CUTLER-HAMMER



PUSH SWITCHES



MP-1



FEATURES OF THE MARUYASU OILTIGHT LINE

1. Easy to install: Ring and Gasket connection to panel.
Easy to connect: Wire holders on terminals and visible contacts.
2. Entirely interchangeable: All measurements are equal.
3. Contact Block parts are all interchangeable.
4. Easy and Reliable operation.
5. Operator is separately airtight from the Contact Block, and is oilproof, waterproof and dust proof.
6. A large selection of Operators and Contact Block assemblies for all types of operations and applications.

QUALITY OF MATERIAL

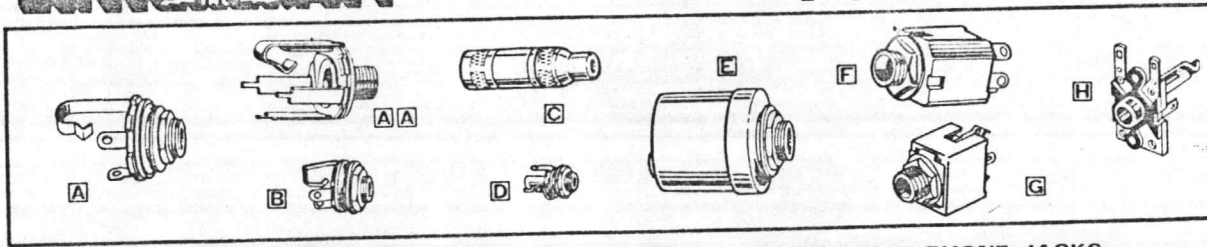
Metallic part	Zinc die cast (Plated with copper first, plated with nickel, finished with chrome.)
Conductive part	Brass (Plated with nickel)
Nonconductive part	Iron (Plated with copper first, then plated with nickel.)
Contact Point	Pure Silver
Spring	Spring Steel
Rubber	Oilproof Rubber (Acidproof, alkalinity proof)
The other parts	Phenol resin, Acrylic acid resin

STANDARD OF SWITCH

Contact Point	600 volt, 2 amp, AC; 250 volt, 6 amp, AC		
Contact Point Construction	1-no or 1-nc to 6-no and 6-nc		
Contact resistance	not beyond 50MΩ		
Isolation pressure	1500 v AC/1 minute		
Isolation resistance	500 v 50MΩ over		
Power of actions of switch	1a-1b 1.1Kg (2.4lbs)	2a-2b 1.7Kg (3.6lbs)	
	4a-4b 2.1Kg (4.6lbs)	6a-6b 3.4Kg (7.4lbs)	
Weight (approx.)	130g (4.5 ounces)		
Diameter of hole for fixing	31mm (1-7/32")		
Thickness of using panel	under 6mm		

CC063





"LITTEL-JAX" PHONE JACKS

A Quality phone jacks that mate with standard $\frac{1}{4}$ " phone plugs. Notched insulating washers mechanically interlock springs and solder lugs. "V" bend in tip spring firmly "holds" mating plug. Minimum space requirements. Economical. Mounts in single $\frac{3}{8}$ " hole; panels up to $\frac{5}{32}$ " thick, except L-11 and L-12A in panels up to $\frac{1}{4}$ " thick.

Nos. C-11 and C-12A mate with No. 440 (PJ-055B) Plug; C-12B, S-12B and S-13B mate with No. 480 (JAN-PJ-065) or No. 484 (W.E. No. 309) Plug. Nos. C-11 and C-12B have locating pins (non-turn devices). No. S-11 similar to No. 11 except $\frac{210}{1000}$ " I.D. sleeve. C-11, C-12B and C-12A per JAN-J-641. All others mate with standard $\frac{1}{4}$ " dia. plugs.

AA New "Littel-Jax" PC-12A for printed circuit mounting. Std. $\frac{1}{4}$ " dia. jack with all the construction features of standard "Littel-Jax". Same circuit as in No. 12A.

No. 14B Stereo "Littel-Jax", switches-out speakers when connecting stereo headphones. Dual N.O. switch contacts, open both stereo circuits independently when a 3-conductor plug is inserted.

TWO CONDUCTOR TYPES

Part No.	Schematic No.	Typical Mating Plug	Mil-Type	U.S.A. List Price
11	I	250	—	\$0.60
C-11	I	440	JJ-034	.90
L-11	I	250	—	.70
S-11	I	S-250	—	.65
12A	III	250	—	.65
C-12A	III	440	JJ-089	1.05
L-12A	III	250	—	.75
S-12A	III	480	—	.75
PC-12A	III	250	—	.75
13	V	250	—	1.25
13A	VI	250	—	1.15
13E	IX	250	—	1.25

THREE CONDUCTOR TYPES

12B	IV	267	—	.75
C-12B	IV	480	JJ-033	1.05
L-12B	IV	267	—	1.00
S-12B	IV	480	—	1.00
13B	VIII	267	—	1.10
S-13B	VIII	480	—	1.40
14B	XII	267	—	1.45

"TINI-JAX" MINIATURE PHONE JACKS

B Miniature 2-conductor Phone Jacks, approximately $\frac{1}{8}$ " the size of the "Littel-Jax"; otherwise similar in construction. Mount in $\frac{1}{4}$ " dia. hole; panel up to $\frac{1}{8}$ " thick. No. 43A has a unique spring design that requires a pear shaped tip, such as Switchcraft "Tini-Plug" No. 750.

Part No.	Schematic No.	Typical Mating Plug	Conductors	U.S.A. List Price
41	I	750	2	\$0.60
42A	III	750	2	.65
43A	VI	750	2	1.00

"TINI-EXTENSION JAX"

C An extension or cable jack to mate with "Tini-Plug". Two-conductor. Metal housing for ruggedness and electrical shielding. Solder lug terminals.

Switchcraft Part No. 125 U.S.A. List Price \$1.80

"MICRO-JAX" SUB MINIATURE PHONE JACK

D Precision manufactured jack for miniaturized applications. Two-conductor, single closed circuit. See Schematic Circuit III. Silver plating on special tempered nickel silver springs. Internally keyed nylon insulation interlocks springs and solder lugs to eliminate shorts. Fits .190" dia. hole in panels to $\frac{3}{32}$ " thick. Only $\frac{1}{25}$ th the size of standard phone jacks. Mates with "Micro-Plug", Series 850, 880.

Switchcraft Part No. TR-2A U.S.A. List Price \$0.70

"SHIELDED JAX"

E A unique modification of the "Littel-Jax". The shield is assembled into and made part of the jack. Ideal for high impedance circuits.

Part No.	Schematic No.	Typical Mating Plug	Conductors	U.S.A. List Price
CN-11	I	250	2	\$1.15
CN-12A	III	250	2	1.20
CN-12B	IV	267	3	1.40

"HI-D JAX" PHONE JACKS

F New smaller, more compact phone jacks, mate with std. $\frac{1}{4}$ " phone plugs. Molded box body protects integral silver-plated, nickel silver springs. Low contact resistance and electrical leakage with little capacity between the springs. Mount on $\frac{3}{8}$ " centers in single $\frac{3}{8}$ " hole in panels up to $\frac{5}{32}$ " thick, depth behind panel $1\frac{1}{32}$ ". All part Nos. with "L" prefix mount in panels up to $\frac{1}{4}$ " thick; part Nos. with "N" prefix feature a threaded nylon bushing to provide complete insulation of jack sleeve from mtg. panel. Part Nos. with "NL" prefix feature a $\frac{3}{8}$ " long threaded nylon bushing (same as "N" series) and mount in panels up to $\frac{1}{4}$ " thick. All part Nos. with "M" prefix are designed and adjusted to mate with telephone and MIL-std. plugs. Tip and ring (3-cond.) springs are gold plated, and shunt and isolate switching circuits (where used) have welded cross bar palladium contacts for stable, low resistance interconnections in sensitive and critical circuits. Prefix "MN" is same as "M" above, except bushing is molded nylon. Stereo "HI-D Jax." Nos. 114B and L-114B switches open both stereo circuits when connecting stereo headphones. Dual N.C. switch contacts open both stereo circuits independently when a 3-cond. plug is inserted.

TWO CONDUCTOR TYPES

Part No.	Schematic No.	Typical Mating Plug	U.S.A. List Price
111	I	250	\$0.60
L-111	I	250	.75
N-111	I	250	.75
NL-111	I	250	.80
112A	III	250	.65
L-112A	III	250	.80
M-112A	I	420	1.10
N-112A	III	250	.80
NL-112A	III	250	.85
113	V	250	1.15
113D	VI	250	1.15
113E	IX	250	1.15

THREE CONDUCTOR TYPES

112B	IV	267	.70
L-112B	IV	267	.85
M-112B	IV	482	1.00
MN-112B	IV	482	1.15
N-112B	IV	267	.85
113B	VIII	267	.90
N-113B	VIII	267	.95
NL-113B	VIII	267	1.00
113F	VII	267	.90
114B	XII	267	1.00
L-114B	XII	267	1.10
M-114B	XII	482	1.30
MN-114B	XII	482	1.45
N-114B	XII	267	1.10
NL-114B	XII	267	1.15

"TINI-D JAX" MINIATURE PHONE JACK

C New, small completely enclosed, molded phone jack. Mate with Switchcraft "Tini-Plug", No. 750 etc. Phenolic housing protects the bifurcated beryllium copper springs from being bent during mounting. No. 142A has threaded bushing for conventional mtg. Tip spring terminals that "snap-in" P.C. boards. Mount on $\frac{3}{8}$ " centers, in $\frac{1}{4}$ " dia. hole in panels up to $\frac{1}{8}$ " thick. Depth behind panel $\frac{1}{16}$ ".

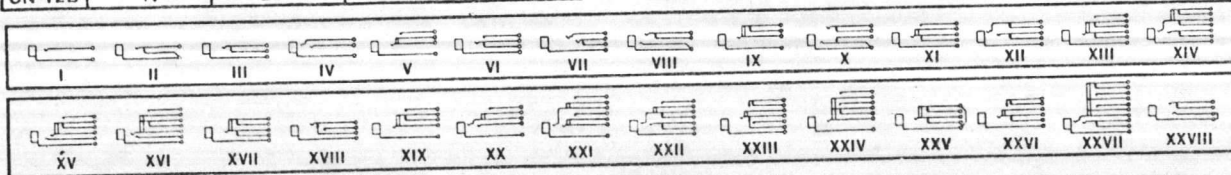
U.S. Pat. No. 3,453,163 Canadian Pat. No. 832,148

Part No.	Schematic No.	Typical Mating Plug	Conductors	U.S.A. List Price
142A	III	750	2	\$0.70

"R-JAX" ECONOMY PHONE JACKS

H Radically new jack design. Simple mounting needs only two (2) $\frac{3}{32}$ " dia. rivets to fasten securely to mounting panel. Accept standard $\frac{1}{4}$ " dia. phone plugs.

Part No.	Schematic No.	Typical Mating Plug	Conductors	U.S.A. List Price
2A	II	250	2	\$0.60
2B	IV	267	3	.65
4B	XII	267	3	.90



The above are strictly electrical schematics and do not necessarily indicate relative solder lug positions.



"LITTEL-PLUG" PHONE PLUGS

Small size phone plugs fit standard $\frac{1}{4}$ " phone jacks except *Nos. S-250, S-260 and S-280 which have a .206" dia. sleeve. **Nos. C-240, C-245 and C-270 feature an integral cable clamp with screw terminals. †No. R-280 has short sleeve or Reverse Recorders. ‡No. 288 has a wide insulator between tip and sleeve for use in a 3-conductor jack to perform a 2-conductor function without shorting. Plugs with solder terminals have built-in cable clamp. Shielded metal handles are nickel plated brass; others are molded of durable plastic: $\frac{3}{8}$ " long x $\frac{1}{2}$ " dia.

TWO-CONDUCTOR TYPE

Part No.	Fig.	Typical Mating "Littel-Jax"	Handle	Terminals	U.S.A. List Price
240	A	11	Black	Screw	\$1.25
C-240**	A	11	Black	Screw	1.45
245	A	11	Red	Screw	1.25
C-245**	A	11	Red	Screw	1.45
250	A	11	Black	Solder	1.20
255	A	11	Red	Solder	1.20
270	B	11	Shielded	Screw	1.70
C-270**	B	11	Shielded	Screw	2.00
280	B	11	Shielded	Solder	1.70
288†	B	11	Shielded	Solder	1.75
S-250	A	S-11	Black	Solder	1.25
S-280	B	S-11	Shielded	Solder	1.70

THREE-CONDUCTOR TYPE

260	A	12B	Black	Screw	\$2.00
S-260*	A	S-12B	Black	Screw	2.70
267	A	12B	Black	Solder	1.75
269	A	12B	Red	Solder	1.75
290	B	12B	Shielded	Screw	2.30
297	B	12B	Shielded	Solder	2.20

STANDARD $\frac{1}{4}$ " PHONE PLUGS

Available with phenolic or shielded, nickel plated over brass handle.

TWO-CONDUCTOR TYPE—SCREW TERMINALS

Typical mating jack "Littel-Jax" No. 11. No. 169 features circuit closing device. No. 170 has a two-piece handle with built-in clamp for $\frac{1}{4}$ " cable.

Part No.	Fig.	Handle	Length & Dia.	U.S.A. List Price
40	A	Black	$2\frac{1}{8} \times \frac{3}{8}$	\$1.25
45	A	Red	$2\frac{1}{8} \times \frac{3}{8}$	1.25
70	B	Shielded	$2\frac{1}{8} \times \frac{1}{2}$	2.05
160	C	Shielded	$1 \times \frac{1}{2}$	1.65
169	C	Shielded	$1 \times \frac{3}{8}$	3.35
170	D	Shielded	$2\frac{1}{8} \times \frac{1}{2}$	2.60

THREE-CONDUCTOR TYPE—SOLDER TERMINALS

Typical mating jack "Littel-Jax" No. 12B. No. 190A has two-piece handle with built-in cable clamp for $\frac{1}{4}$ " cable.

60	A	Black	$2\frac{1}{8} \times \frac{1}{2}$	\$1.70
90	C	Shielded	$1 \times \frac{1}{2}$	2.15
190	B	Shielded	$2\frac{1}{8} \times \frac{1}{2}$	2.50
190A	D	Shielded	$2\frac{1}{8} \times \frac{1}{2}$	3.10

"LUG-PLUG" PHONE PLUGS

Low cost, two-conductor phone plugs. Fit all $\frac{1}{4}$ " phone jacks. All have solder lug terminals. Handle: Shielded metal or phenolic.

Part No.	Fig.	Typical Mating "Littel-Jax"	Handle	Length & Dia.	U.S.A. List Price
350	A	11	Black	$1\frac{1}{2} \times \frac{1}{2}$	\$1.00
355	A	11	Red	$1\frac{1}{2} \times \frac{1}{2}$	1.00
380	—	11	Shielded	$1 \times \frac{1}{2}$	1.25

"TINI-PLUG" MINIATURE PHONE PLUGS

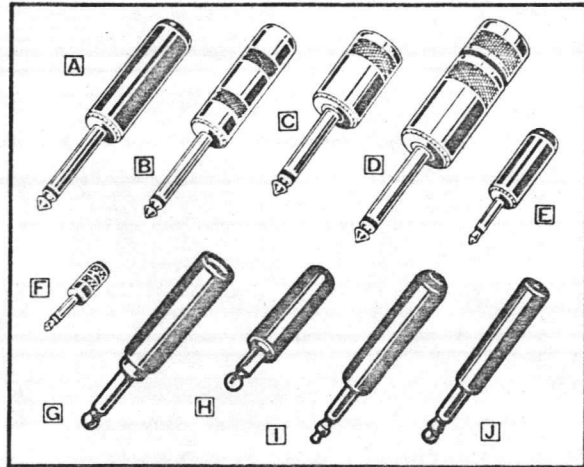
Miniature 2-conductor phone plugs for use with "TINI-JAX" only $\frac{1}{3}$ the size of standard phone plugs. Handles $1\frac{3}{8}$ " overall length, are plastic or brass, nickel plated.

Part No.	Fig.	Terminal	Handle	U.S.A. List Price
740	E	Screw	Black	\$1.15
745	E	Screw	Red	1.15
750	E	Solder	Black	1.10
755	E	Solder	Red	1.10
770	E	Screw	Shielded	1.60
780	E	Solder	Shielded	1.55

"MICRO-PLUG"® SUB-MINIATURE PHONE PLUGS

Sub-miniature 2-conductor phone plugs, only $1\frac{1}{4}$ " long; $\frac{1}{4}$ " O.D., .097" dia. sleeve. Mate with No. TR-2A. Have screw on handles in black, red or natural anodized aluminum; accommodates cables up to $\frac{3}{64}$ " dia. All plugs have integral cable clamps.

Part No.	Fig.	Description	U.S.A. List Price
850	F	Black Handle	\$1.05
855	F	Red Handle	1.05
880	F	Natural Handle	1.05



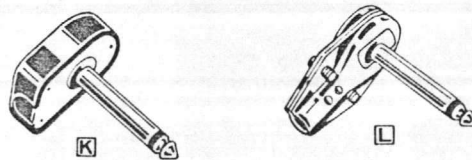
MILITARY TYPE "LITTEL-PLUG" AND "EXTENSION JAX"

Designed to meet exact industrial and military requirements. Plugs are made in accordance with MIL-P-642(A) specifications. One-piece tip rod and one-piece sleeve and plug body provide internal interlock to prevent parts shifting in position. Type S20 Extension Jack meets MIL-J-641A specifications and mates with "Littel-Plug" No. 430. No. 470 has shielded handle; all others plastic: †Red; ‡Black. All plugs have screw terminals.

Part No.	Fig.	Mil-Type No.	Typical Mating Jack	Cond.	U.S.A. List Price
420†	G	PJ-047B	MT-388	2	\$2.20
425†	G	PJ-047R	MT-388	2	2.20
430†	H	PJ-054B	820	2	1.95
435†	H	PJ-054R	820	2	1.95
440†	—	PJ-055B	MT-331	2	1.95
445†	—	PJ-055R	MT-331	2	1.95
450†	H	PJ-540B	820	2	1.95
470	—	PJ-055M	MT-331	2	2.65
480†	I	PJ-068	MT-342B	3	4.55
482†	J	PJ-051R	MT-332B	3	5.05
483†	J	PJ-051B	MT-332B	3	5.05
484†	J	PJ-309	M-444	3	4.55
820†	—	JJ-026	430 Plug	2	2.75

Switchcraft Part No. P-1074-1—Strain Relief Clamp, Nickel Plate Brass. Package of 25..... U.S.A. List Price \$1.05

"FLAT-PLUG" PHONE PLUGS



$\frac{1}{3}$ " phone plugs featuring flat, space-saving handles. Ideal for applications where conventional plugs would protrude too far. Nos. 220, 225 have adapter clips which make them convenient to clamp standard phone tips to terminals. Shielded flat plugs, Nos. 228 and 238 have nickel plated steel handles; all others have red or black plastic handles. No. S-230 has a .206" dia. sleeve.

TWO-CONDUCTOR TYPE

Part No.	Fig.	Typical Mating Jack	Handle	Terminals	U.S.A. List Price
220	K	11	Black	Screw	\$1.75
225	K	11	Red	Screw	1.75
227	K	11	Black	Solder	1.40
228	L	11	Shielded	Solder	1.60
229	K	11	Red	Solder	1.40

THREE-CONDUCTOR TYPE

230	K	12B	Black	Screw	\$2.15
S-230	K	S-12B	Black	Screw	2.70
235	K	12B	Red	Screw	2.15
237	K	12B	Black	Solder	2.10
238	L	12B	Shielded	Solder	2.25
239	K	12B	Red	Solder	2.10



SOUND POWERED TELEPHONE HANDSETS

The Stromberg-Carlson (USI Type) Sound Powered handset is a precision instrument. Molded parts have maximum resistance to breakage. Metal parts are non-corrosive materials wherever possible or are protected by plating, painting or chemical treatment. Alnico magnets in the receiver and transmitter units remain virtually constant and therefore do not limit the useful life of these telephones. All cables have a rubber sheath; all handsets are weatherproof.

Special handsets can be furnished with three or four conductor cables (regular or retractable) and with a single pole double throw switch for special uses.

	702019-003	702019-001	702003-315	702019-075	702019-575	702019-675	702019-845
Bureau Ships Approved		x	x				
Underwriters Laboratory Approved Class 1 Group D	x						
U. S. Coast Guard Approved				x			
Press to Operate Switch	x	x	x	x		x	
Extra Rugged	x	x	x	x			
Interchangeable Units			x	x	x	x	x
Cable Length (feet)	4½	4½	6	4½	4	4	4
Weight - less cord (ounces)	22	22	22	22	20	22	20
Handset Impedance* (ohms)	810	810	780	780	780	780	780
Receiver Impedance* (ohms)	1150	1150	1140	1140	1140	1140	1140
Transmitter Impedance* (ohms)	1690	1690	1400	1400	1400	1400	1400
Receiver d.c. Resistance (ohms)	60	60	60	60	60	60	60
Transmitter d.c. Resistance (ohms)	90	90	60	60	60	60	60

Coiled cord extended length 10' to 12'

*Warble frequency test 500 to 2500 cycles per second

INSTALLATION

The speaker's voice supplies all necessary power — **never connect batteries or external power sources to the talking circuit.** Handsets should be connected in parallel. Polarity does not affect performance. Standard telephone wiring with two insulated conductors twisted into a pair is recommended to prevent externally induced noises. When #19 AWG wire is used and conditions are normal, satisfactory transmission for 30 miles or more is assured. On shorter lines, up to 10 handsets may be used. Separate equipment and wiring is required for ringing.

Installation of handset 702019-003 in hazardous locations (Class 1 Group D) should be made with wiring (except handset cable) enclosed in a grounded rigid metal conduit as specified by Underwriters Laboratories, Inc.

MAINTENANCE

All handsets are carefully inspected to insure continued dependable performance. Unless physically damaged, no maintenance should be required.

Each handset has spring contacts to permit rapid installation of Sound Powered units. Since the units require precision assembly and testing, it is recommended that they be returned to the factory for adjustment. If parts are required, see Replacement Parts List on reverse side.

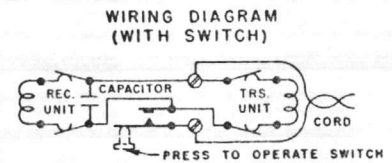
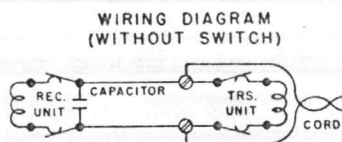
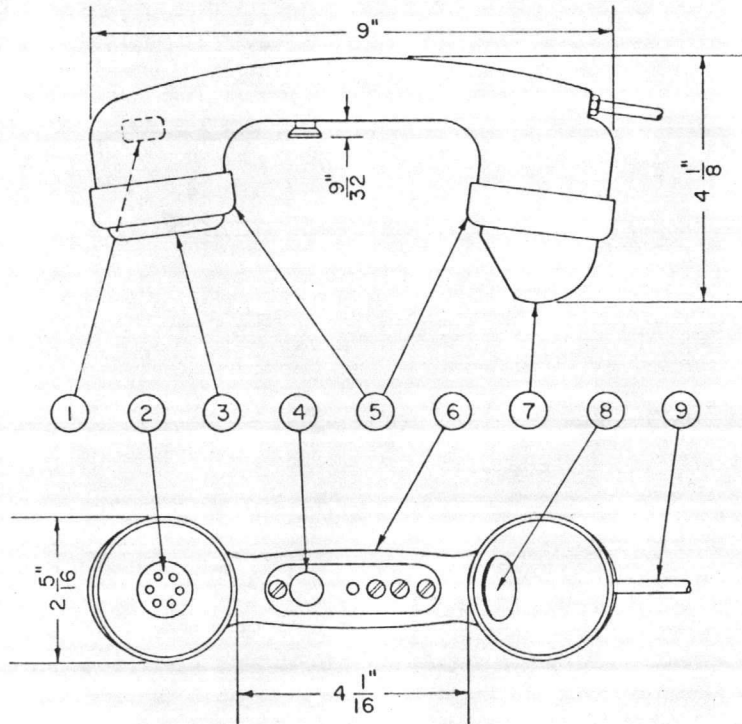
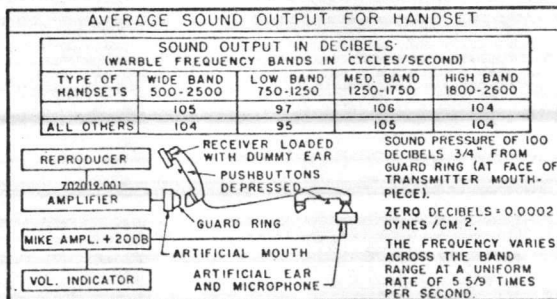
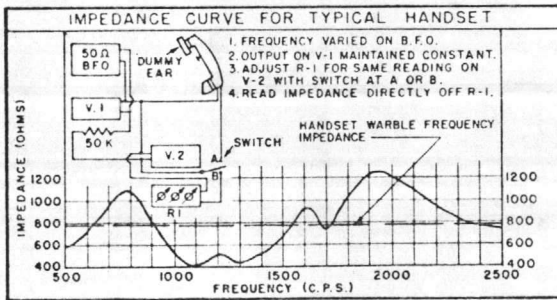
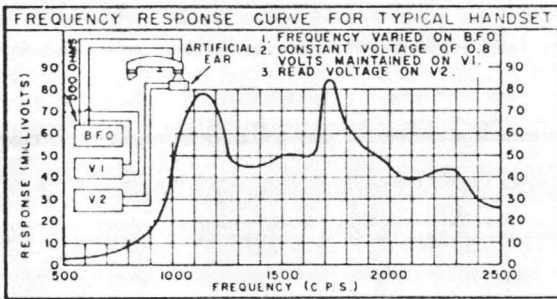


SOUND POWERED TELEPHONE HANDSET

Replacement Parts List

Ordering Information — Include both part number and name

Piece	Part No.	Part Name	702019-003	702019-001	702003-315	702019-075	702019-575	702019-675	702019-845
1	702000-761	Capacitor, 15 MFD	x	x	x	x	x	x	x
2	702020-050	Telephone Receiver Unit			x	x			
2	702020-052	Telephone Receiver Unit	x	x					
2	702020-064	Telephone Receiver Unit					x	x	x
3	701000-237	Receiver Ear Cap			x	x	x	x	x
3	701005-535	Receiver Ear Cap	x	x					
4	702002-884	Handset Switch	x	x					
4	702002-885	Handset Switch				x			
4	702002-881	Handset Switch						x	
4	702002-877	Handset Switch			x				
5	701000-244	Retaining Ring	x	x	x	x			
5	701000-245	Retaining Ring					x	x	x
6	701007-298	Handle Shell Ass'y (incl. 1411-1 capacitor)					x		x
6	701007-299	Handle Shell Ass'y (incl. 1411-1 capacitor)	x	x	x	x		x	
7	701000-221	Mouthpiece	x	x	x	x	x	x	x
8	702020-050	Telephone Transmitter Unit			x	x			
8	702020-053	Telephone Transmitter Unit	x	x					
8	702020-064	Telephone Transmitter Unit					x	x	x
9	702000-774	Handset Cable (4 1/2' rubber covered)	x	x		x			
9	702005-753	Handset Cable (4' rubber cover w alligator clips)							x
9	702003-478	Handset Cable (4' rubber covered)					x	x	
9	702003-512	Handset Cable (1' rubber covered retracted coil)			x				



Stromberg-Carlson

A Subsidiary of General Dynamics



Retractable Communication Cords Neoprene

RETRACTILE COMMUNICATION COIL CORDS

Retracted Lengths 2 & 4 Feet — Extended Lengths 12 & 25 Feet

DESCRIPTION: Multi-conductor communication cord manufactured with extra flexible #23 AWG-21/36 tinned soft cadmium copper for maximum flex life. Insulated with rubber for communication circuits of maximum 120 working volts. The overall jacket is a specially compounded cured neoprene jacket giving long life to the retractile cord.

APPLICATION: Used in communication equipment, such as telephone car carriers, mobile radio equipment, ham operations, head sets, citizen band units and radio transmitter to receiver head sets, communication cords eliminate hazards and inconveniences caused by tangled straight cords.

ALPHA NO. 2 FT. LEAD	ALPHA NO. 4 FT. LEAD	NO. OF CONDS.	CONDUCTOR SIZE	STRAND	AMP RATING	VOLTAGE RATING	NOM. COIL O.D.	NOM. CORD O.D.
680/2	680/4	2	23	21/36	1	120	3/4"	.215"
681/2	681/4	3	23	21/36	1	120	13/16"	.220"
682/2	682/4	4	23	21/36	1	120	15/16"	.250"
683/2	683/4	5	23	21/36	1	120	1-1/16"	.285"
684/2	684/4	6	23	21/36	1	120	1-1/8"	.305"
685/2	685/4	7	23	21/36	1	120	1-1/4"	.320"

COLOR CODE OF CONDUCTORS

- 1—Black
- 2—White
- 3—Red
- 4—Green
- 5—Blue
- 6—Yellow
- 7—Brown

RETRACTILE COMMUNICATION CORDS (Shielded)

Retracted Lengths 2 & 4 Feet — Extended Lengths 12 & 25 Feet

DESCRIPTION: Same as above, except that shielded conductors are individually shielded with a cadmium copper shield to eliminate external electrical interference. Shield can be pigtailed for direct soldering connections.

APPLICATION: Same applications as above, but where a shielded conductor is needed.

ALPHA NO. 2 FT. LEAD	ALPHA NO. 4 FT. LEAD	NO. OF CONDS.	CONDUCTOR SIZE	STRAND	VOLTAGE RATING	SHIELDING	NOM. COIL O.D.	NOM. CORD O.D.	COLOR CODE OF CONDUCTORS
690/2	690/4	1	24	41/40	75	Shielded	5/8"	.160"	White
692/2	692/4	2	1-23 1-24	21/36 41/40	120 75	Unshielded Shielded	7/8"	.240"	Black White
694/2	694/4	3	2-23 1-24	21/36 41/40	120 75	Unshielded Shielded	7/8"	.240"	Black & Red White
696/2	696/4	4	2-23 2-24	21/36 41/40	120 75	Unshielded Individually Shielded	1"	.270"	Red & Black White & Green

MINIATURE RETRACTILE COMMUNICATIONS CORDS

Retracted Length 2 Feet — Extended Length 10 Feet

DESCRIPTION: A small diameter plastic cord with stranded tinned copper conductors for maximum flexibility, insulated and jacketed with polyvinylchloride. Each cord is available in a 2 ft. retracted length with a 6" straight lead on each end and extends to approximately 10 feet.

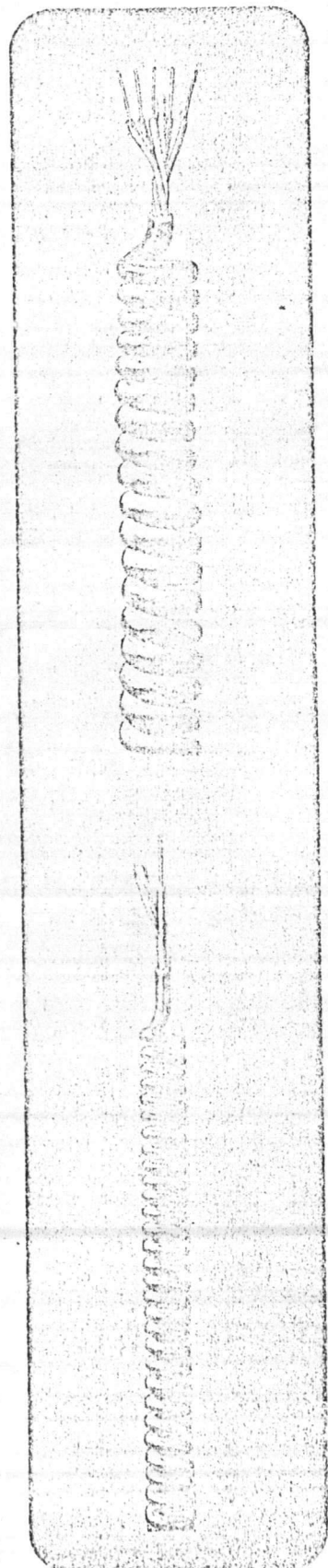
APPLICATION: For low voltage power and communication equipment where miniaturization is required due to space and weight limitations.

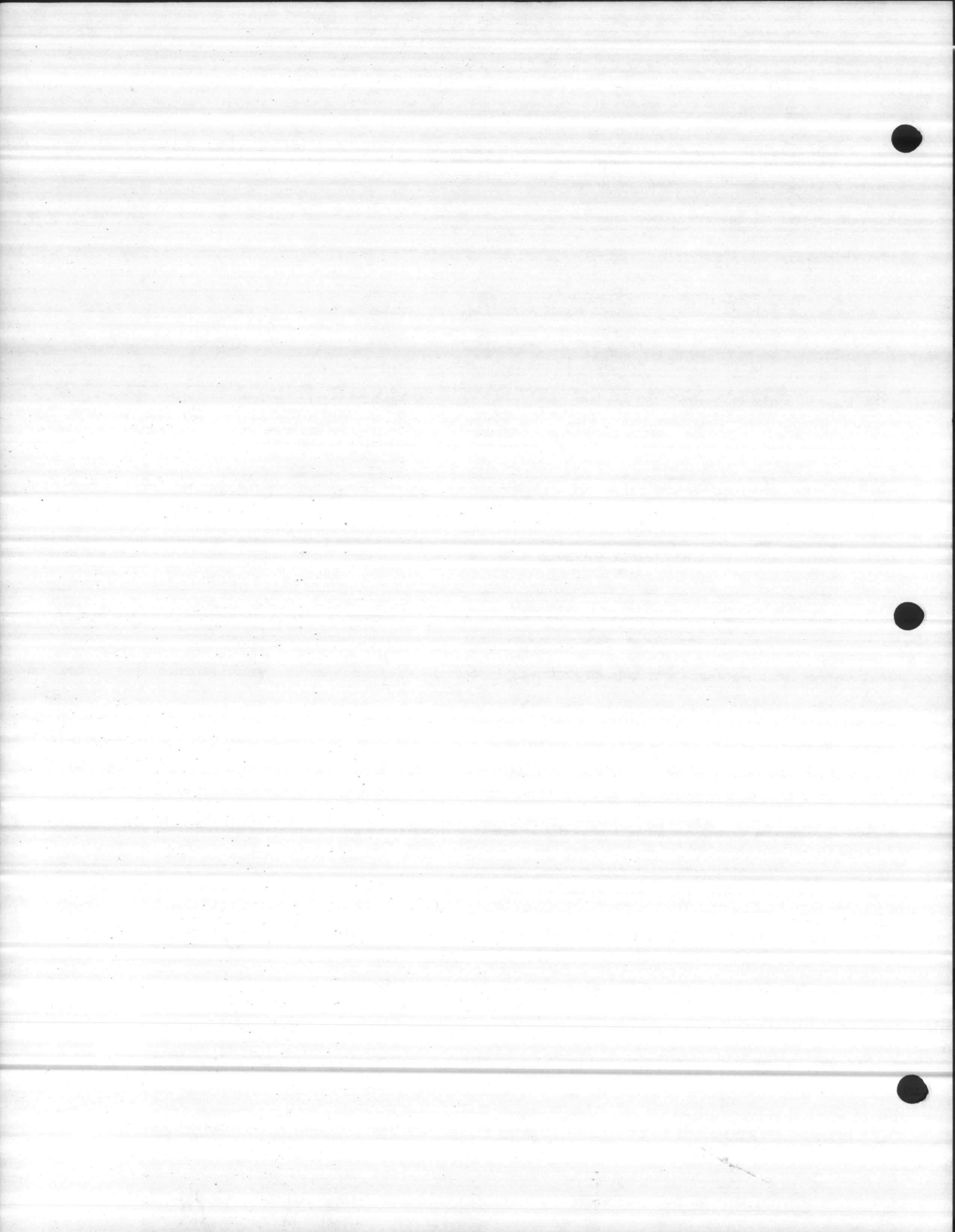
ALPHA NO.	NO. OF CONDS.	CONDUCTOR SIZE	STRAND	AMP RATING	VOLT RATING	NOM. COIL O.D.	NOM. CORD O.D.
651	2	28	19/40	0.5	100	1/2"	.135"
652	4	28	19/40	0.5	100	1/2"	.150"

For 3 conductor, use 4 conductor with one lead unused

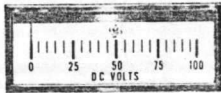
COLOR CODE OF CONDUCTORS

- 1—Black
- 2—White
- 3—Green
- 4—Red





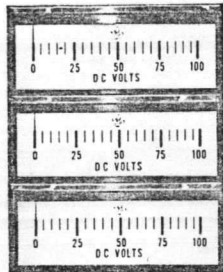
Series 100 TYPE 185 EDGEWISE PANEL METERS



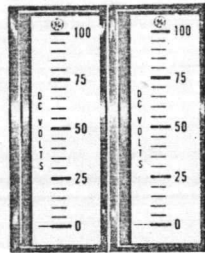
Horizontal Type 185



Vertical Type 185 meter with Bezel



Type 185 3 stack mounted.



Type 185 2 stack mounted.

Features: Completely shielded case. No special calibration required for panel material — Dust-tight cases — Stack mounting of meters is possible with all sides of meter case flush — Optional bezel and mounting bracket for 1-, 2-, or 3-unit stack — Zero regulator provided in rear of case.

SPECIFICATIONS

Accuracy: D-c meters— $\pm 2\%$ of full scale. A-c rectifier type— $\pm 3\%$ (60 cycle sine wave at 25°C).

ANSI Specification: All meters meet ANSI Specification C-39.1.

Overload: Voltmeter—20% momentary and sustained. Ammeter—1000% momentary, 20% sustained.

Scale Data: 53 degrees rotation. Length—1.785".

Insulation Level: 1800V Rms Hi-pot.

Response Time and Damping: Meets ANSI Specification C-39.1. Response time: three seconds (max.) for microameters; two seconds (max.) for all other d-c ratings; and 2.5 seconds (max.) for a-c ratings.

Damping: Maximum of 40% overshoot, minimum damping factor of 2.5. Mounting Dimensions: See Page 32.

NOTE: Mounting hardware is not included. See bottom of this page to order.

Series 100 TYPE 185 EDGEWISE PANEL METERS, A-C & D-C

Rating and Scale*	Terminal Resistance Ohms	Horizontal Scale Cat. No.*	Vertical Scale Cat. No.*	Rating and Scale*	Terminal Resistance Ohms	Horizontal Scale Cat. No.*	Vertical Scale Cat. No.*	
DC RATINGS				D-C MILLIAMMETERS—Zero-center, Self-contained				
D-C VOLTMETERS—Zero-left, Zero-bottom, Self-contained, Linear-scale 1000 ohms/volt				1-0-1ma 40 50-185 112 FAFA 50-185 114 FAFA				
10 v	1000 Ohms/volt	50-185 011 MTMT	50-185 013 MTMT	5-0-5 ma 1.0	50-185 112 FXFX	50-185 114 FXFX	50-185 114 GZGZ	
15 v		50-185 011 NDND	50-185 013 NDND	10-0-10 ma 0.5	50-185 112 GZGZ	50-185 114 GZGZ	50-185 114 HYHY	
30 v		50-185 011 NLNL	50-185 013 NLNL	50-0-50 ma 0.5	50-185 112 HYHY	50-185 114 HYHY	50-185 114 KMKM	
50 v		50-185 011 NTNT	50-185 013 NTNT	500-0-500 ma 0.049	50-185 112 KMKM	50-185 114 KMKM		
100 v		50-185 011 PKPK	50-185 013 PKPK					
150 v		50-185 011 PZPZ	50-185 013 PZPZ					
300 v	50-185 011 RXXR	50-185 013 RXXR						
D-C VOLTMETERS—Zero-center, Self-contained 2000 ohms/volt				D-C AMMETERS—Zero-left, Zero-bottom, Self-contained, Linear-scale				
15-0-15 v	2000 Ohms/volt	50-185 012 NDND	50-185 014 NDND	1 amp 0.049	50-185 111 LALA	50-185 113 LALA	50-185 113 LSLS	
50-0-50 v		50-185 012 NTNT	50-185 014 NTNT	5 amp 0.0099	50-185 111 LSLS	50-185 113 LSLS	50-185 113 MTMT	
150-0-150 v		50-185 012 PZPZ	50-185 014 PZPZ	10 amp 0.0049	50-185 111 MTMT	50-185 113 MTMT		
D-C VOLTMETERS—Zero-left, Zero-bottom. Rated 0-1 ma. For use with External Resistor. Catalog No. does NOT include resistor. See page 19.				D-C AMMETERS—Zero-center, Self-contained				
500 v	40	50-185 171 FASF	50-185 173 FASF	5-0-5 amp 0.0049	50-185 112 LSLS	50-185 114 LSLS		
600 v		50-185 171 FASJ	50-185 173 FASJ					
750 v		50-185 171 FASM	50-185 173 FASM					
D-C MICROAMMETERS—Zero-left, Zero-bottom, Self-contained, Linear-scale				D-C AMMETERS—Zero-left, Zero-bottom, Linear-scale 50 mv Shunt-rated. Catalog numbers do NOT include shunt or leads. See page 19.				
20 ua	2030	50-185 111 CFCF	50-185 113 CFCF	20 amp 12.5 ohms calibrated	50-185 121 ECNG	50-185 123 ECNG		
50 ua		50-185 111 CYCY	50-185 113 CYCY	50 amp for use with two-way	50-185 121 ECNT	50-185 123 ECNT		
100 ua		50-185 111 DRDR	50-185 113 DRDR	300 amp shunt-lead resistance	50-185 121 ECRX	50-185 123 ECRX		
500 ua		50-185 111 EMEM	50-185 113 EMEM	500 amp of 0.065 ohms	50-185 121 ECSF	50-185 123 ECSF		
D-C MICROAMMETERS—Zero-center, Self-contained				AC RATINGS				
50-0-50 ua	1350	50-185 112 CYCY	50-185 114 CYCY	A-C VOLTMETERS—Rectifier-type 3-percent Accuracy Self-contained, Linear-scale 1000 Ohms/volt				
500-0-500 ua		50-185 112 EMEM	50-185 114 EMEM	10 v	1000 Ohms/volt	50-185 051 MTMT	50-185 053 MTMT	
			15 v	50-185 051 NDND		50-185 053 NDND		
			30 v	50-185 051 NLNL		50-185 053 NLNL		
			50 v	50-185 051 NTNT		50-185 053 NTNT		
			100 v	50-185 051 PKPK		50-185 053 PKPK		
			150 v	50-185 051 PZPZ		50-185 053 PZPZ		
D-C MILLIAMMETERS—Zero-left, Zero-bottom, Self-contained, Linear-scale				A-C MICROAMMETERS—Rectifier-type 3-percent Accuracy Self-contained, Linear-scale				
1 ma	40	50-185 111 FAFA	50-185 113 FAFA	500 ua	985	50-185 151 EMEM	50-185 153 EMEM	
5 ma		50-185 111 FXFX	50-185 113 FXFX	A-C MILLIAMMETERS—Rectifier-type 3-percent Accuracy Self-contained, Linear-scale				
10 ma		50-185 111 GZGZ	50-185 113 GZGZ	1 ma	570	50-185 151 FAFA	50-185 153 FAFA	
20 ma		50-185 111 HFHF	50-185 113 HFHF	5 ma		139	50-185 151 FXFX	50-185 153 FXFX
50 ma		50-185 111 HYHY	50-185 113 HYHY	10 ma		90	50-185 151 GZGZ	50-185 153 GZGZ
100 ma		50-185 111 JRJR	50-185 113 JRJR	20 ma		62	50-185 151 HFHF	50-185 153 HFHF
300 ma		50-185 111 KGKG	50-185 113 KGKG					
500 ma		50-185 111 KMKM	50-185 113 KMKM					

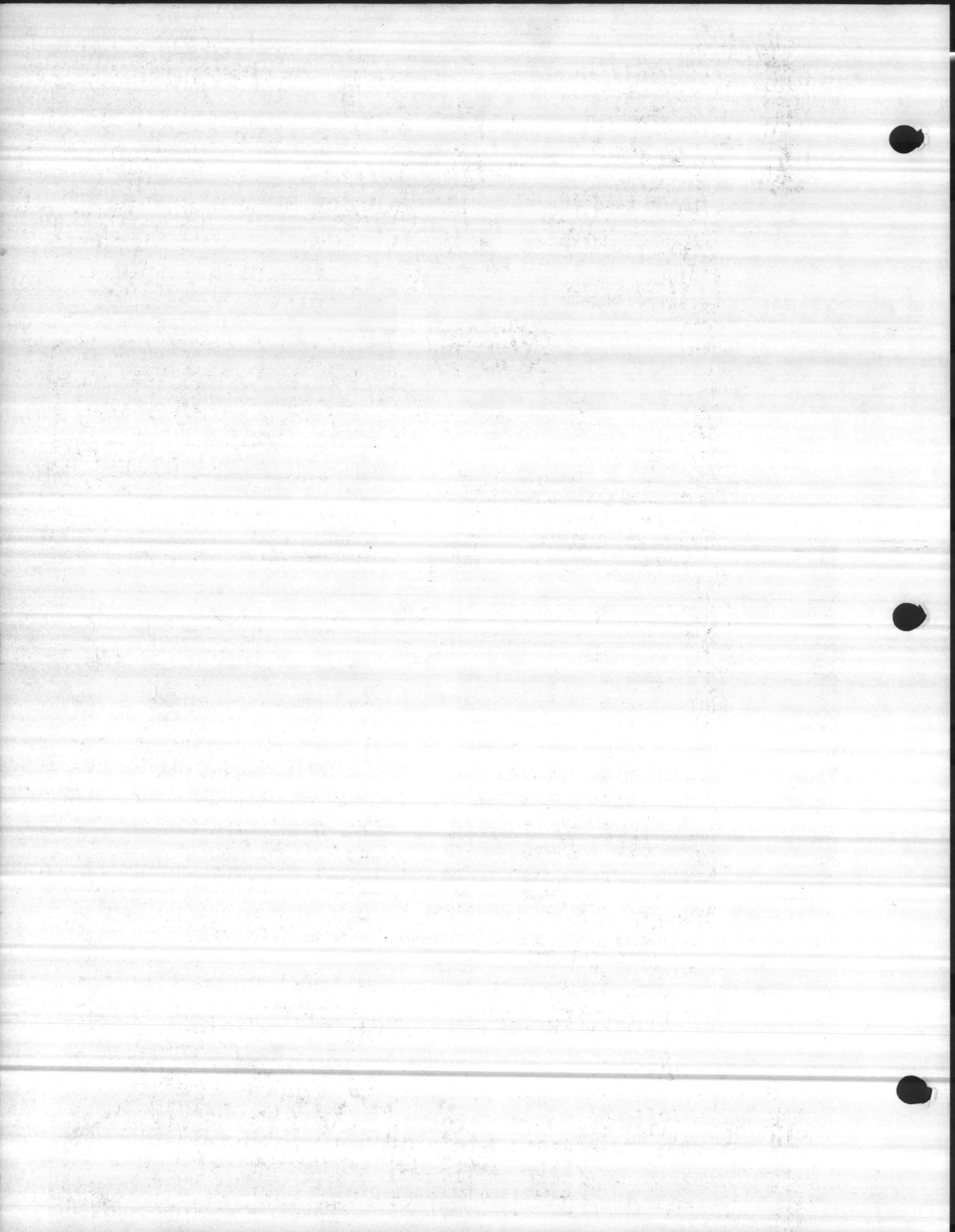
MOUNTING HARDWARE

For mounting convenience, mounting kits also should be ordered when ordering Type 185 Edgewise Meters. The kits contain all necessary parts for quickly stack-mounting one, two, or three Type 185 meters, either vertically or horizontally. These meters can be mounted without bezel or mounting kit, by means of the four predrilled holes in the meter case, but

the kit results in faster installation and improved panel appearance. Each kit contains a bezel, mounting bracket(s), speed nuts, and bolts.

Type of Mounting	Catalog No.
For mounting one meter only . . .	4149K 16G.778
For mounting two meters	4149K 16G.779
For mounting three meters	4149K 16G.780

FOR PRICES, SEE YOUR AUTHORIZED GE MODIFICATION CENTER, DISTRIBUTOR, OR GENERAL ELECTRIC SALES OFFICE



SPECIFICATIONS

ACCURACY CLASS
(Standard) ± 1.5 percent of full-scale span for d-c horizontal and vertical and a-c horizontal. ± 2 percent for a-c vertical.

(Optional) Refer to Company Suppressed-zero (mechanical) ± 2 percent of full-scale span

A-C Rectifier-type Ammeters and Voltmeters (Standard)
 ≈ 2.5 percent on 60-cycle sine wave at 25 C

SALES [STANDARD]
Ranges—(see Ratings, Standard)
Length—4.5 inches
Degrees rotation—60 degrees

Color
Background—White
Numerals—Black
Legend—Black
Scale Division—Black
Numeral height— $\frac{1}{4}$ -inch
Illumination—Refer to Company
Number of scale divisions—100 maximum

Maximum number of letters (counting spaces as letters) on vertical meters, 25; on horizontal meters, 30
Scale linearity—D-c—linear
A-c—nonlinear

REPEATABILITY
 ≈ 2 percent of full scale
Overload
Sustained—120 percent for a-c and d-c voltmeters. 120 percent for 8 hours for a-c and d-c ammeters.
Momentary—10 times rated current applied for 10 consecutive intervals of $\frac{1}{2}$ second with one-minute interval between successive applications for a-c and d-c ammeters. Mechanical overload same as momentary overload for ammeters.

RESPONSE TIME
A-c—4 seconds maximum
D-c—2.5 seconds maximum

DAMPING (Standard)—Nominal overshoot except ratings listed below. 50 microamperes—critical; 1 milliamperes—6 percent; 50 millivolts—20 percent.

INSULATION LEVEL
Operating—600 volts
Hi-Pot—5000 volts rms terminals to case for 1 minute

MOUNTING POSITION
0 degrees from horizontal or vertical is standard. If other mounting angle is necessary, then angle must be specified and instrument calibrated for the specified angle.

MOUNTING
Semi-flush
OPERATING ENVIRONMENT
Temperature (Standard)—4 F to +150 F (-20 C to +65 C)

Pressure—Atmospheric
Shock—50 G's
Corrosive fumes, salt-spray. Refer to Company
Explosion-proof (Standard)—No
Maximum magnetic field without external shielding (Standard)—D-c or a-c, 1 gauss for 3 percent accuracy
(Optional)—Refer to Company for recommendations to minimize errors

SPECIFICATIONS (CONT'D)

Case
Material—Base high impact styrene
Finish (Standard) Spray painted
Color (Standard) Aluminum
(Optional) Black
Pointer color—White
Window and case—Lexan
Magnetic shielding—D-c, self-shielding—
A-c, soft iron shields
Gasketed cover (weather resistant) available

Type Terminals—Stud type

Shipping and Storage
Net weight
D-c—18 ounces
A-c—19 ounces
Shipping weight—
Standard D-c=30 ounces
MIL bag pack D-c=30 ounces
A-c=31 ounces

Shipping Container Size

Container	Size in Inches			Cubic Feet
	Width	Height	Depth	
Standard	3.5	8	9	0.146
MIL Bag Pack	3.5	8	9	0.146

D-c Ammeters

CORE MAGNET D'ARSONVAL TYPE

Scale and Rating	Terminal Resist-ance, Ohms	1 1/2-percent Accuracy Vertical Cat. No.	1 1/2-percent Accuracy Horizontal Cat. No.	List Price, GO-87L
------------------	----------------------------	--	--	--------------------

Scale and Rating	Terminal Resist-ance, Ohms	1 1/2-percent Accuracy Vertical Cat. No.	1 1/2-percent Accuracy Horizontal Cat. No.	List Price, GO-87L
Self-contained				
0-50 UA	2760	50-180 113 CYCY	50-180 111 CYCY	\$83
0-100 UA	1525	50-180 113 DRDR	50-180 111 DRDR	76
0-200 UA	690	50-180 113 EAEA	50-180 111 EAEA	69
0-500 UA	125	50-180 113 EWEW	50-180 111 EWEW	62
0-800 UA	63	50-180 113 EWEW	50-180 111 EWEW	62
0-1 MA	62.7	50-180 113 FAFa	50-180 111 FAFa	62
0-2 MA	31.2	50-180 113 FGFg	50-180 111 FGFg	62
0-5 MA	2.4	50-180 113 FFFx	50-180 111 FFFx	62
0-10 MA	1.4	50-180 113 GZGz	50-180 111 GZGz	62
0-50 MA	2.0	50-180 113 HTHY	50-180 111 HTHY	62
0-100 MA	0.25	50-180 113 JRJR	50-180 111 JRJR	62
0-200 MA	0.15	50-180 113 KAKA	50-180 111 KAKA	62
0-500 MA	0.10	50-180 113 KMKH	50-180 111 KMKH	62
0-800 MA	0.062	50-180 113 KWKW	50-180 111 KWKW	62
0-1 A	0.05	50-180 113 LALA	50-180 111 LALA	62
0-2 A	0.025	50-180 113 LELE	50-180 111 LELE	62
0-5 A	0.010	50-180 113 LSLs	50-180 111 LSLs	62
0-10 A	0.005	50-180 113 MTAH	50-180 111 MTAH	62
0-15 A	0.003	50-180 113 NDND	50-180 111 NDND	62
0-20 A	0.25	50-180 113 NGNG	50-180 111 NGNG	62
0-30 A	0.001	50-180 113 NLNL	50-180 111 NLNL	62
0-40 A	0.001	50-180 113 NPNP	50-180 111 NPNP	62
0-50 A	0.001	50-180 113 NNTN	50-180 111 NNTN	62

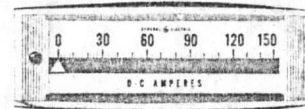
Shunt-rated—50-mv unless otherwise specified

0-10 A	12.5	50-180 123 ECWt	50-180 121 ECWt	\$82*
0-20 A	12.5	50-180 123 ECNG	50-180 121 ECNG	82*
0-30 A	12.5	50-180 123 ECNL	50-180 121 ECNL	82*
0-40 A	12.5	50-180 123 ECNP	50-180 121 ECNP	82*
0-60 A	12.5	50-180 123 ECNW	50-180 121 ECNW	82*
0-80 A	12.5	50-180 123 ECPD	50-180 121 ECPD	82*
0-100 A	12.5	50-180 123 ECPK	50-180 121 ECPK	82*
0-200 A	12.5	50-180 123 ECRX	50-180 121 ECRX	82*
0-300 A	12.5	50-180 123 ECRX	50-180 121 ECRX	82*
0-400 A	12.5	50-180 123 ECSC	50-180 121 ECSC	82*
0-500 A	12.5	50-180 123 ECSE	50-180 121 ECSE	82*
0-600 A	12.5	50-180 123 ECSE	50-180 121 ECSE	82*
0-800 A	12.5	50-180 123 ECFSH	50-180 121 ECFSH	82*
0-1 KA	12.5	50-180 123 ECVA	50-180 121 ECVA	82*
0-50 MV	12.5	50-180 123 ECt	50-180 121 ECt	82*
50-0-50 MV	25	50-180 124 ECt	50-180 122 ECt	82*
0-100 MV	25	50-180 123 GBt	50-180 121 GBt	82*
100-0-100 MV	50	50-180 124 GBt	50-180 122 GBt	82*

D-c Voltmeters
SELF-CONTAINED, CORE MAGNET D'ARSONVAL TYPE, 1000 OHMS/VOLT SENSITIVITY

Scale and Rating	Terminal Resist-ance, Ohms	1 1/2-percent Accuracy Vertical Cat. No.	1 1/2-percent Accuracy Horizontal Cat. No.	List Price, GO-87L
0-1 V	1000	50-180 013 LALA	50-180 011 LALA	\$82
0-5 V	5000	50-180 013 LSLs	50-180 011 LSLs	82
0-15 V	15000	50-180 013 NDND	50-180 011 NDND	82
0-30 V	30000	50-180 013 NMLL	50-180 011 NMLL	82
0-50 V	50000	50-180 013 NHTH	50-180 011 NHTH	82
0-80 V	80000	50-180 013 PDPD	50-180 011 PDPD	82
0-150 V	150000	50-180 013 PZPz	50-180 011 PZPz	85
0-300 V	300000	50-180 013 RRRx	50-180 011 RRRx	76
0-400 V	600000	50-180 013 SJSJ	50-180 011 SJSJ	76
150-0-150	150000	50-180 014 PZPz	50-180 012 PZPz	89
300-0-300	300000	50-180 014 RRRx	50-180 012 RRRx	76

Type 180 d-c millimeter, d'Arsonval type



Type 180 d-c ummeter, d'Arsonval type

D-c Millimeters
MECHANICALLY ZERO-SUPPRESSED, LIVE-ZERO, SELF-CONTAINED (To read output of process transmitters, blank legend.)

Rating	Scale	2-percent Accuracy Vertical Cat. No.	2-percent Accuracy Horizontal Cat. No.	List Price, GO-87L
1-5 mA	5	50-180 183 FYAA 1A8A	50-180 181 FYAA 1A8A	\$70
4-20 mA	5	50-180 183 HEAA 1A8A	50-180 181 HEAA 1A8A	70
10-50 mA	5	50-180 183 HXAA 2A8A	50-180 181 HXAA 2A8A	70

D-c Millimeters and Millivoltmeters

(For use with Type 472 Transducers)

Scale and Rating	Legend	1.5-percent Accuracy Vertical Cat. No.	1.5-percent Accuracy Horizontal Cat. No.	List Price, GO-87L
V	Volts	50-180 V	50-180 V	\$83
mV	Volts	50-180 mV	50-180 mV	83
V	Volts	50-180 V	50-180 V	83
V	Volts	50-180 V	50-180 V	83
V	Volts	50-180 V	50-180 V	83
V	Volts	50-180 V	50-180 V	83
V	Volts	50-180 V	50-180 V	83
V	Volts	50-180 V	50-180 V	83
V	Volts	50-180 V	50-180 V	83

* Normally in factory stock.

* Prices do not include shunt or shunt leads. See pages 30-31 for pricing information.

† Scale and legend to be specified by customer.

‡ Pennil calibrated points at 0, 25 percent, 50 percent, 75 percent, 100 percent of full-scale position.

¶ Scale and rating depend on transducers selected. Refer to pages 33-36 to specify transducers.

Prices subject to change without notice

INSTRUCTION BOOK	4556K70.001
------------------	-------------

PRICES

A-c Voltmeters
60 CPS, IRON-VANE TYPE

Scale	Transformer Rating	2-percent Accuracy Vertical Cat. No.	1 1/2-percent Accuracy Horizontal Cat. No.	List Price, GO-87L
0-150 V		50-180 033 PZPz	50-180 031 PZPz	\$89
0-300 V	Self-contained	50-180 033 RRRx	50-180 031 RRRx	75
0-500 V		50-180 033 SFSF	50-180 031 SFSF	89
0-600 V		50-180 033 SJSJ	50-180 031 SJSJ	97

Transformer-rated elements, 150-volt

Scale	Transformer Rating	2-percent Accuracy Vertical Cat. No.	1 1/2-percent Accuracy Horizontal Cat. No.	List Price, GO-87L
0-300 V	240/120	50-180 033 PZRX	50-180 031 PZRX	\$89
0-600 V	480/120	50-180 033 PZSJ	50-180 031 PZSJ	89
0-750 V	600/120	50-180 033 PZSM	50-180 031 PZSM	89
0-3 KV	2400/120	50-180 033 PZVJ	50-180 031 PZVJ	89
0-5.25 KV	4000/120	50-180 033 PZVY	50-180 031 PZVY	89
0-4 KV	4800/120	50-180 033 PZVX	50-180 031 PZVX	89
0-9 KV	7200/120	50-180 033 PZWJ	50-180 031 PZWJ	89
0-15 KV	12000/120	50-180 033 PZWZ	50-180 031 PZWZ	89
0-18 KV	14400/120	50-180 033 PZXE	50-180 031 PZXE	89

A-c Ammeters
40/70 CPS, IRON-VANE TYPE

Scale	Transformer Rating	2-percent Accuracy Vertical Cat. No.	1 1/2-percent Accuracy Horizontal Cat. No.	List Price, GO-87L
0-1 A		50-180 143 LALA	50-180 141 LALA	\$89
0-2 A		50-180 143 LILJ	50-180 141 LILJ	89
0-5 A		50-180 143 LSLs	50-180 141 LSLs	89
0-10 A		50-180 143 MTAH	50-180 141 MTAH	89
0-15 A		50-180 143 NDND	50-180 141 NDND	89
0-20 A		50-180 143 NGNG	50-180 141 NGNG	89
0-30 A		50-180 143 NMLL	50-180 141 NMLL	83
0-50 A		50-180 143 NNTN	50-180 141 NNTN	83

A-c Ammeters
40/70 CPS, IRON-VANE TYPE

Scale	Transformer Rating	2-percent Accuracy Vertical Cat. No.	1 1/2-percent Accuracy Horizontal Cat. No.	List Price, GO-87L
-------	--------------------	--------------------------------------	--	--------------------

Transformer-rated elements, 5-ampere

0-10 A	10/5	50-180 143 LSMT	50-180 141 LSMT	\$89
0-15 A	15/5	50-180 143 LSND	50-180 141 LSND	89
0-20 A	20/5	50-180 143 LSNG	50-180 141 LSNG	89
0-25 A	25/5	50-180 143 LSNJ	50-180 141 LSNJ	89
0-30 A	30/5	50-180 143 LSNL	50-180 141 LSNL	89
0-40 A	40/5	50-180 143 LSNP	50-180 141 LSNP	89
0-50 A	50/5	50-180 143 LSNT	50-180 141 LSNT	89
0-75 A	75/5	50-180 143 LSPP	50-180 141 LSPP	89
0-100 A	100/5	50-180 143 LSPK	50-180 141 LSPK	89
0-150 A	150/5	50-180 143 LSPZ	50-180 141 LSPZ	89
0-200 A	200/5	50-180 143 LSRL	50-180 141 LSRL	89
0-300 A	300/5	50-180 143 LSRL	50-180 141 LSRL	89
0-400 A	400/5	50-180 143 LSRL	50-180 141 LSRL	89
0-500 A	500/5	50-180 143 LSRL	50-180 141 LSRL	89
0-600 A	600/5	50-180 143 LSRL	50-180 141 LSRL	89
0-800 A	800/5	50-180 143 LSRL	50-180 141 LSRL	89

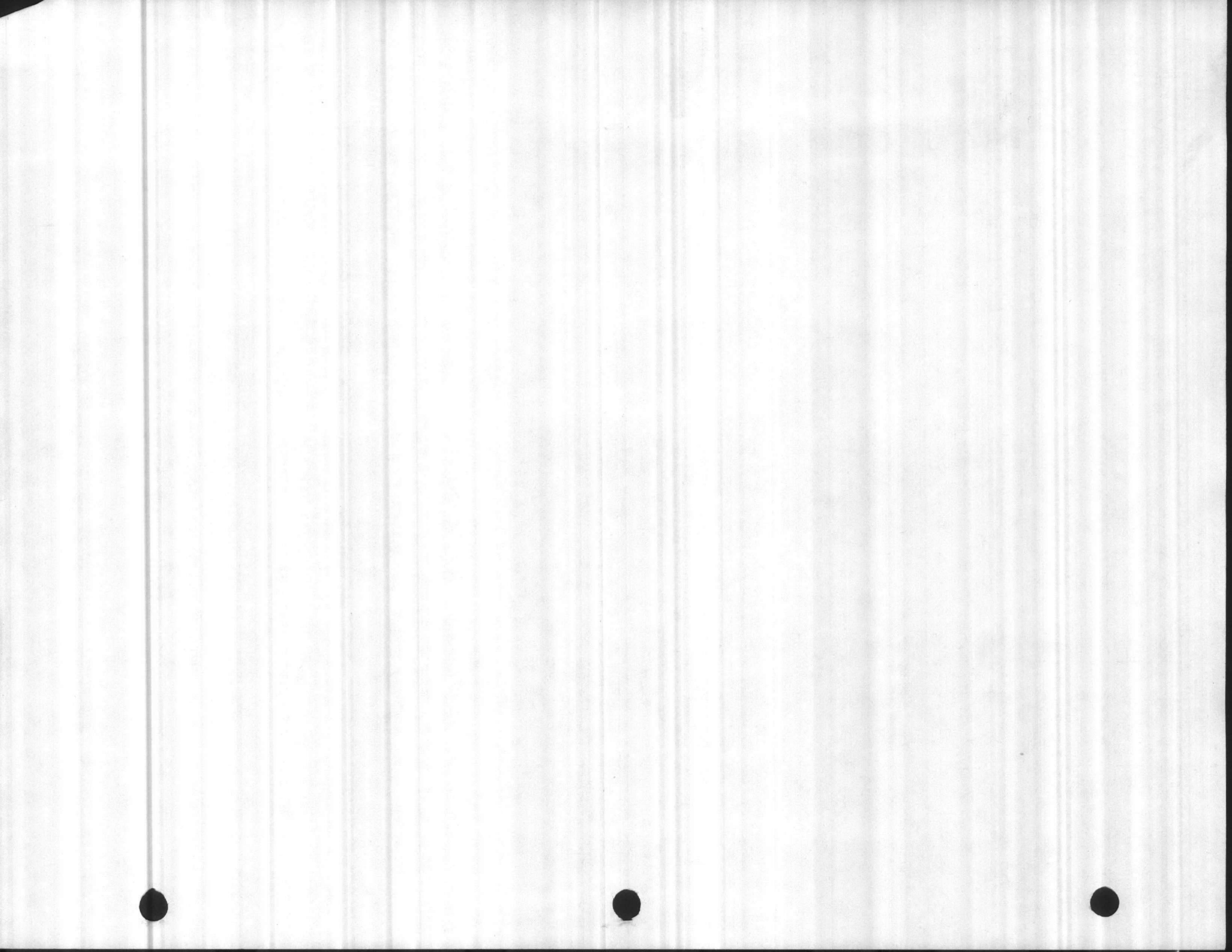
0-1 KA	1000/5	50-180 143 LSVA	50-180 141 LSVA	89
0-1.2 KA	1200/5	50-180 143 LSVC	50-180 141 LSVC	89
0-1.5 KA	1500/5	50-180 143 LSVC	50-180 141 LSVC	89
0-2 KA	2000/5	50-180 143 LSVE	50-180 141 LSVE	89
0-3 KA	3000/5	50-180 143 LSVM	50-180 141 LSVM	89
0-4 KA	4000/5	50-180 143 LSVM	50-180 141 LSVM	89

Type 180 a-c ammeter, iron-vane type



Burden Data

Type	Impedance in Ohms	Effective Resistance in Ohms	Inductance in Henries	Volt-ampere	Watts	Reactive Volt-ampere	Power Factor
120-VOLT, 60							





APPLICATION — Bulletin 830 pressure controls are compact, reliable, and inexpensive devices designed to start and stop motors driving water pumps or air compressors used in domestic, commercial, and industrial service. They can be used to operate small pump motors direct, or as pilot devices to operate motor starters which control larger motors. For low pressure service, two ratings are available as listed in the table below. For high pressure service, only one rating is available.

CONSTRUCTION — The Bulletin 830 pressure controls are equipped with a handy slip-on cover simplifying installation. The contact blocks are double pole having silver contacts with the terminal screws easily accessible for wiring and can be removed or replaced without affecting the setting. These controls are supplied as standard with two conduit holes. All interior metal parts are zinc plated and chromated for corrosion protection. The enclosure is also treated to resist corrosion and in addition, has a primer coat, plus a glossy gray baked enamel finish.

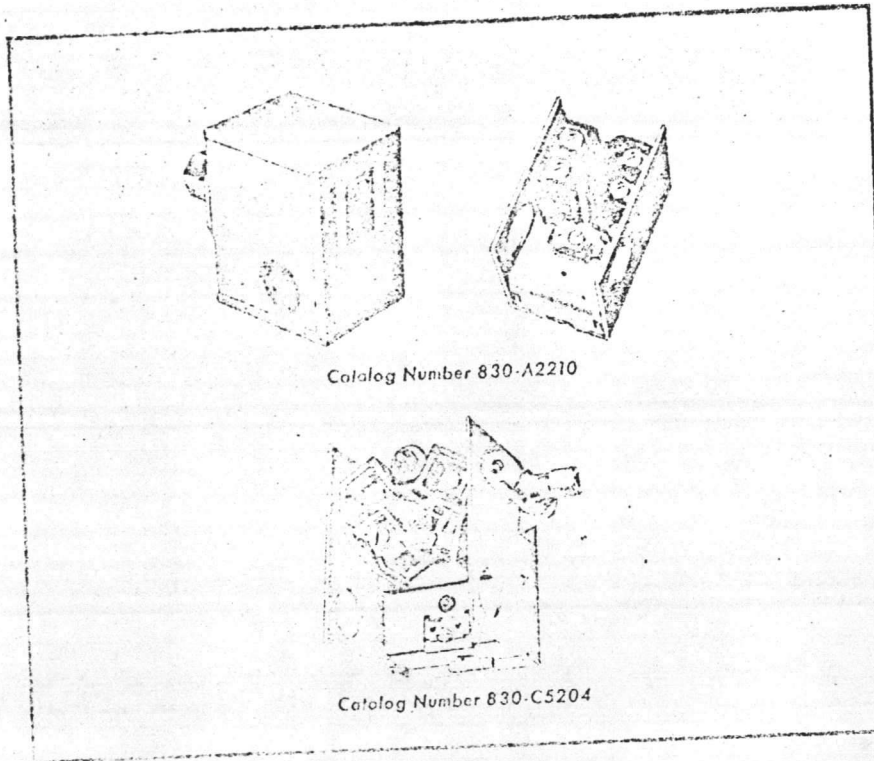
PULSATION PLUG — When Bulletin 830 pressure controls are used on reciprocating pumps where pronounced surges are encountered, Catalog Number 830-N3 pulsation plug should be used. Pulsation plug also helps to displace sediment deposits that might affect the action of the control. It can be easily removed or installed in the field with a 1/4" spinlite wrench. List price is \$0.30 each. Sold only in standard package of 25.

RELEASE VALVE — The Catalog Number 830-C5204, designed for air compressor service, is equipped with a 2-way release valve to exhaust air in the line between the compressor and the tank when the contacts open. Compressor motor can then be started unloaded.

1/4" NIPPLE — Catalog Number 830-N2 Nipple is used to change the standard 1/4" internal pipe thread connection to a 1/4" external pipe thread. List price is \$1.40 each. Sold only in standard package of 25.

NOTE — 1/4" internal pipe thread is standard for the pressure connection. Other types and sizes of connections are available on quantity orders.

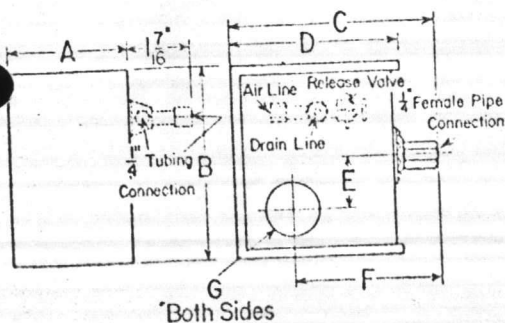
ORDERING INFORMATION — Specify the catalog number selected from price table.



Range Pounds per Square Inch	Adjustable Differential Pounds per Square Inch	Maximum Horsepower Ratings, ---							Catalog Number	Price
		Single Phase		Polyphase		DC				
		115 Volts	230 Volts	450 575 Volts	230 Volts	450 575 Volts	37 Volts	115 Volts			230 Volts
15-60	15-20	1	1	1	1	1	1/4	1/4	1/4	830-A2210 with Pulsation Plug \$11.40 830-A2200 without Pulsation Plug 11.10
15-80	15-25	2	3	5	5	5	1/2	1	1/2	830-B5210 with Pulsation Plug 30.80 830-B5200 without Pulsation Plug 30.50
25-200	25-40	2	3	5	5	5	1/2	1	1/2	830-C5204 with 2-way Release Valve 41.60 830-C5200 without Release Valve 30.50

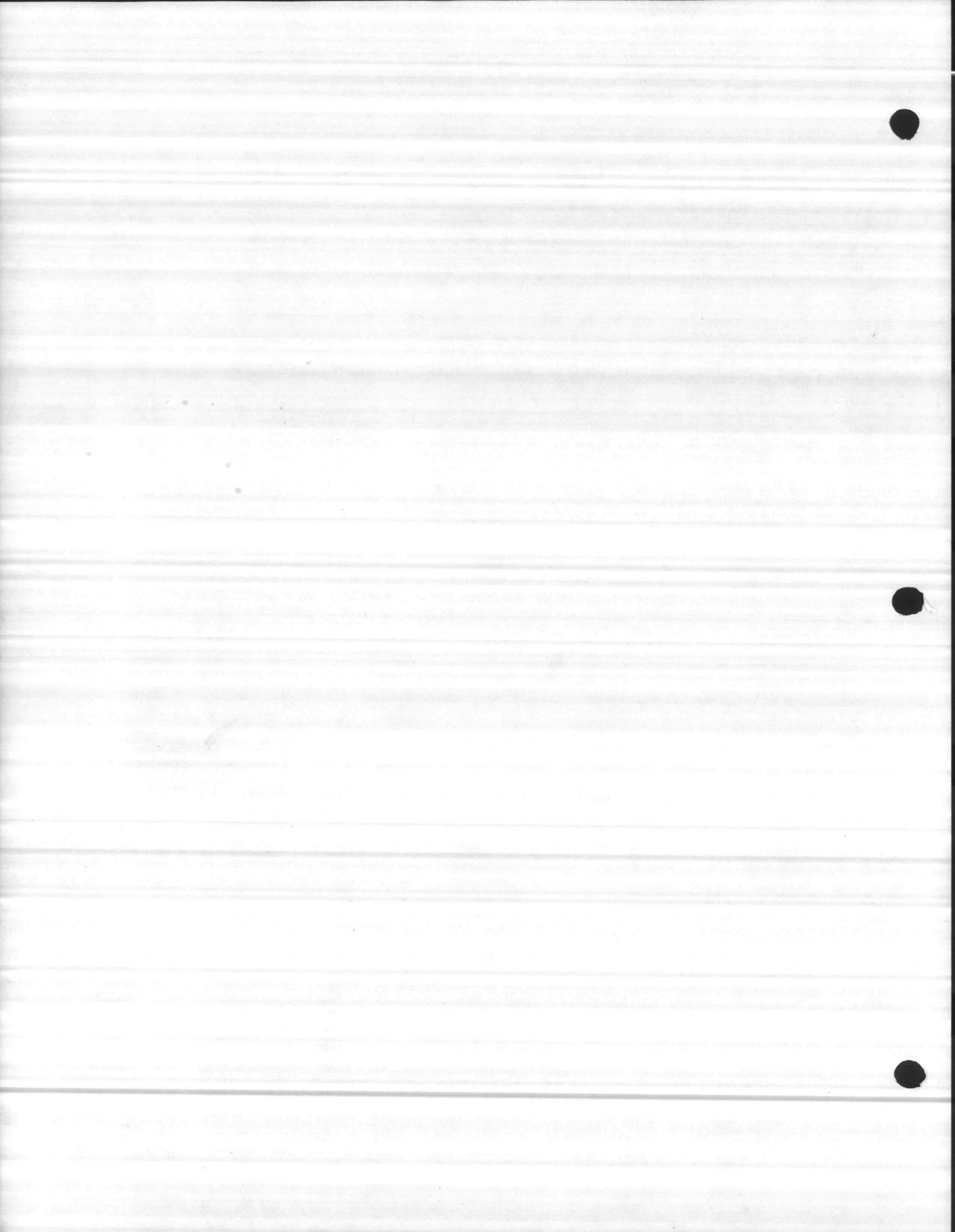
☐ The differential is equal to the cut-out pressure minus the cut-in pressure.
 Example: An 830-A2200 with a cut-out setting of 40 PSI can be adjusted to a minimum cut-in pressure of 20 PSI up to a maximum cut-in pressure of 25 PSI. The 830-A2200 is factory set to cut-in at 20 PSI and cut-out at 40 PSI.

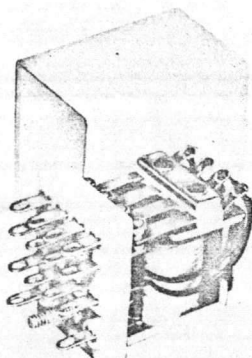
☑ Catalog Number 830-N1 rubber grommets are available for the 830-A2210 or 830-A2200. List price is \$0.20 each. Sold only in standard package of 25.



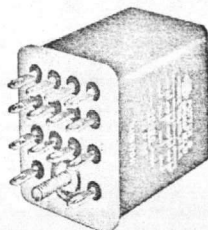
APPROXIMATE DIMENSIONS AND SHIPPING WEIGHTS

Catalog Number	Dimensions in Inches						Conduit Information G	Ship. Weight in Lbs.
	A	B	C	D	E	F		
830-A2210 A2200	1 15/16	3	3 3/8	2 1/2	2 7/32	2 23/32	3/8" Dia. Hole	1
830-B5210 B5200	2 29/32	4 3/32	4 19/32	3 1/2	1 1/16	3 3/8	3/8" Dia. Hole & 1 1/8" Knockouts	2





KHP Enclosure detached



KHS



KHU

U/L File E22575
CSA File LR 15734

GENERAL PURPOSE 3 AMP MULTICONTACT AC or DC SMALL RELAY

ENGINEERING DATA

Only slightly larger than a cubic inch, the KHP and KHS Series AC and DC relays add a new dimension in reliability to electro-magnetic switching. These miniature relays are specifically designed to meet the exacting requirements of data processing, computer, process control and other applications.

The KHP Series is offered with nylon dust enclosures in either natural or in various colors. The KHS Series is furnished in hermetically sealed metal cases. KHS frame should not be grounded without consulting factory for load levels. KHC relays are identical with KHP relays except for having printed circuit terminals.

The KHU, one of the smallest 4-pole relays recognized under the Component Program of Underwriters' Laboratories, Inc. and Canadian Standards Association, is a companion design to the KHP Series. The contacts are rated 1/10 HP, 3 amps, 120V AC; 3 amps, 28V DC, resistive. Several design variations applied to the KHU result in relays having different designators. These are:

KHX U/L recognized for opposite polarity ratings.

KHE Same U/L recognition as the KHX Series but with printed circuit terminals.

KHF Same UL recognition as KHU Series but with printed circuit terminals.

For quick selection of features available for KH Series relays, please refer to the Ordering Guide.

Spacings provided for KHU Series relays are 1/16" through air and over the surface of insulating material and are maintained between an uninsulated live part and an uninsulated live part of opposite polarity and the grounded frame.

GENERAL:

Insulation: Molded high-dielectric material.

Initial Breakdown Voltage: 500 volts rms 60 Hz.

Temperature Range: -45°C to +70°C.

Time Values: Please see chart of Time Values for Standard Relays

Approximate Weight: 1.6 ozs.

Terminals: See Ordering Information.

Mountings: #3-48 stud, sockets with printed circuit or solder terminals, or bracket plate with #6-32 threaded stud.

Enclosures: Please see Ordering Information. Cover colors are available in black, red, blue, yellow, and green by special order.

CONTACTS:

Arrangements: 2 Form C (DPDT), 4 Form C (4PDT) or 2 Form Z (DPDT-DB).

Material: Gold-flashed silver is standard. Silver cadmium-oxide, gold-alloy and palladium contact materials are available.

Rating: Standard Contact Material: Gold-flashed silver. Rated 3 amps at 30V DC or 120V AC, resistive.

Also Available: Silver-cadmium oxide, rated 3 amps at 30V DC or 120V AC, inductive. Used for weld resistant and non-sticking characteristics. Palladium, rated 3 amps at 30V DC or 120V AC. Gold Alloy, for low level applications up to 1.0 amps at 30V DC or 120V AC, resistive. Bifurcated contacts, rated 1 amp at 30V DC or 120V AC, resistive.

Expected Life: Electrical: 100,000 operations min. @ rated load. Ratings are based on tests of relays with ungrounded frames.

COILS: (See Coil Data Chart.)

Voltages: to 120 volts, AC, 50/60 Hz.
to 120 volts, DC.

Power @ 25°C: AC: 1.20 volt-amperes nominal; .550 volt-amperes minimum.

DC: 0.5 watt minimum operate; 0.9 watt nominal; 2.0 watts maximum.

Pick-up @ 25°C: AC: 85% of nominal voltage.

DC: 75% of nominal voltage.

Duty: Continuous.

COIL DATA FOR KH SERIES

Nominal Voltage	DC COILS		AC COILS	
	Resistance in Ohms ± 10% @ 25°C	Nominal Inductance in Henrys	Resistance in Ohms -15%	Nominal AC Current in mA
6	40	.08	10.5	200
12	160	.28	43	100
24	650	1.0	160	52
48	2,600	4.5	668	25
90	9,000	13.5	—	—
110	11,000	17.0	—	—
120	11,000	—	3,900	11.0

NOTE: For 220 and 240V AC or DC, use series dropping 5W resistor.

TIME VALUES FOR STANDARD DC RELAYS*

*Does not include bounce times.

Nominal Voltage @ + 25°C	Time Values
Pick-up time	13 milliseconds
Drop-out time	6 milliseconds

OK if ratings same as KUP series



ENGINEERING DATA

KUP Series relays have been engineered for reliability, ease of installation and an excellent cost-to-quality relationship. KUP Series fit several types of custom nylon sockets, making the series convenient plug-in relays.

Standard relays are furnished with .187" terminals.

Clear polycarbonate dust covers are used on the KUP Series relays. It is plain, for use when the relay is mounted in a socket. A hold-down spring can be furnished for socket-mounted KUP Series (not applicable to screw terminal sockets).

Reliability and long life of the KUP Series are enhanced by long contact arms and a unique method of staking the stationary contacts, as well as barriers molded into the front. All are rated 10 amperes.

KUP Series relays are recognized under the Component Program of Underwriters' Laboratories, Inc., File No. E22575 and Canadian Standards Association, File No. 15734. Only standard KUP relays are included. Any electrical or mechanical deviations from standard relays are subject to re-examination by U/L and CSA.

SPECIFICATIONS

CONTACTS:

Arrangements: Please see chart, Page 3.

Material: Silver-cadmium-oxide is standard.

U/L Rating: $\frac{1}{4}$ H.P. 120VAC, $\frac{1}{3}$ H.P. 240VAC, 10 amps @ 28 VDC or 240 VAC, 80% P.F.

COILS



Voltage: Please see chart, Page 3

Power: DC: 1.2 watts, AC: 3 poles 2.7 VA; 3 poles 2.7 VA

Resistance: Please see chart, Page 3

Duty: Continuous

Treatment: Centrifugally impregnated with high quality electrical varnish.

TITLE: TECHNICAL DATA POTTER & BRUMFIELD KUP SERIES RELAYS		DRAWN	DESIGNED		
			DGL		
 CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED	PAGE	DRAWING NO	REV
		DGL	1 OF 3	ES50077	A

GENERAL:

Description: Versatile, low cost 10 amperes general purpose relays.

Insulating Materials: Molded phenolic.

Initial Insulation Resistance: 100 megohms minimum.

Expected Life: Mechanical: 10 million operations.

Electrical: 100,000 operations min. @ rated load.

Initial Breakdown Voltage: 1500 volts rms 60Hz between all elements. 500 volts rms 60Hz between open contacts.

Temperature Range: KUP enclosed: AC:

3 poles -45°C to 45°C

DC: -45°C to +70°C

Time Values: (approx.): Operate: 15 milliseconds

Release: 10 milliseconds



Weight: KUP enclosed relay 3.0 ozs.

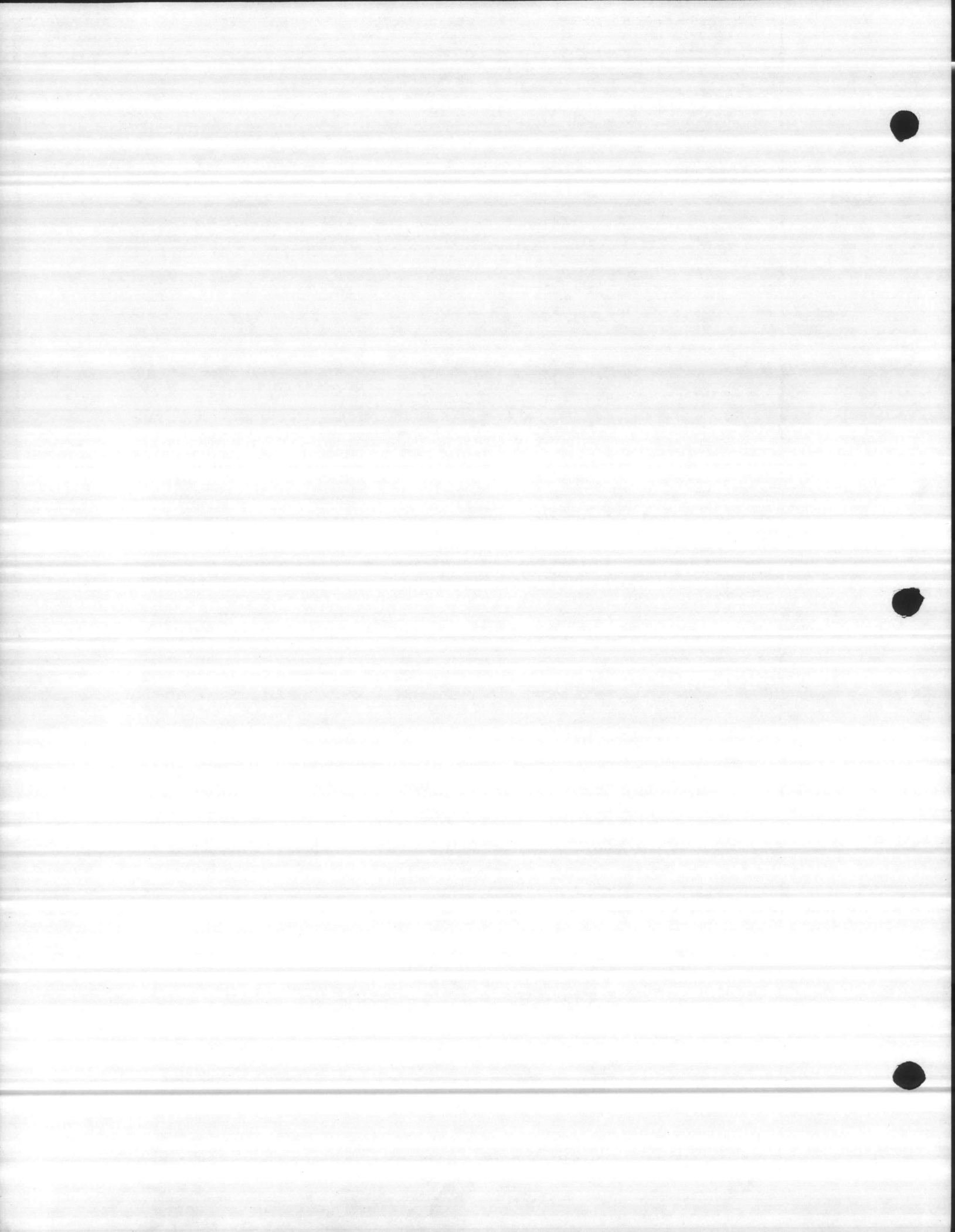
Operate: AC: 85% of nominal voltage @ 25°C.

DC: 75% of nominal voltage @ 25°C.

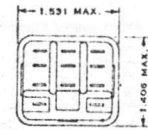
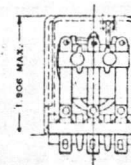
Enclosure: Heat and shock resistant, clear plastic polycarbonate.

Terminals: .187" standard.

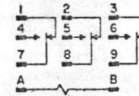
TITLE: TECHNICAL DATA POTTER & BRUMFIELD KUP SERIES RELAYS		DRAWN	DESIGNED		
			DGL		
 CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED	PAGE	DRAWING NO	REV
		DGL	2 OF 3	ES50077	A



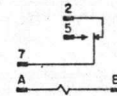
AC COILS -- (50/60HZ)			CECO PART NO.
Voltage 50/60Hz	DC Resistance In Ohms	Nominal Current In Milliamperes	3 Form C
24	72	115	800057-01
120	1,700	24	800057-02
240	7,200	12	800057-03



KUP CIRCUIT DIAGRAMS



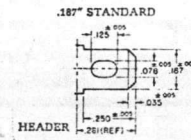
3 Form C
AC
RELAYS



1 Form C
DC
RELAYS

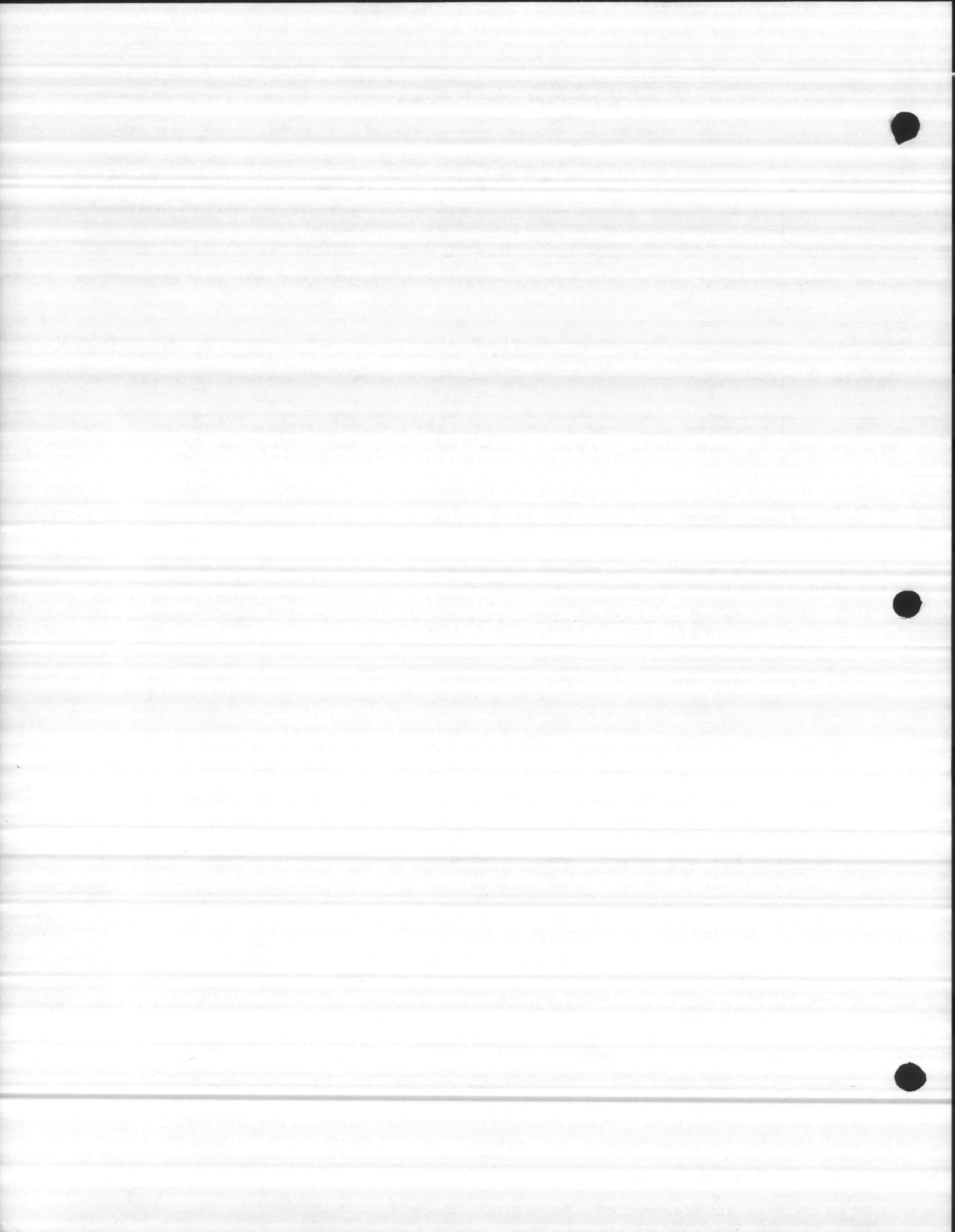
DC COILS			CECO PART NO.
Voltage	DC Resistance In Ohms	Nominal Current In Milliamperes	1 Form C
12	120	100	800057-04
24	472	51	800057-05

TERMINAL DIMENSIONS



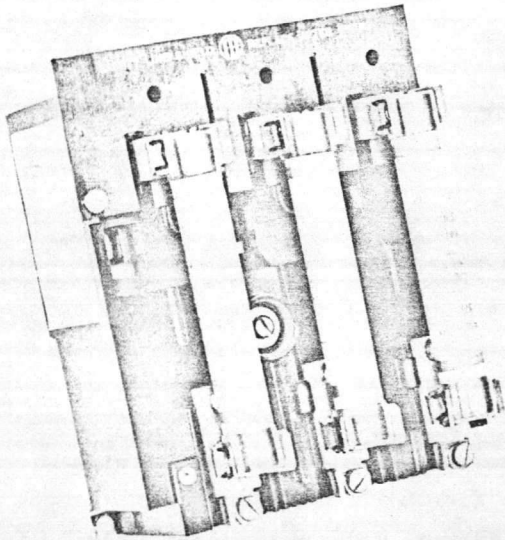
Thickness: .020

TITLE: TECHNICAL DATA POTTER & BRUMFIELD KUP SERIES RELAYS		DRAWN	DESIGNED	
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		CHECKED	PAGE	DRAWING NO.
		DGL	3 OF 3	ES50077
				REV A





DISCONNECT SWITCH



CLASS D10 DISCONNECT SWITCHES*

600V—Without Service Entrance Rating

Switch Rating Amperes	Max. Horse Power Rating†				Cat. No.	List Price
	120V	200-240V	480V	600V		
30	5	10	20	25	D10S1	\$ 35.60
60	10	20	40	50	D10S2	38.60
100	15	30	60	75	D10S3	60.00
200	25	50	100	100	D10S4	114.00

600V—With Service Entrance Rating

Switch Rating Amperes	Max. Horse Power Rating†				Cat. No.	List Price
	120V	200-240V	480V	600V		
30	5	10	20	25	D10S1H	\$ 42.70
60	10	20	40	50	D10S2H	46.30
100	15	30	60	75	D10S3H	72.00
200	25	60	100	100	D10S4H	137.00

*Fuse clips not included.

†Non-fused rating. With fuses, rating depends on fuse size.

CLASS D11 HANDLE OPERATING MECHANISM

Rotary Handle Operator Kits—Door Mounting
NEMA 1 or NEMA 12

For MC Switches

Description	Switch Size	Enclosure Interior Depth—Inches	Cat. No.	List Price
Standard Depth	30, 60	5-3/16	D11SD1	\$ 7.50
Variable Depth		6-3/16—16-5/8	D11SF2	12.00
Standard Depth	100, 200	6-3/16	D11SF2	12.00
Variable Depth		6-3/16—16-5/8		

CLASS D11 AUXILIARY ELECTRICAL INTERLOCK

For Mounting On 30A-200A Disconnect Switch[Ⓢ]

Block Description	With Switch Contacts Open	Cat. No.	List Price
1 Normally Open		D11NO	\$12.00
1 Normally Closed		D11NC	12.00
1 Normally Open and 1 Normally Closed		D11NOC	16.00
2 Normally Open		D11NOO	16.00
2 Normally Open and 2 Normally Closed		D11NOC2	20.00

ⓈOne block per switch

High I²T rating: The I-T-E switch meets automotive and heavy industry requirements. (See Interrupting and Withstandability Ratings on reverse side.)

Longer contact life: Quick-make, quick-break, cam-trip and spring-loaded action throws the switch into ON position under pressure—provides a quick-break when switching to OFF position. The double-break contact principle also assures longer contact life and exceptional interrupting capacity.

Visible contact indication: Clear ON or OFF markings plus actual contact positions are both visible through pole "windows."

Fuse-mounting flexibility: Fuse clips are mounted on top of the switch, providing a compact unit. Interchangeable fuse-clip kits are available for quick adaptation to other ratings.

Dead-front construction: When the switch is in the OFF position, all visible current-carrying parts are de-energized, thus providing additional safety for maintenance electricians.

Auxiliary interlocks: One-or-two-pole interlocks can be added to the disconnect when required.

CLASS D12 FUSE CLIP KITS

D10 Switch Size	Fuse-Clip Rating		Cat. No.	List Price	
	Amperes	AC Volts			
30A	No Fuse		D12C01	\$ 1.00	
	0-30	250	D12C21	2.00	
	0-30	600	D12C62	3.00	
	0-30	J Fuse	D12CJ1	6.00	
	31-60	250	D12C22	3.00	
	31-60	600	D12C62	6.00	
	31-60	J Fuse	D12CJ2	7.00	
	61-100	250	D12C23	8.00	
	No Fuse		D12D02	3.00	
	60A	0-30	600	D12D61	3.00
31-60		250	D12D22	3.00	
31-60		600	D12D62	5.00	
31-60		J Fuse	D12DJ2	7.00	
61-100		250	D12D23	8.00	
61-100		600	D12D63*	14.00	
61-100		J Fuse	D12DJ3	13.00	
No Fuse		D12E03	5.00		
100A		31-60	600	D12E62	6.00
		61-100	250	D12E23	10.00
	61-100	600	D12F63	11.00	
	61-100	J Fuse	D12EJ3	14.00	
	101-200	250	D12F24	13.00	
	101-200	600	D12F64	15.00	
	101-200	J Fuse	D12FJ4	17.00	
	201-400	250	D12F25*	23.00	
	201-400	J Fuse	D12FJ5*	28.00	
	No Fuse		D12F04	10.00	
200A	61-100	600	D12F63	11.00	
	101-200	250	D12F24	13.00	
	101-200	600	D12F64	15.00	
	101-200	J Fuse	D12FJ4	17.00	
	201-400	250	D12F25*	23.00	
	201-400	600	D12F65*	36.00	
	201-400	J Fuse	D12FJ5*	28.00	

*Cannot be used with service entrance rated switch.

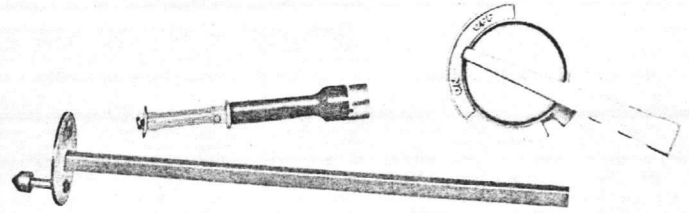


**MC SWITCH INTERRUPTING
AND WITHSTANDABILITY RATINGS**

Switch Rating Amperes	Interrupting Rating Amperes Symmetrical 600V AC, 3 Phase	Withstandability I ² T (amperes ² seconds)
30	1,200	.38 x 10 ⁶
60	1,800	1.28 x 10 ⁶
100	2,000	2.62 x 10 ⁶
200	3,600	5.25 x 10 ⁶

NOTE: These switches are for motor circuit applications.

**VARIABLE DEPTH
HANDLE KIT**



LUG DATA

Switch Rating	Number Per Pole	Wire Range	Wire Type
30	1	#14-#8	Cu
60		#14-#4	Cu
100		#14-#1/0	Al-Cu
200		# 6-250 MCM	Al-Cu

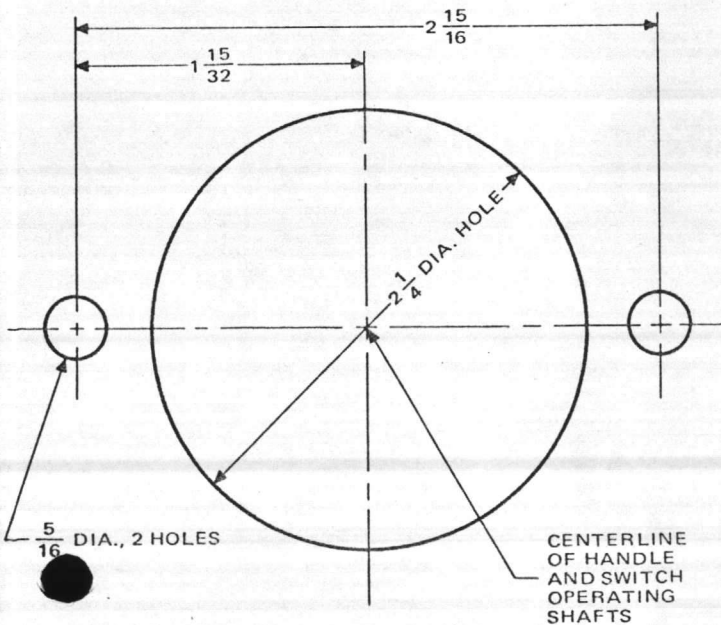
DIMENSIONS

SWITCH DIMENSIONS IN INCHES

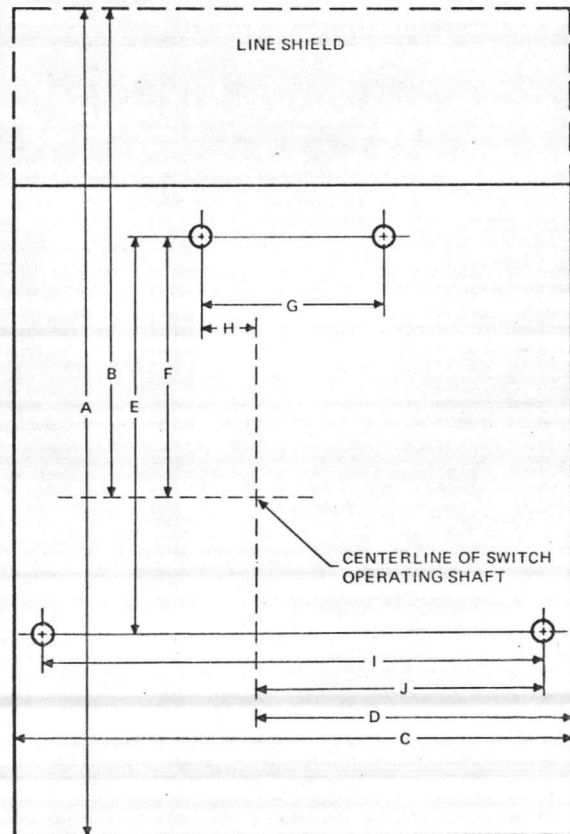
Switch Size	A	B	C	D	E	F	G	H	I	J	K*	L**
30	5/16	4 15/32	5 7/8	3 15/32	6	3 15/32	1 7/8	13/32	5 7/16	3 1/4	4 3/32	4 11/32
60	7/5/16	4 15/32	5 7/8	3 15/32	6	3 15/32	1 7/8	13/32	5 7/16	3 1/4	4 11/32	4 11/32
100	9 27/32	5 11/32	8 3/16	4 5/8	5 13/16	3 13/16	2 11/16	51/64	7 5/16	4 3/16	5 1/64	4 27/32
200	12 3/16	7 7/32	8 3/16	4 5/8	5 13/16	3 13/16	2 11/16	51/64	7 5/16	4 3/16	5 23/32	4 27/32

- * Max. Depth with largest fuse.
- ** Depth including insulating barrier on service entrance switches.

HANDLE INSTALLATION DATA



SWITCH DIMENSIONAL SKETCH



IPE Imperial

Think of



first in industrial control



DESCRIPTION

The ACTION PAK 2100 Series Process Control Modules accept a DC process-variable input, and provide a DC process-controllable output with proportional action (single mode) as needed to maintain the process at setpoint. Proportional action provides output increases and decreases inversely proportional to input errors.

ACTION ORDER NO:
DATE:

ADJUSTMENT PROCEDURE

1. Initially set GAIN control fully counterclockwise, plug module into the system, and set the SETPOINT as desired.
2. When the system comes up to setpoint, increase GAIN clockwise until system oscillations just begin, and then back off until the oscillations just stop.



PROGRAM INPUT (AP2103/8) _____

SPECIFICATIONS

INPUT IMPEDANCE

DC Voltage In: 10k ohms per volt in.

DC Current In: 200-400mV shunt, typical.

PROPORTIONAL BAND

1-10% of span, adjustable. (Consult factory for other adjustment ranges.)

OUTPUT DRIVE

DC Current out-drives up to 500ohm load. (250 ohm 10-50mA output) DC Voltage out-max. current 10mA.

REGULATION

Regulated for line variations of $\pm 10\%$.

ZERO AND SPAN ACCURACY

Within 1% of span (factory-set). (Each adjustable over 15% of span, typical.)

SCALE GRADUATION

(Top-Mounted and Remote Potentiometer) 0-100%. (Consult factory for other scales.)

SETPOINT POTENTIOMETER

VALUE (Remote Potent.) 1K ohm. (LD100 Linear, Dial and DD1000 10-turn Digital Dial access. available.)

DC-PROGRAMMED SETPOINT

0-1V or 0-10V upon request (AP4800 Series compatible.)

AC LINE COMPATIBILITY

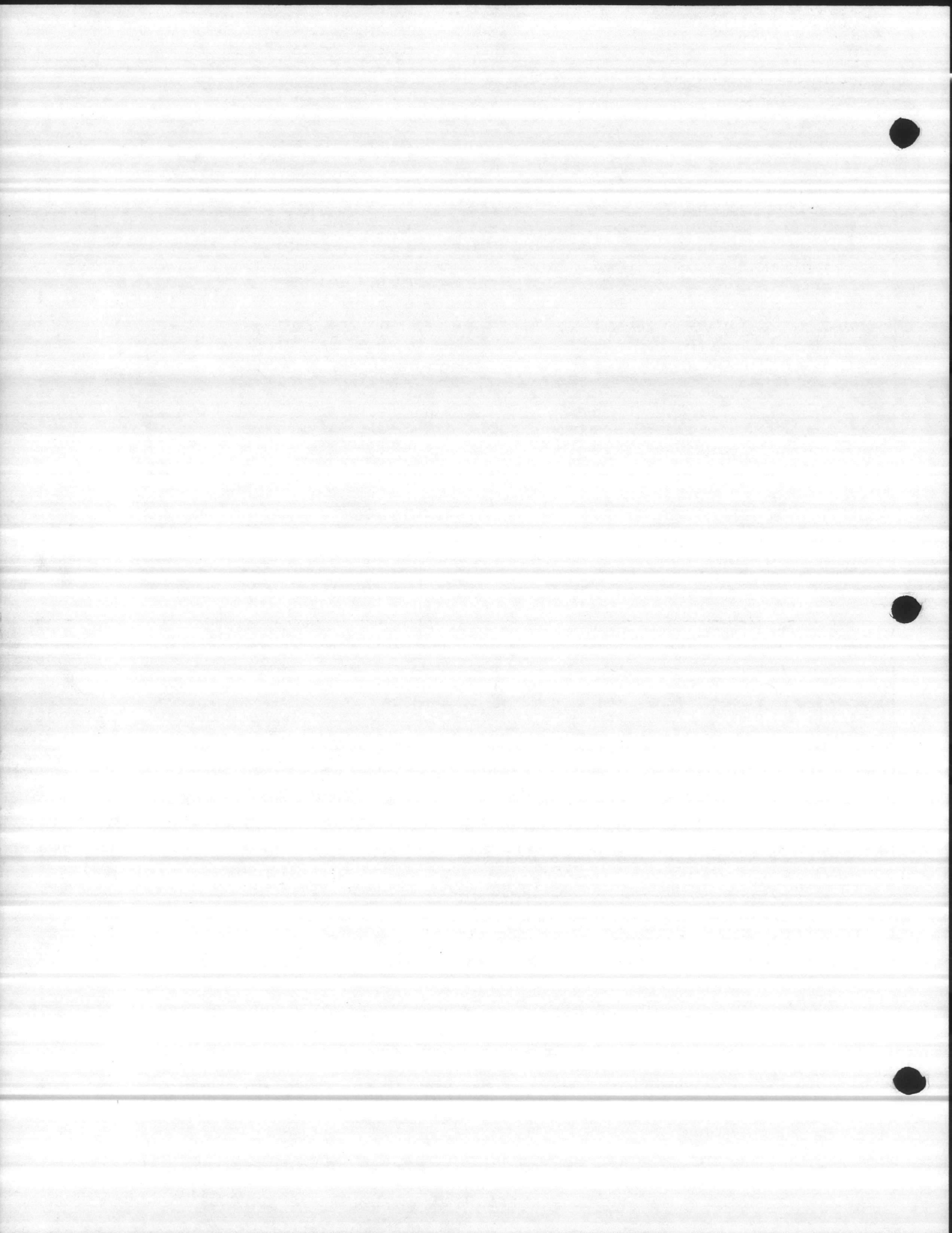
Direct 120VAC, 50-400Hz line (240VAC available)

GROUND

2-wire floating power, using ground for electrostatic shield between primary and secondary.

POWER DEMAND

5W maximum.

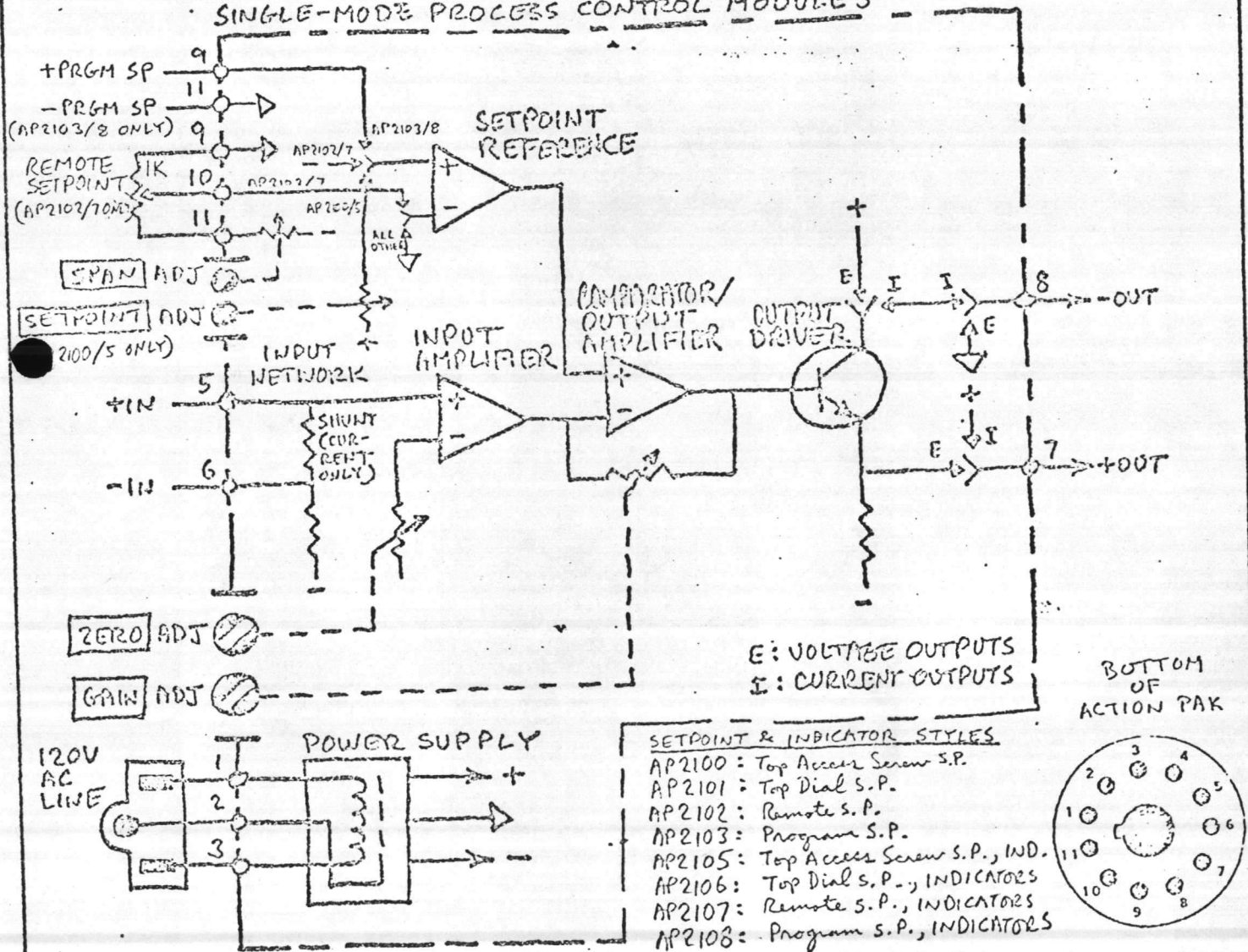


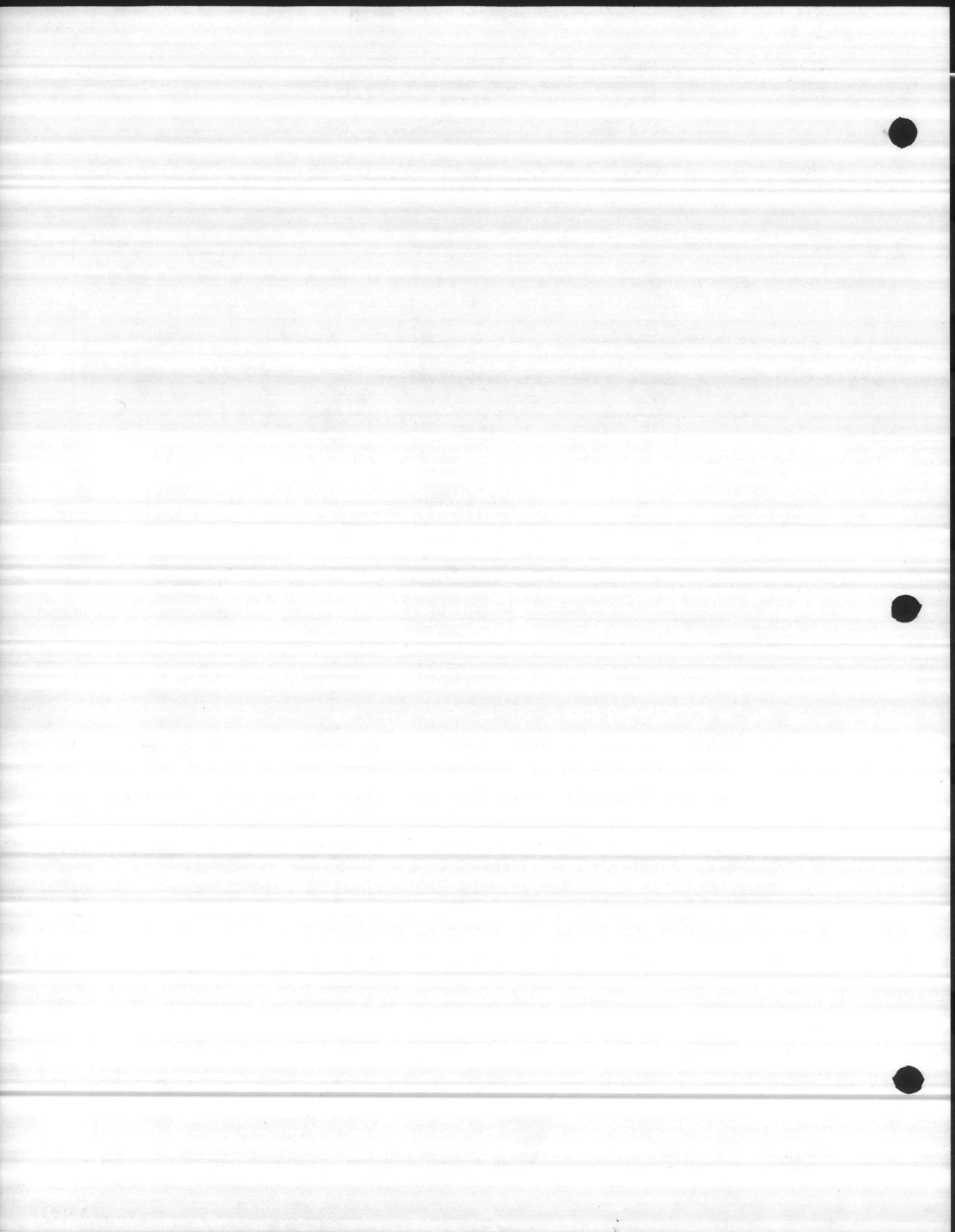
ADJUSTMENT PROCEDURE

- Initially set GAIN control fully counterclockwise, plug module into the system, and set the SETPOINT as desired,
- When the system comes up to setpoint, increase GAIN clockwise until system oscillation just begins, and then back off to just stop the oscillations.

BLOCK AND WIRING DIAGRAM

AP2100 SERIES DC-INPUT, DC-OUTPUT, SINGLE-MODE PROCESS CONTROL MODULES





DESCRIPTION

The ACTION PAK 3200 Position-Proportioning, Valve-Control Module accepts a dc voltage or current proportional-control signal (single-mode, 2-mode, or 3-mode) for complete position-proportioning control of motorized valves.

The AP3200 Module's output drives the valve-positioning motor until a position-feedback slidewire on the valve returns a signal that matches the control signal. The module uses relay contacts for switching power to the valve motor's forward and reverse coils; power is switched off completely when the position feedback matches the control input. The module supplies the excitation for the feedback slidewire.

Zero, span, and deadband (differential) calibrations are all screwdriver adjustable and accessible through the top of the module. Line power and ground are completely isolated from the AP3200 Module's other circuits; this allows control of any valve-motor supply line that requires isolation from line power and ground.

ADJUSTMENT PROCEDURE

1. Apply a mid-range control input, and allow valve position to stabilize; adjust DIFF clockwise to induce valve oscillation, then back off to just stop oscillation.
2. Apply a valve fully-closed control input, and allow valve position to stabilize; adjust ZERO to stabilize valve position at fully-closed.
3. Apply a valve fully-opened control input, and allow valve position to stabilize; adjust SPAN to stabilize valve position at fully-opened.

SPECIFICATIONS

INPUT IMPEDANCE

Voltage Inputs: 10Kohms per volt
Current Inputs: 500mV drop.

OUTPUT ACCURACY

Within 1% of span.

OUTPUT RELAY CONTACTS

Rated 5A at 120V ac, 28V dc.

ADJUSTMENT RANGE

ZERO: $\pm 15\%$ of span.
SPAN: $\pm 15\%$ of span.
DIFF: 1-25% of span.

AC LINE REGULATION

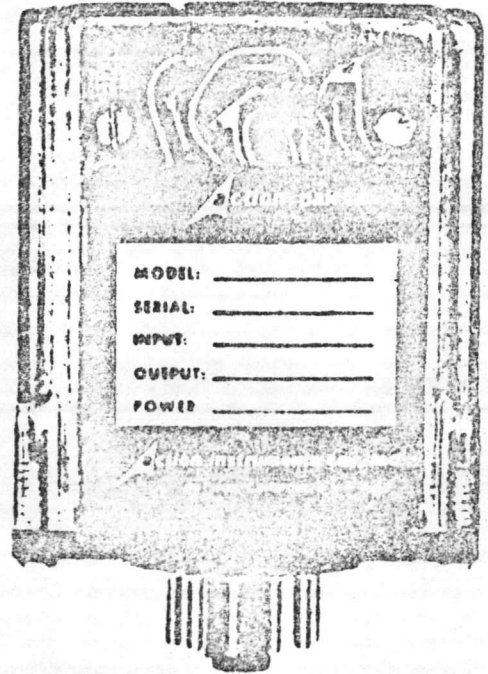
Regulated for variations of up to 10%.

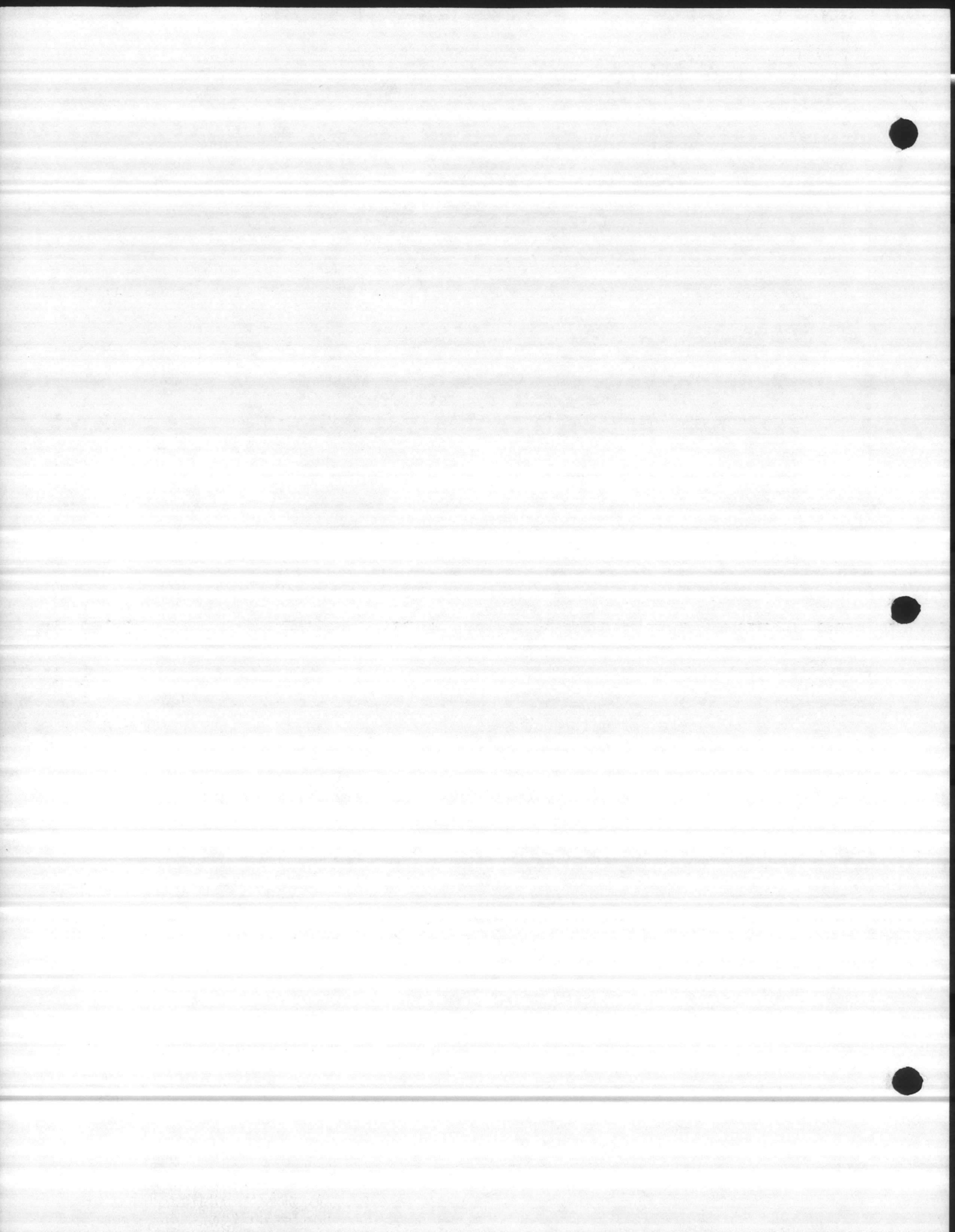
AC LINE POWER DEMAND

5W maximum.

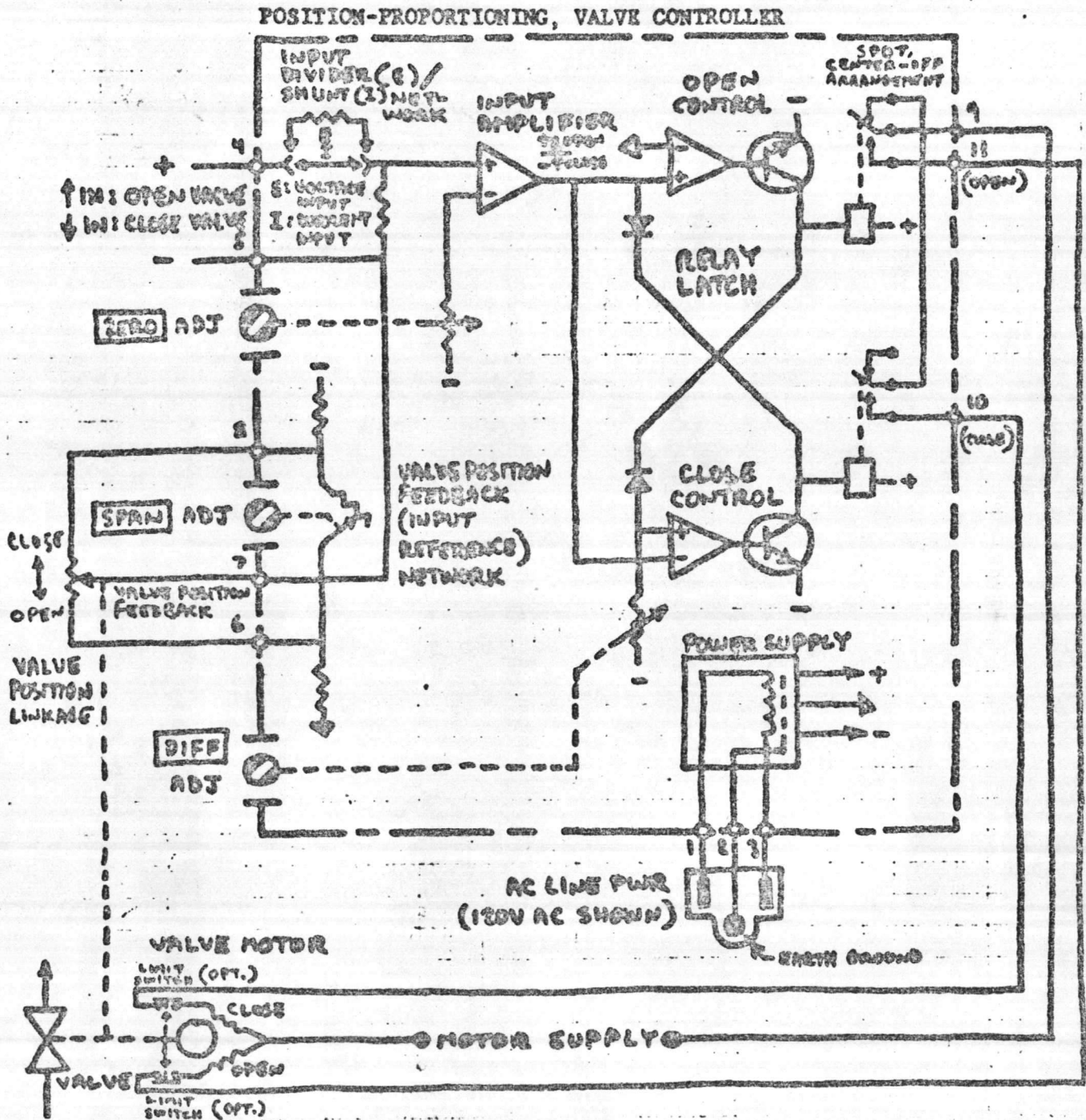
ACTION ORDER NO:

DATE:





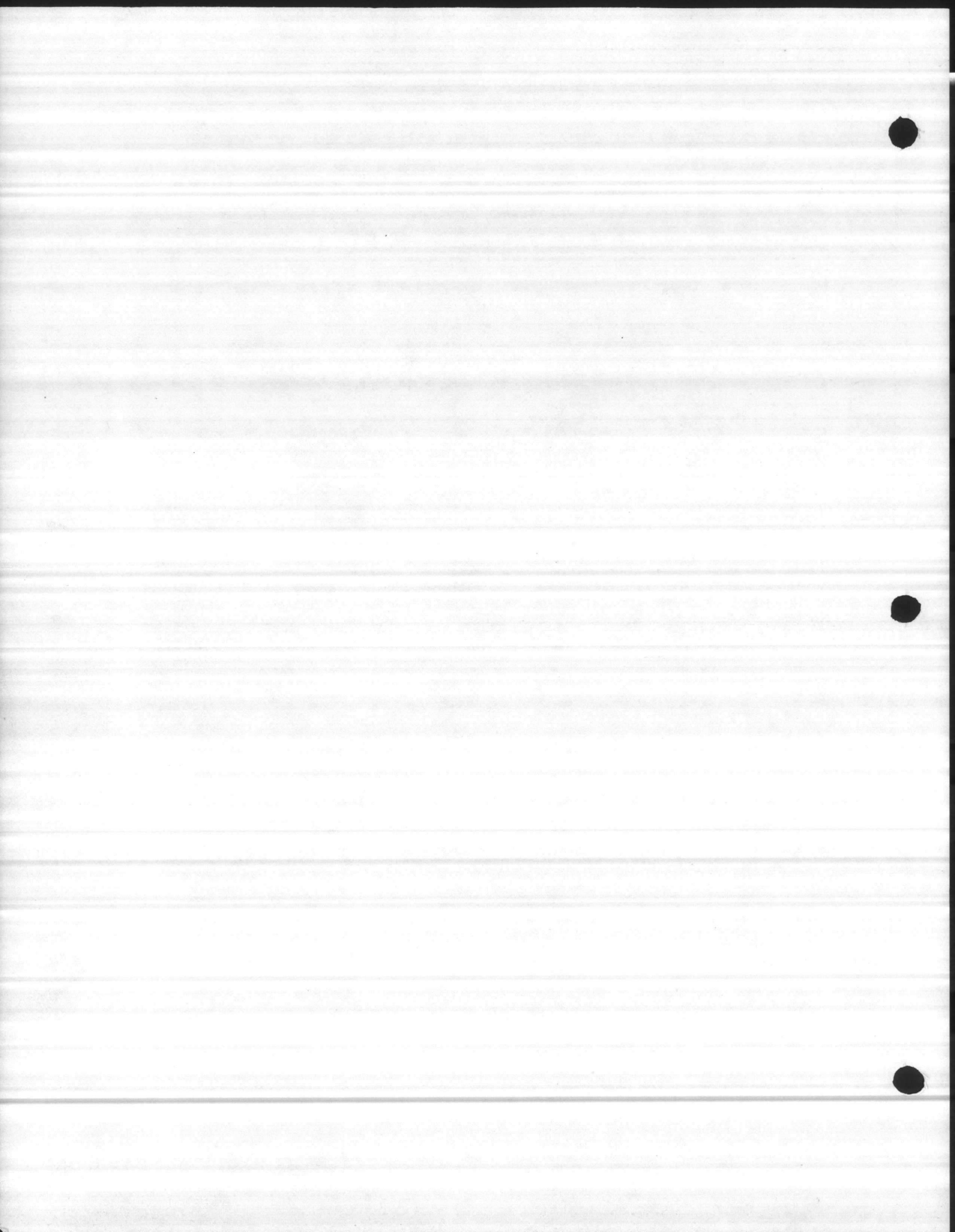
BLOCK AND WIRING DIAGRAM



WARRANTY

All Action Instruments products have 3 years unconditional warranty, except for gross physical damage or misuse.

PRINTED IN U.S.A.



METATRONIC* 2000

RECORDER

SPECIFICATIONS

SPECIFICATION SUMMARY SHEET B220-13 d

INPUT

Voltage: 0-5 Volts DC into 700K ohms
1-5 Volts DC into 1.33 megohms
0-10 Volts DC into 375K ohms
-10 to 0 to +10 Volts DC into 300K ohms
Current: 4-20MA DC into 250 ohms.
10-50 MA DC into 100 ohms.

NUMBER OF PENS

1, 2, or 3 pen (Red, blue, and green respectively).

TYPE OF OPERATION

Null balance Servo system.

ACCURACY

$\pm 0.5\%$ of full scale or better.

DEADBAND

0.3 % of full scale or better.

SENSITIVITY

0.15% of full scale or better.

ZERO ADJUSTMENT

Variable $\pm 10\%$.

SPAN ADJUSTMENT

Variable $\pm 10\%$.

RESPONSE TIME

Less than 3 second full scale—standard.
Less than 10 second full scale—optional.

RELATIVE HUMIDITY

10 to 90% RH; (40-100°F) storage 5 to 95% RH.
10 to 50% RH. (40-120°F)

AMBIENT TEMPERATURE

40 to 120°F.

STORAGE TEMPERATURE

-40 to +165°F.

CHART DRIVE

Synchronous Motor 24 Volt AC 50/60 Hz.
Standard: 1, 2, 4 inches/hour and 1, 2, 4 in./min.
Optional: 2 speed chart drive (60 to 1 Ratio) on-off switch.
Chart Tear-off Standard.
Chart drive on-off switch—optional.
2 speed chart drive—60 to 1 ratio—optional.

CHARTS

4" Strip chart (see Y1980).

SCALE

0-100 Standard
Optional (See Y1990).

PENS

Cartridge type with pen lifters.

POWER REQUIRED

24 Volt AC 50/60 Hz. 3 watts (chart drive)
24.5 Volt DC; 120 ma or 3 watts per pen.

POWER VARIATION

24-28 Volt DC at rated specifications
22-28 Volt DC extreme.

POWER SUPPLY EFFECT

0.1% per volt variation.

WEIGHT

10 pounds.

SIZE

4.4" wide x 6" high x 16" deep.

MOUNTING

0 to 30° from horizontal.

ALARMS

Optional: Single or dual for each pen, electronic type.
Repeatability: 1%.
Range Adjustability: -5% to $+100.5\%$.
Contact Rating: 30 volts AC or DC @ 1 amp.

Input Impedance: > 500 K ohms.

Relay Action: Normally energized—fail safe standard.

Deadband: $\pm 1\%$ of full scale.

Power Required: 24.5 Volts DC at 55MA DC for single alarm
96MA DC for dual alarm. Rated 24-28 Volts DC.

Ambient Temperature: 0-150°F.

Temperature Effect: $\pm 0.02\%/^{\circ}\text{F}$.

Response Time: 200 millisecond.

Power Supply Effect: 0.1% per volt of change.



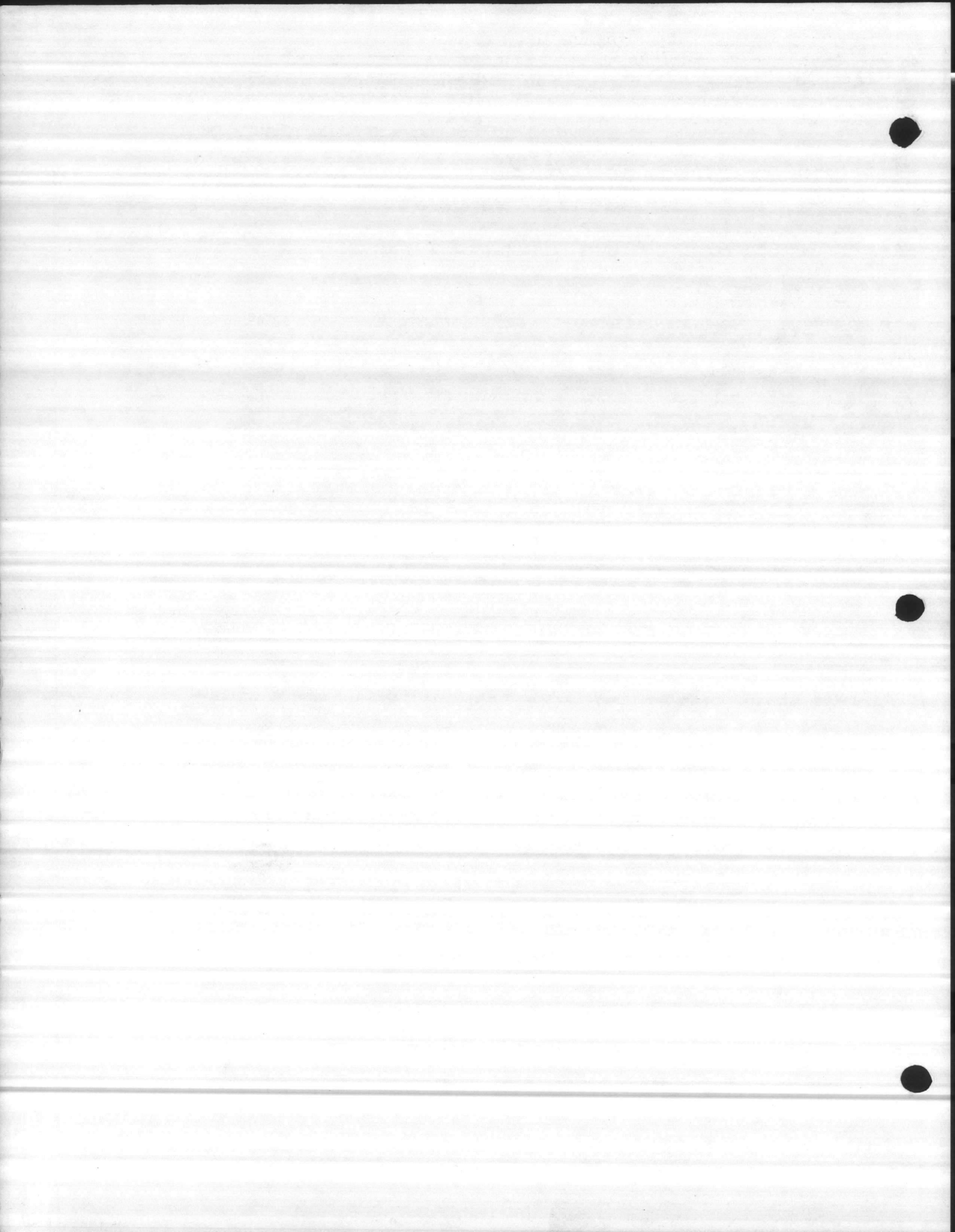
Bristol Division

BRISTOL ROAD, WATERBURY, CONNECTICUT 06720 • (203) 756-4451

AMERICAN CHAIN & CABLE COMPANY, INC.

© AMERICAN CHAIN & CABLE COMPANY, INC., 1974

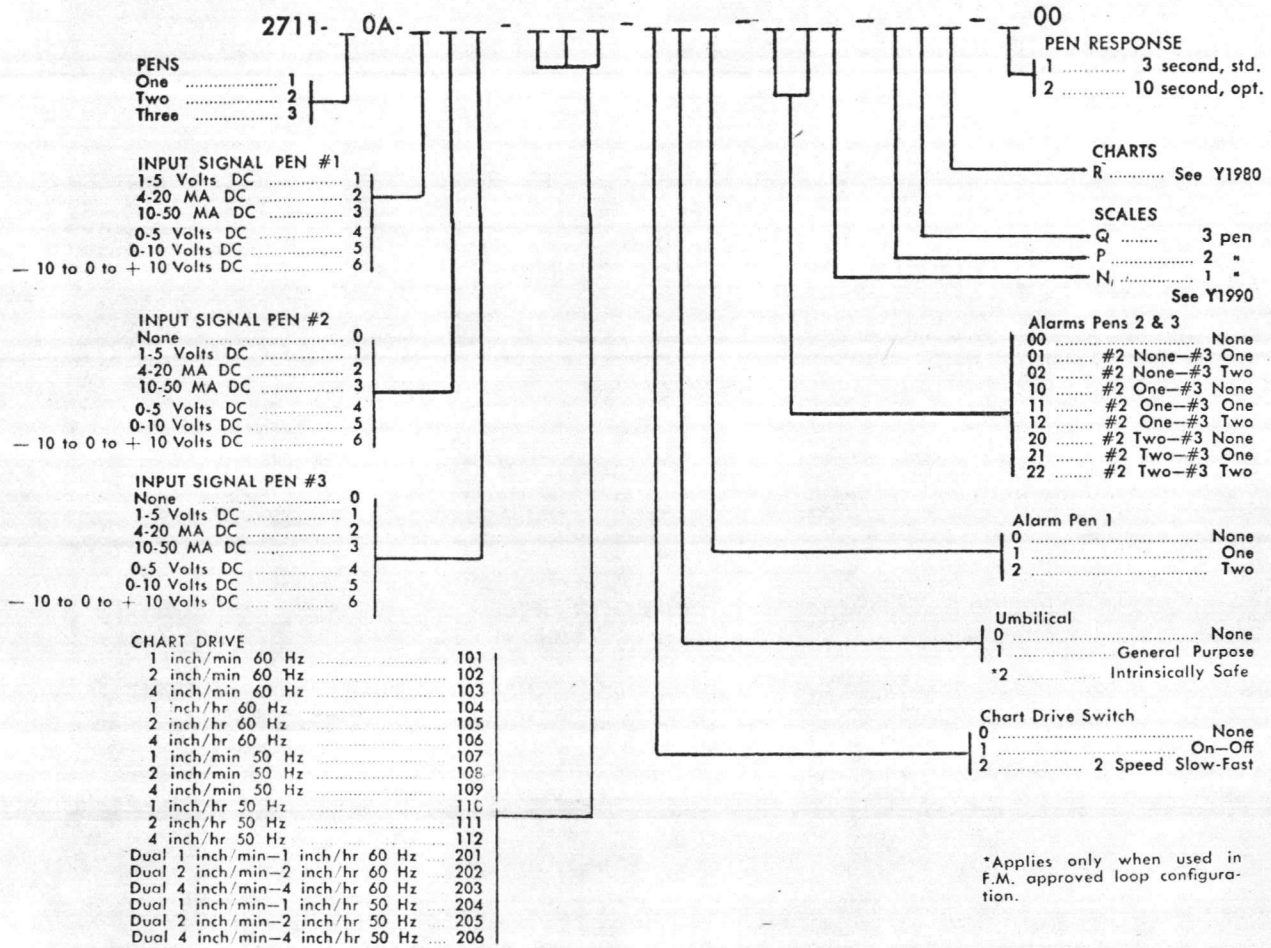
PRINTED IN U.S.A.
KGD



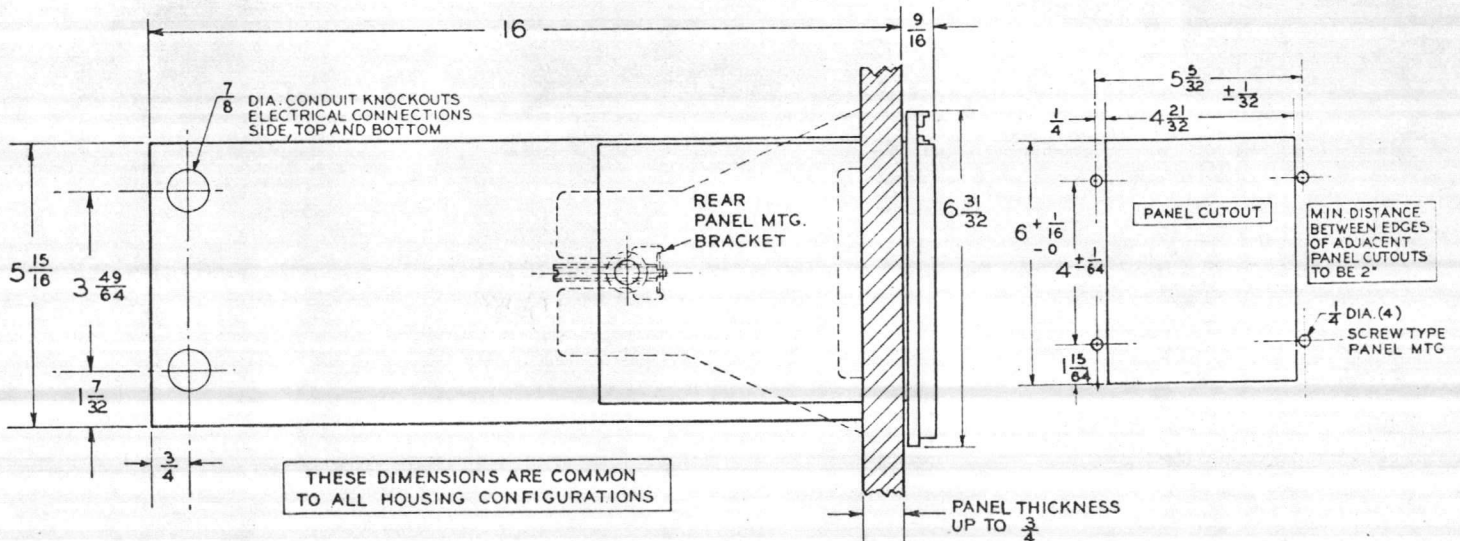
METATRONIC⁺ 2000 RECORDER

SPECIFICATION SUMMARY SHEET B220-13d

MAKE-UP OF INSTRUMENT MODEL NUMBER



OVERALL DIMENSIONS



Bristol Division

BRISTOL ROAD, WATERBURY, CONNECTICUT 06720 • (203) 756-4451

AMERICAN CHAIN & CABLE COMPANY, INC.



METATRONIC* 2000 HOUSINGS

BRISTOL® instruments

SPECIFICATION SUMMARY SHEET B220-20 D

FEATURES

- Compact design.
- Design flexibility.
- Simple installation.
- Stackable mounting
- Space saving.

DESCRIPTION

The Metatron 2000 Housings are designed to physically support and to furnish the customer terminal section of the system for either panel mounted or relay rack mounted units. All of the Metatron 2000 controllers, stations, recorders, indication and function modules can be mounted in these housings. These housings are available in one, two, and eight bay versions for general purpose applications. The compact design allows up to eight instruments in one 19" relay rack with only 16 inches overall depth. This makes panel space saving standard and makes panel design completely flexible. The one and two bay units are also available in side by side stackable models for custom panel installation.

MODEL NUMBERS

2700-10A-11

Single unit housing is used for any Metatron 2000 controller, station, indicator, and function modules and is complete with mounting hardware.

2700-10A-12

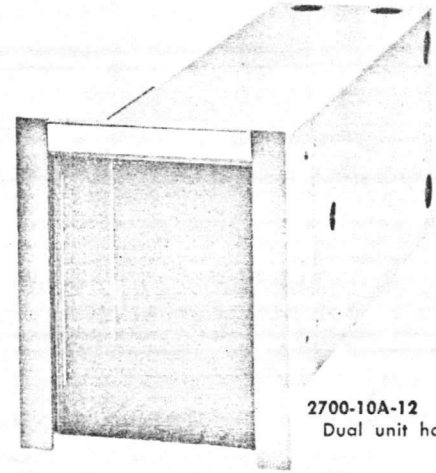
Dual unit housing is used for a recorder or two controllers, stations, indicators, or function modules. This is complete with mounting hardware.

2700-10A-18

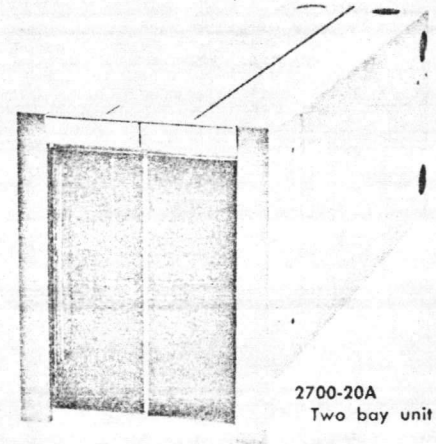
Eight unit housing is used for up to eight controllers, stations, indicators, and function modules, or four recorders.

2700-20A

This series of housings are one and two bay units which can be side by side stacked for custom panel configurations.



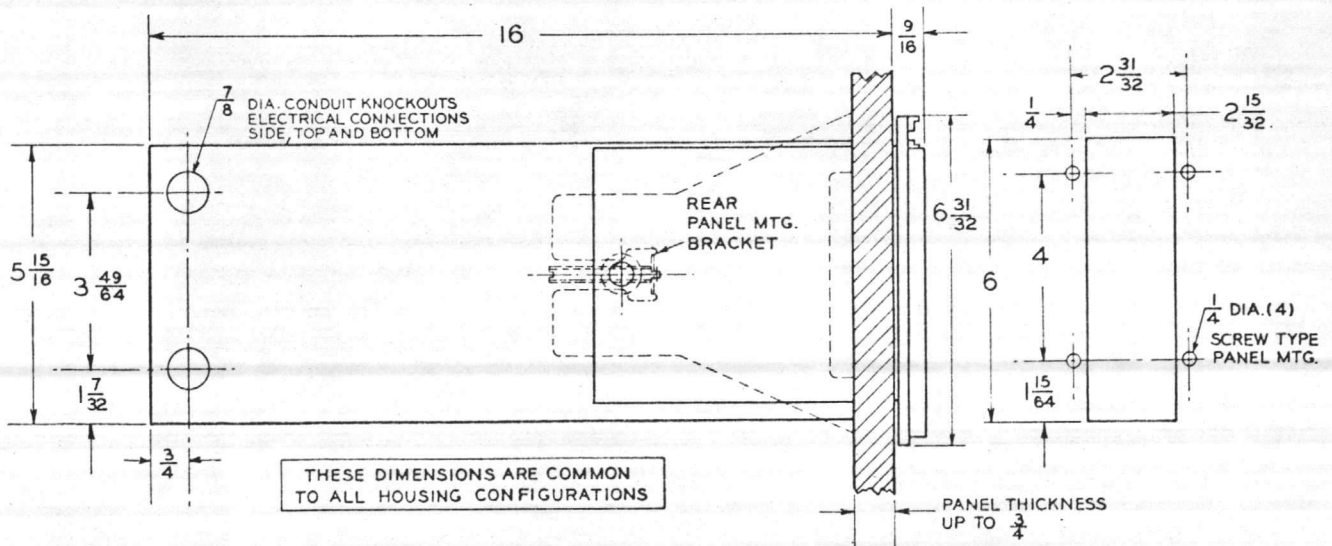
2700-10A-12
Dual unit housing



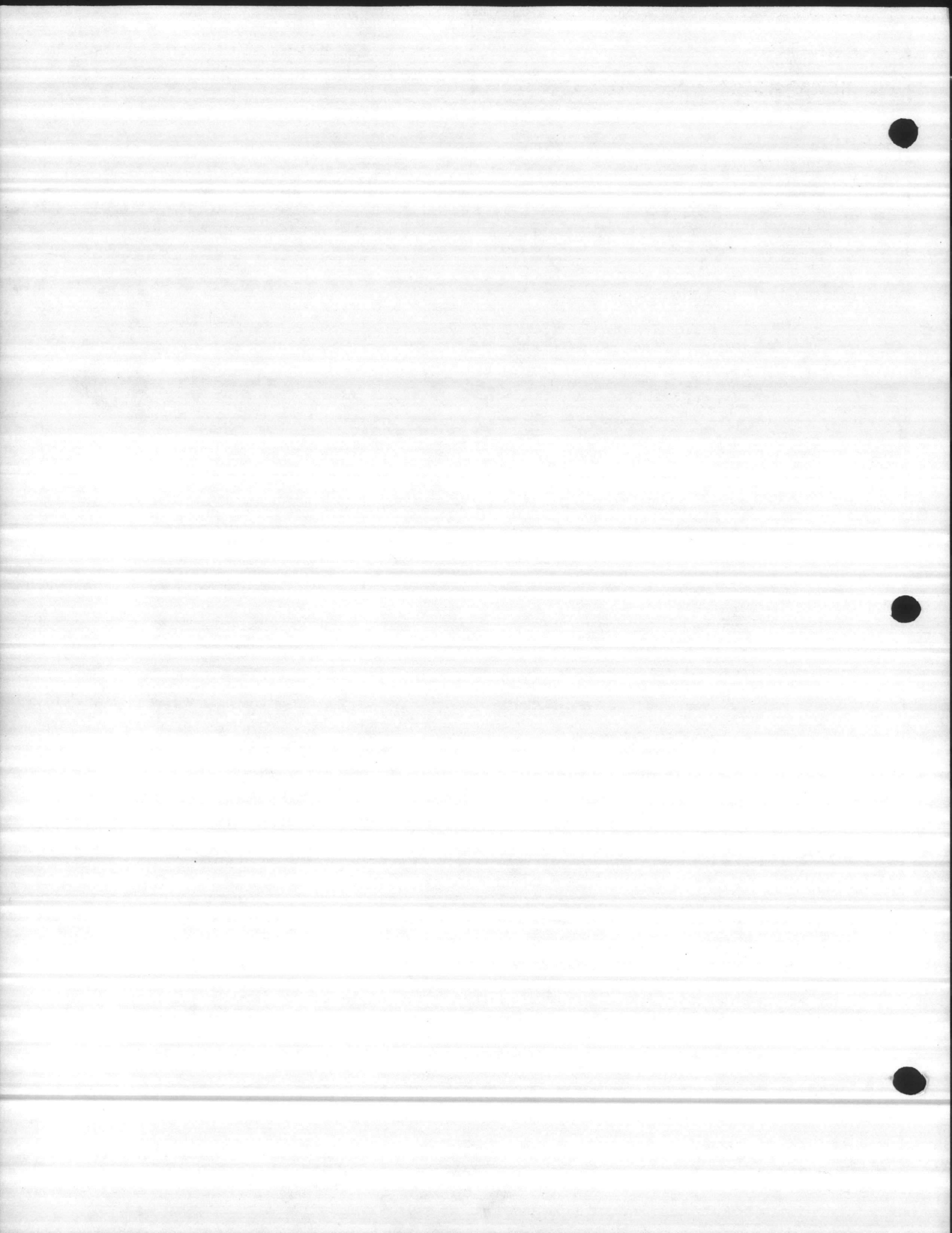
2700-20A
Two bay unit

* Trademark of American Chain & Cable Co., Inc.

OVERALL DIMENSIONS



Bristol Division



HOUSINGS

SPECIFICATIONS

DEPTH

16 inches from front of panel.

HEIGHT

Face 7" (including side trim).

WIDTH

Face (including side trim).

1. One bay case— $3 \frac{11}{16}$ "
2. Two bay case— $5 \frac{7}{8}$ "
3. Eight bay case—19"
4. Stackable housings— $1 \frac{1}{2}$ " + $(2 \frac{3}{16}$ " x # of bays).

WEIGHT

One bay case—5 pounds.
Two bay case—6 pounds.
Eight bay case—16 pounds.

PANEL CUTOUT DIMENSIONS

1. Height— $6" + \frac{1}{16}" - 0$
2. Width
 - A. One bay case— $2 \frac{15}{32}" \pm \frac{1}{32}"$
 - B. Two bay case— $4 \frac{21}{32}" \pm \frac{1}{32}"$
 - C. Eight bay case— $17 \frac{25}{32}" \pm \frac{1}{32}"$
 - D. Stackable housings— $9 \frac{3}{32}" + (2 \frac{3}{16}"N) \pm \frac{1}{32}"$
(N=number of bays)

VERTICAL CENTER TO CENTER SPACING

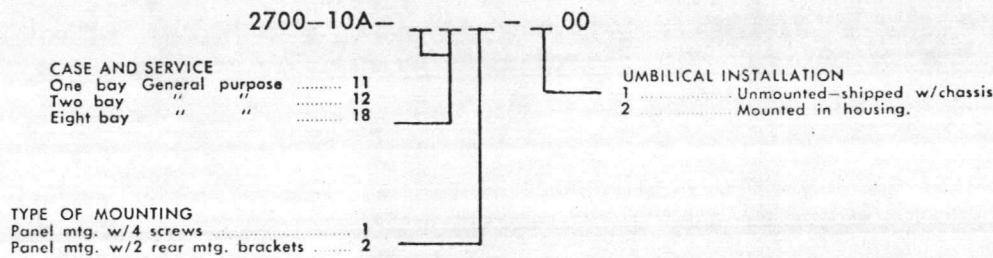
1. Relay rack—standard 7" spacing.
2. Panel—minimum of 8".

MOUNTING

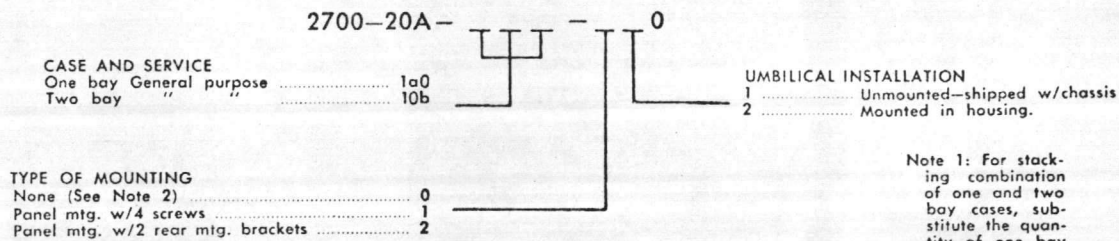
1. Front of panel.
2. Rear of panel.

MAKE-UP OF INSTRUMENT MODEL NUMBER

Standard Housings



Stackable Housing



Note 1: For stacking combination of one and two bay cases, substitute the quantity of one bay case for "a" and the quantity of two bay cases for "b". Maximum number of bays per assembly is 8 without horizontal support.

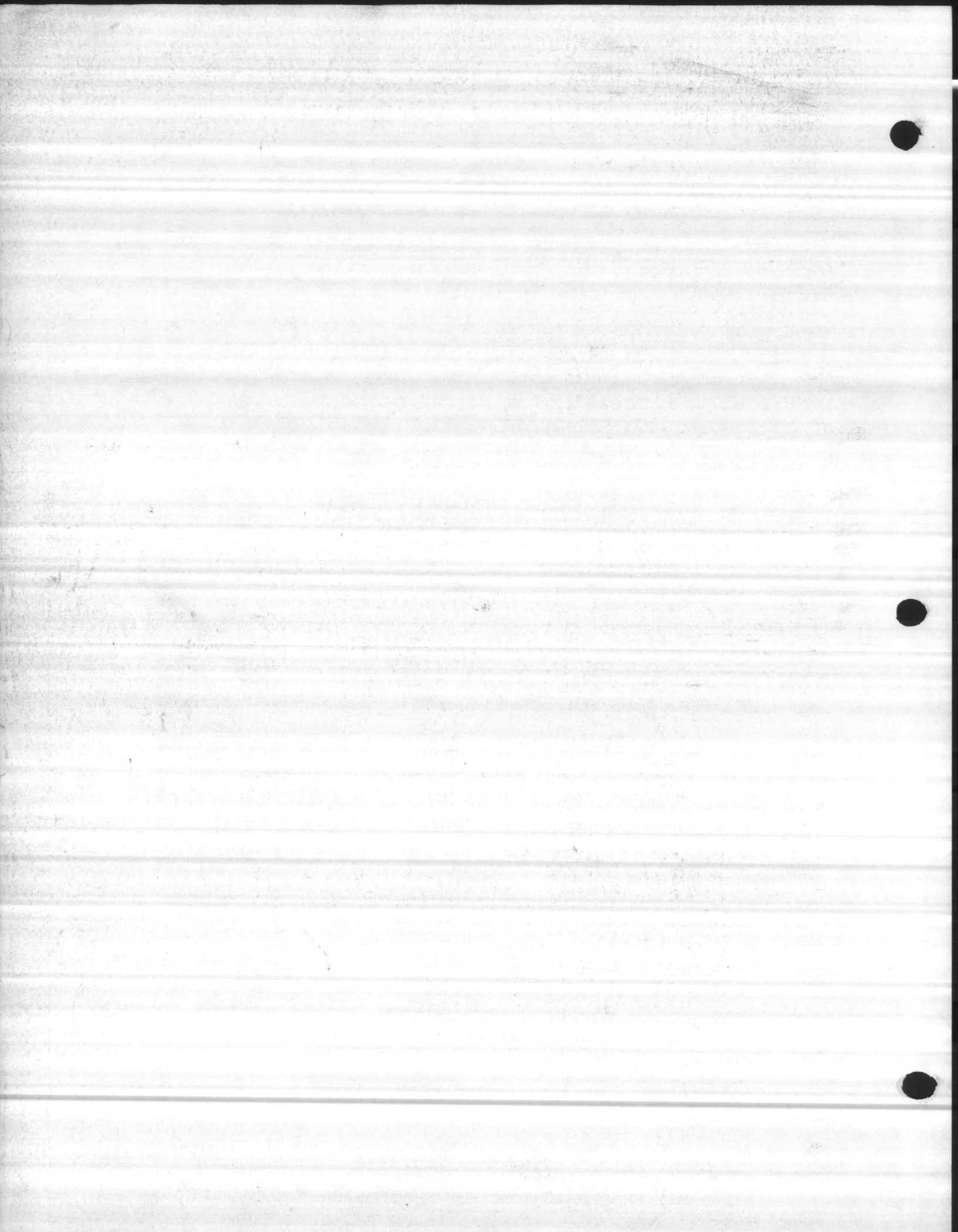
Note 2: For field enlargement of existing housing only (no mounting material).



Bristol Division

BRISTOL ROAD, WATERBURY, CONNECTICUT 06720 • (203) 756-4451

AMERICAN CHAIN & CABLE COMPANY, INC.





CONSOLIDATED ELECTRIC CO.

RIVERVIEW INDUSTRIAL PARK

141 SOUTH LAFAYETTE FREEWAY (HWY. 56)
ST. PAUL, MINNESOTA 55107

March 16, 1976

Peabody Southeast
P.O. Box 7248
Jacksonville, N.C. 28540

ATTENTION: Mr. Frank Wright
Project Engineer

SUBJECT: Jacksonville, N.C., Utilities Expansion, our S.O. 15726

Gentlemen:

Enclosed are nine (9) sets of revised submittal drawings in accordance with your Mr. R.D. Foster's letter of 11-25-75, my letter of 1-6-76, and three page notes of meeting at J.K. Timmons and Associates on 1-8-76.

You will note that we have added Item AA to our Shop Order 15726. This is a control panel for the two Decant Pumps and their associated three-way discharge valves. This item was apparently overlooked in the original submittal. Please note that this control system was grouped with two others in the specifications, paragraph 15J.5.9, as automatic bubbler systems. However, since a day or so is normally required to allow the particles to settle out in the decant basin, we feel it is best to use a manual control here, with a Model 9G Float Switch for low-level cut-out. A manual override of the low level cutout is also provided for pumping out the sludge. A selector switch is furnished for each valve with "surge basin" and "sludge line" valve position lights. A high level alarm is also provided, as are high temperature lockouts for each pump.

We have added descriptive sheets on the various items of instrumentation used and referenced model numbers on the wiring diagrams and parts lists. On the sewage filter console, the pneumatic instrumentation is changed to electronic since the use of electric valve actuators eliminated the need for air compressors.

The remaining changes in this submittal are as outlined in my letter of 1-6-76. Please return an approved set of drawings as soon as possible, so that we can proceed with manufacture.

Very truly yours,

Tom Moore

Thomas W. Moore
TWM:bd

cc: McMahan Co. (1)

Enclosure

Automation and supervisory control systems for municipal and industrial water supply, waste treatment and process applications

March 16, 1956

Peabody, Southeast
P.O. Box 7218
Jacksonville, N.C. 28540

ATTENTION: Mr. Frank Weigert
Project Engineer



Department:



METATRONIC* 2000 25 WATT POWER SUPPLY

BRISTOL® instruments

SPECIFICATION SUMMARY SHEET B220-16-1A

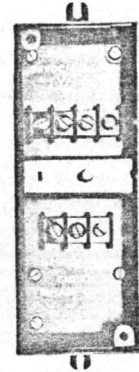
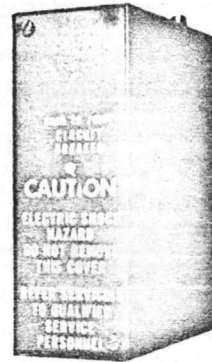
FEATURES:

- State of the Art Electronics
- Compact Size
- Overvoltage Protection
- Short Circuit Protection
- 120 Volts A-C Operation

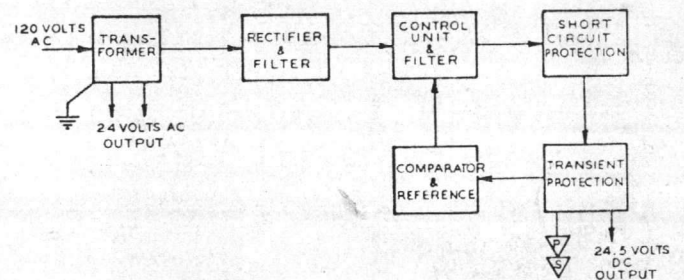
DESCRIPTION:

The 25 Watt Power Supply is compatible with all METATRONIC 2000 controllers, stations, recorders, indicators, and transmitters. This unit is designed to furnish power for individual control loops and small systems. It operates on A-C line voltage and has two output voltages. One voltage output is 24 V. A-C for recorder chart drives, and the second voltage is 24.5 V. D-C for the METATRONIC 2000 instruments.

This unit is protected by a resettable circuit breaker and output protection for both short circuit and overvoltage operation. The short circuit protection is a current foldback circuit, and the overvoltage protection is a diode type. The power supply uses the latest state of the art electronics and features compact size for small system operation. It is designed to be mounted on any of the standard METATRONIC housings, remote-mounted separately, or in the weatherproof housing.



BLOCK DIAGRAM

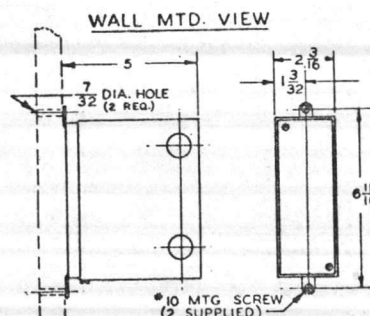
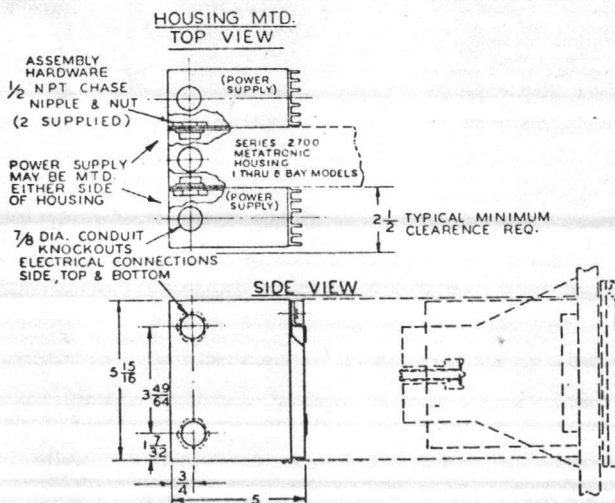


OPERATION

As shown in the block diagram, the A-C line is fed into a stepdown transformer. The stepdown transformer has one secondary for 30 volts A-C and with a tap for 24 volt A-C also. The 24 volt A-C is used for the recorder chart drives. The 30 volt A-C has been rectified and filtered and is applied as positive D-C voltage to the control unit. The comparator samples the output voltage and compares it to the reference. The difference between these two voltages determines the degree of conduction from the control unit.

A current foldback circuit is used to protect the D-C regulator from destruction by intermittent or continuous shorting of the output terminals. The regulator is also protected by diodes from destruction by voltage transients applied to the output terminals. The limit of this protection is +100 volts and -100 volts at 3 amps maximum current.

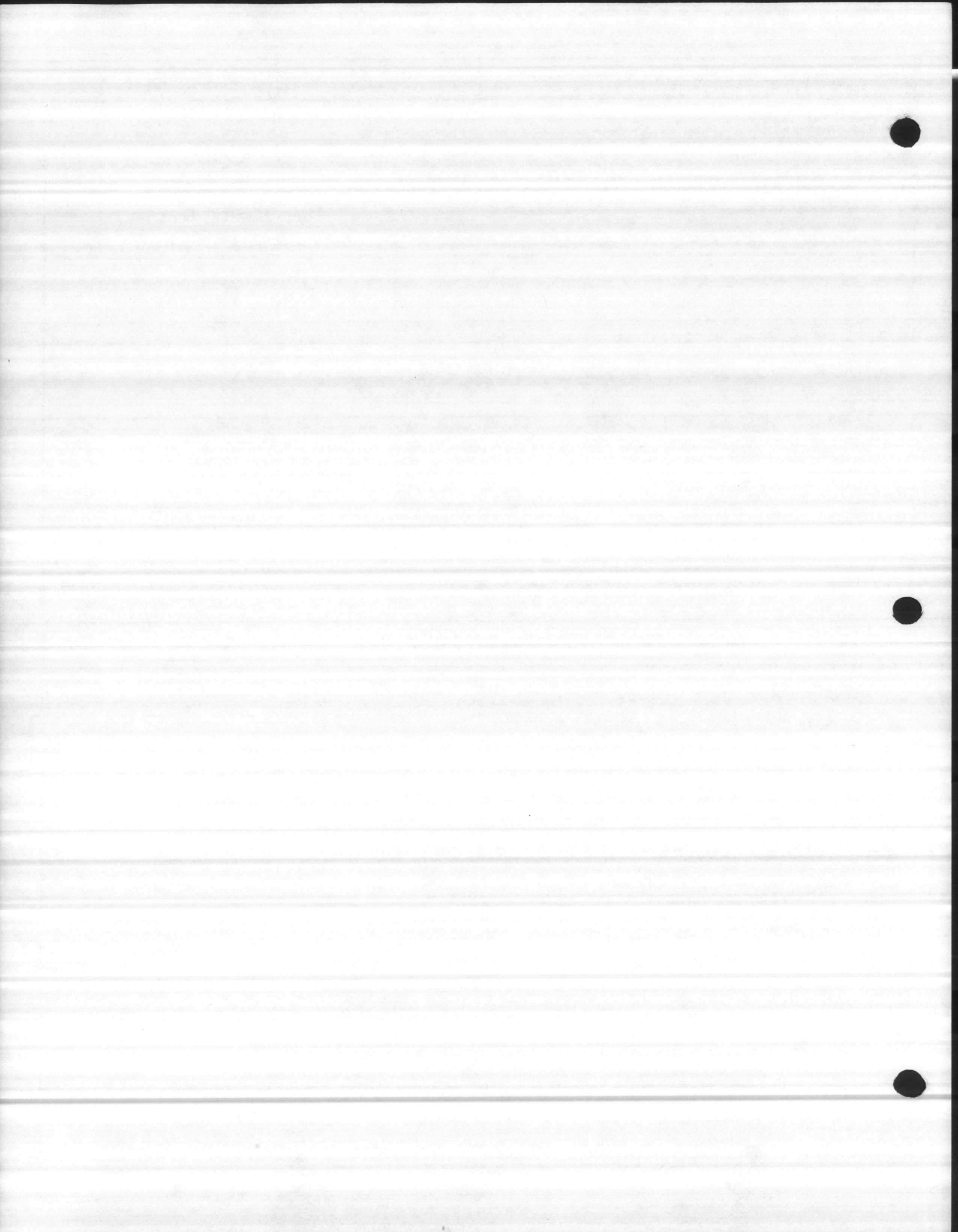
MODEL NUMBER—2007-40B



OVERALL DIMENSIONS



Bristol Division



25 WATT POWER SUPPLY SPECIFICATIONS

SPECIFICATION SUMMARY SHEET B220-16 -1a

TABLE I—Available Power

24V. A-C Chart Drive	24.5V. D-C Power (Watts)	24.5V. D-C Current (MA)
0	19.6	800
1	17.2	700
2	15.9	650
3	13.5	550
4	12.3	500

Input Voltage:

Normal 107–127 V. A-C Single Phase
Extreme 102–132 V. A-C Single Phase

Input Frequency:

48–62 Hz.

Power Requirement (Input)

41 Watts @ 120 V. A-C Full Load

Output Voltage:

D-C Voltage—Adjustable to 24.5 V. D-C \pm 0.1 V. D.C.
A-C Voltage—24 V. RMS Nominal

Maximum Output Current:

	(at 107V. A-C min.)	(at 102V. A-C min.)
D-C ma.	500–800	350–600
A-C ma.	600–0	600–0

Output Load Capability (See Table I)

Output Ripple—(24.5 V. D-C)

25 millivolts P-P (Max.)

Regulation: (Including Temperature & Humidity)

Normal Input Voltage (107–127 V. A-C)
+24.5V. D-C \pm 0.5 V. D-C @ 0 to 800 MA
24 V. A-C + 4 V. A-C and - 3.5 V. A-C @ 150 to 600 MA
Extreme Input Voltage (102–132 V. A-C)
+24.5 V. D-C \pm 0.5 V. D-C @ 0 to 600 MA
24 V. A-C + 5 V. and - 4 V. A-C @ 150 to 600 MA

Ambient Temperature:

Operating—0°F to 150°F.
Storage— - 20°F to + 185°F.

Humidity:

10% to 90% RH (40 to 100°F)
10% to 50% RH (0 to 150°F)

Cooling:

Natural Convection

Isolation:

All output terminals are isolated from the grounded case.

Terminals: (Screw Type)

Input—L₁ & L₂ and Chassis Ground
Output— +24.5 V. D-C, Signal & Power Return, 2
Terminals 24V. A-C.

Line Protection:

Circuit Breaker—Resettable

Output Protection:

D-C Voltage—Short Circuit Protection (current foldback overload protection)
Applied external voltage transients protected to +100V. (with blocking diodes). Negative voltages clamped to -1V. @ 3 amps. (normally reverse biased diode).
A-C Voltage—Resettable Circuit Breaker

Dimensions:

5¹⁵/₁₆" High x 2¹/₂" Wide x 5" Deep

Weight:

2.5 pounds

Mounting:

1. Wall mounted
2. Side mounted on rear of Metatronic Housing
3. Weatherproof Case

© AMERICAN CHAIN & CABLE COMPANY, INC., 1974

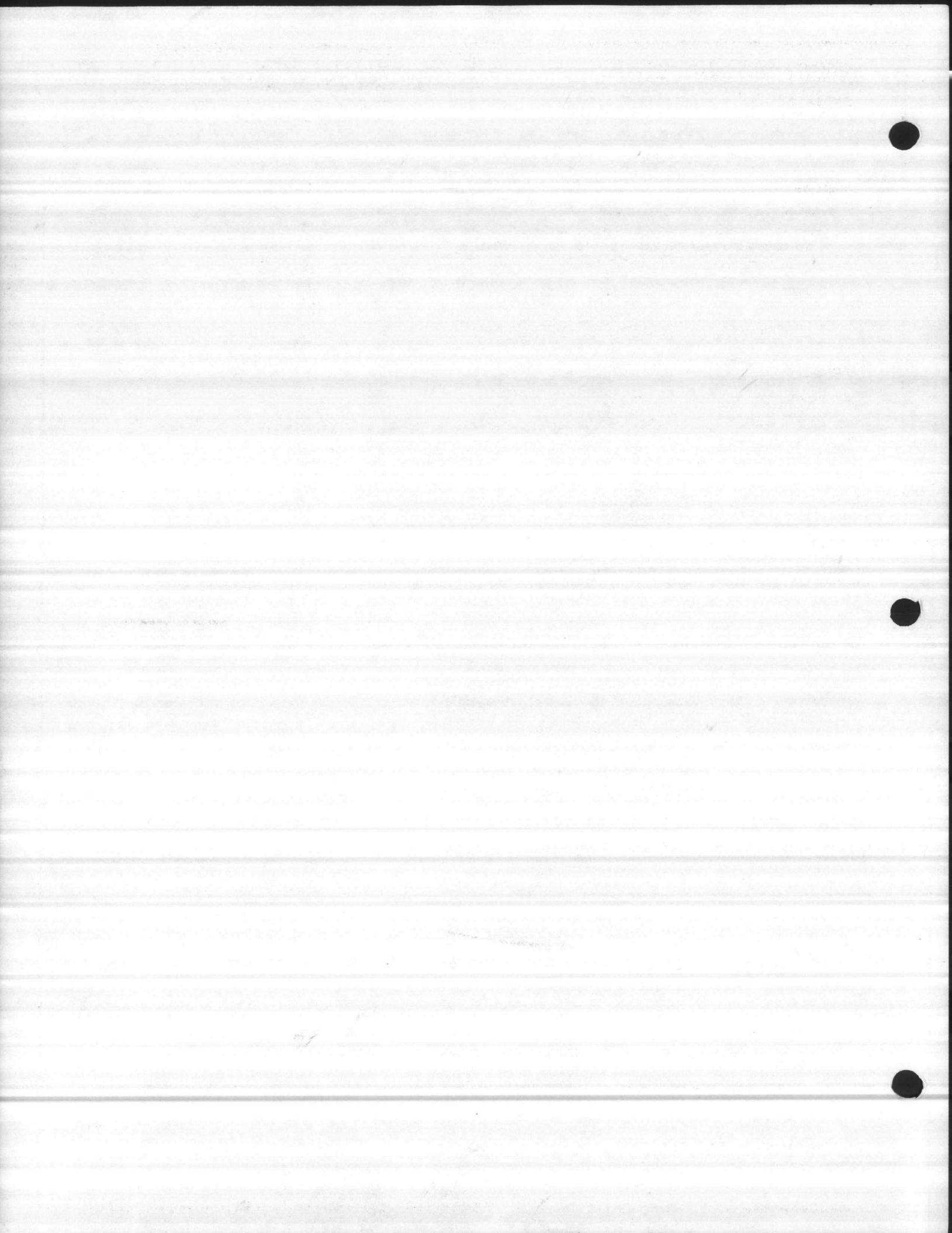


Bristol Division

BRISTOL ROAD, WATERBURY, CONNECTICUT 06720 • (203) 756-4451

AMERICAN CHAIN & CABLE COMPANY, INC.

PRINTED IN U.S.A.
KGD



METATRONIC* 2000 50-WATT POWER SUPPLY

BRISTOL® instruments

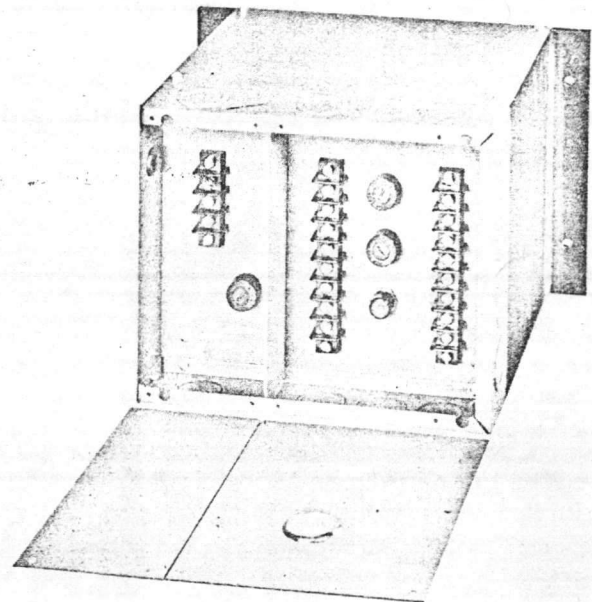
FEATURES

- State of the Art Electronics.
- Either 115VAC or 230VAC operation.
- Battery Back-up.
- Overvoltage Protection—Optional.
- 60 or 50 Hz Design
- Input & output fuse protected

DESCRIPTION

The METATRONIC 2000 Power Supply Pack is a small, 50 watt power supply for 8 instruments. The unit is designed to supply both DC and AC power to the METATRONIC 2000 controllers, stations, recorders, transmitters, and indicators. The two outputs and the input are individually fused for line protection. The unit has battery backup circuits built in; terminals are furnished for battery connections. This power supply operates from line voltage.

The power supply is available in two models: The 2007-10B is standard designed for an electrical classification of General Purpose; the 2007-20B is the same as 2007-10B, except the 20B has crowbar type over-voltage protection. Both units have a light to indicate DC power output.

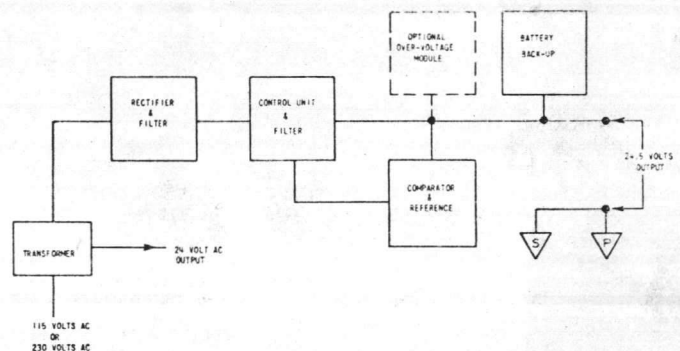


OPERATION

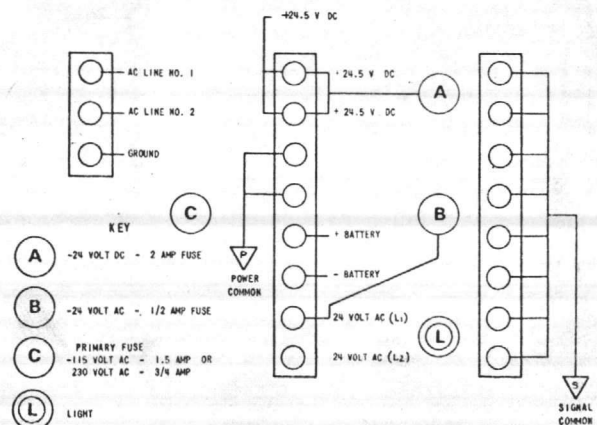
As shown in the diagram below, the AC line is fed into a stepdown transformer. The transformer has two secondaries, one 24 Volt AC and the other at 30 Volt AC. The 24 Volt AC is used for the recorder chart drives. The 30 Volt AC is rectified and filtered and is applied as the positive DC Voltage to the control unit. The comparator samples the output voltage and compares it to the reference. The difference between these two voltages determines the degree of conduction of the control unit.

If the power supply voltage drops below 24 Volt DC, the battery back-up circuit will allow current to flow to the load, if a battery is connected to the proper terminals. On the 2007-20B models, if the output voltage attempts to exceed 30 Volt DC, a Zener diode will break down and apply a voltage to the gate of the thyristor. The thyristor will fire and short the output of the power supply and blow the primary fuse. Thus the load will not be damaged.

BLOCK DIAGRAM



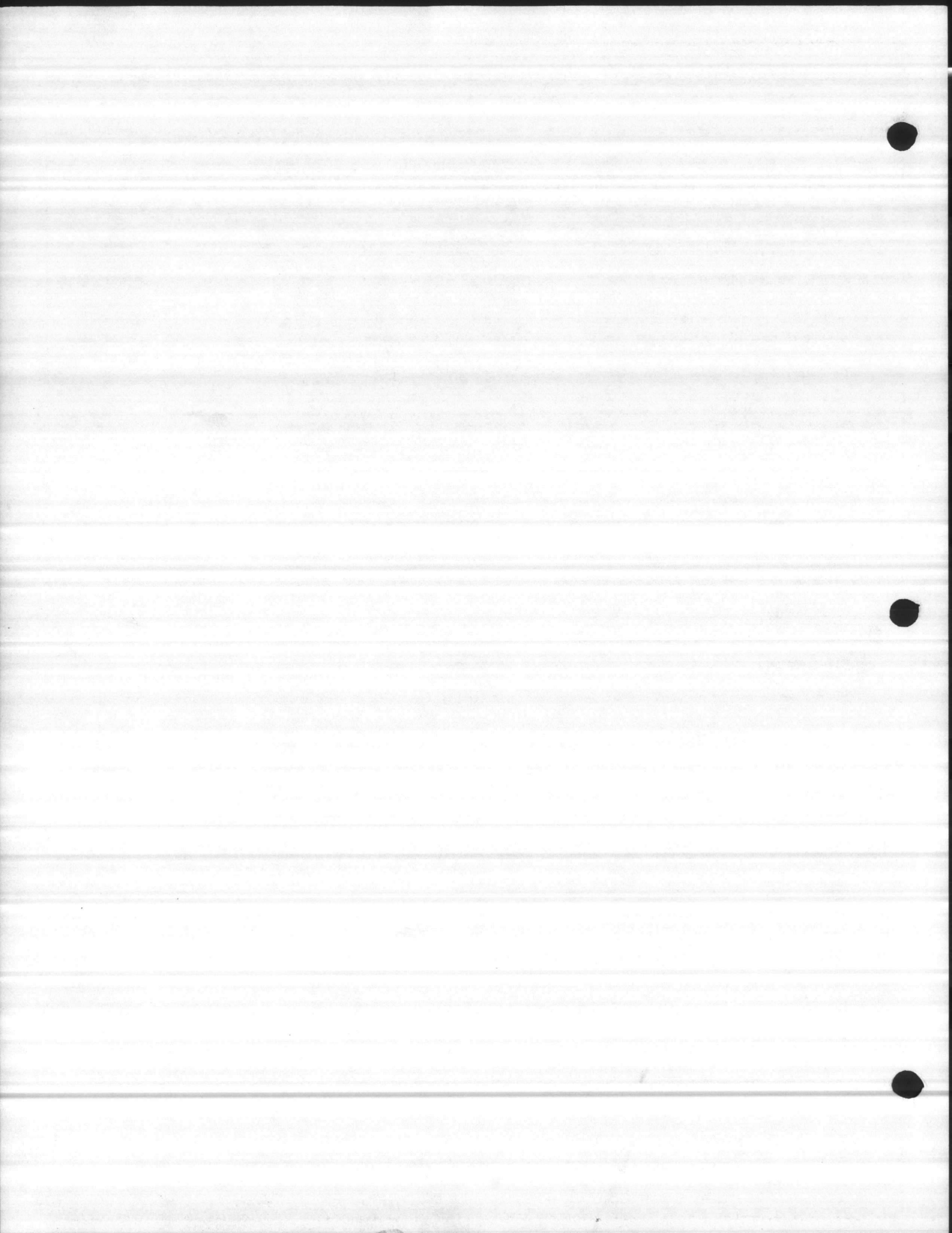
TERMINAL CONNECTIONS

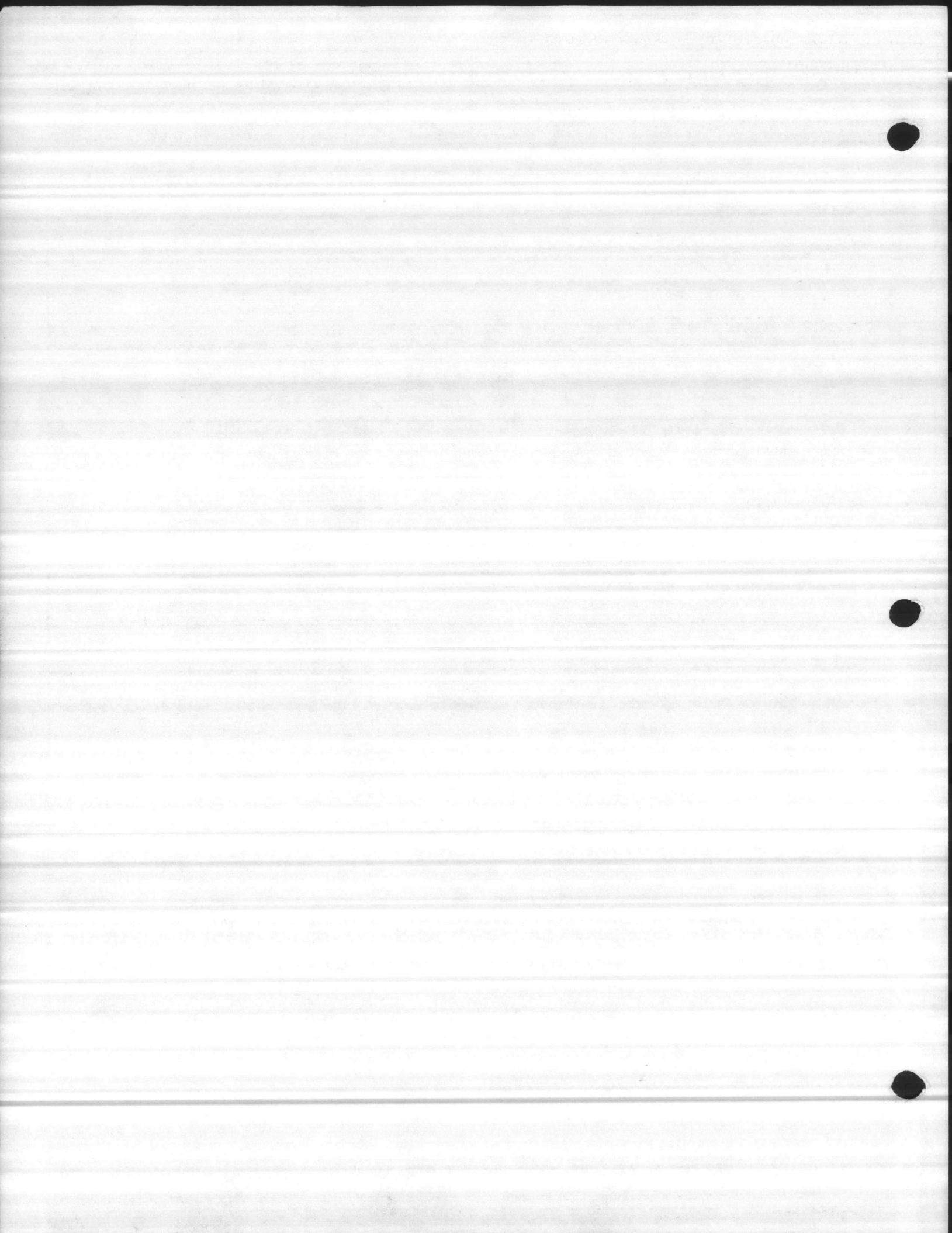


* Trademark of American Chain & Cable Co., Inc.



Bristol Division







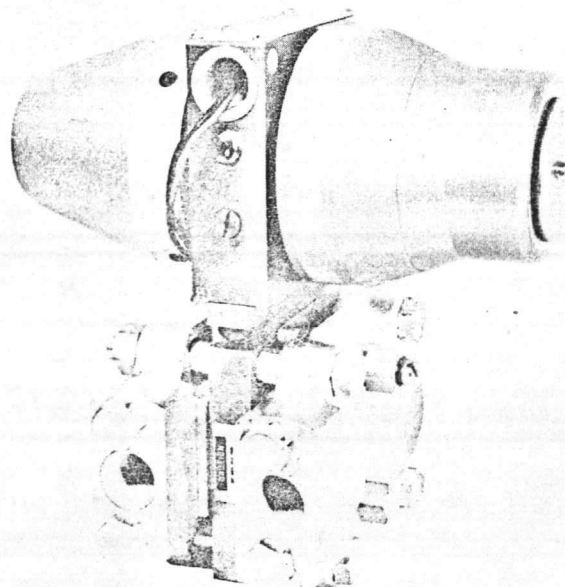
METATRONIC® 2000 DIFFERENTIAL PRESSURE TRANSMITTER

FEATURES

- Diaphragm-Type.
- Choice of Diaphragm and Body Material.
- Continuously Adjustable Zero and Span.
- Two-Wire Electronics.

DESCRIPTION

The *Metatron* 2000 Differential Pressure Transmitter is a diaphragm-type transmitter designed to measure differential pressures of 5" H₂O to 200 psi. The transmitter has a zero adjustable up to 75% of maximum span and a span adjustment of 4-to-1 on each range. The standard transmitter has a 316 SS diaphragm and carbon steel flanges; however, a wide choice of special diaphragm and body materials is optionally available. The standard static pressure rating for the transmitter is 3000 psi for all ranges except the two low range models, which have a 1500 psi static rating. Transmitter electronics feature state of the art design, allowing for two wire operation. They operate on either 24 volt or 50 volt DC power depending on the output load required. The electronics are enclosed in an explosion-proof housing.



OVER PRESSURE

Units will meet Underwriters Laboratories 913 "Strength of Part" section.

Standard operation with up to full static on either side.

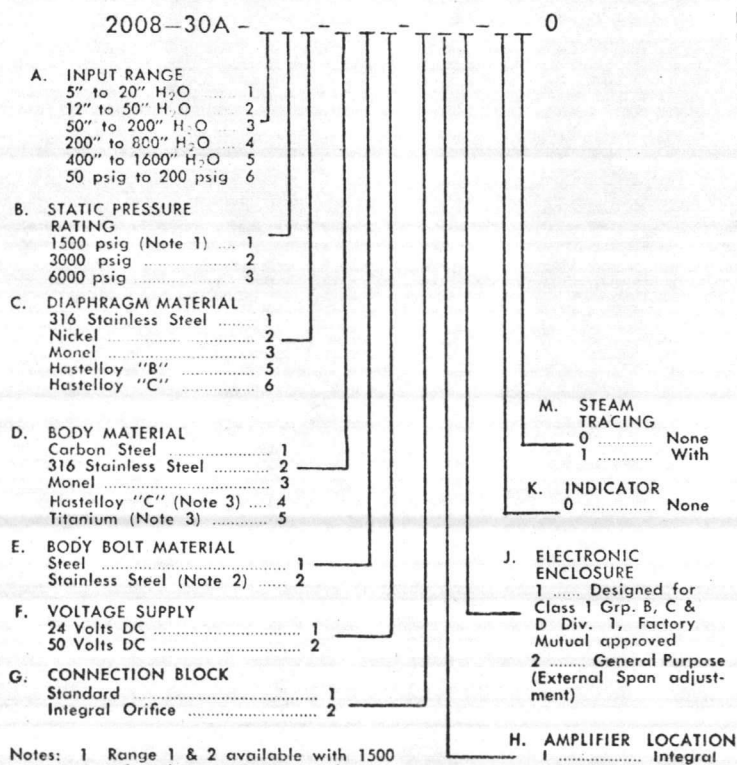
Body tested to two times rated static without leakage.

Body tested to three times rated static with leakage.

OPERATION

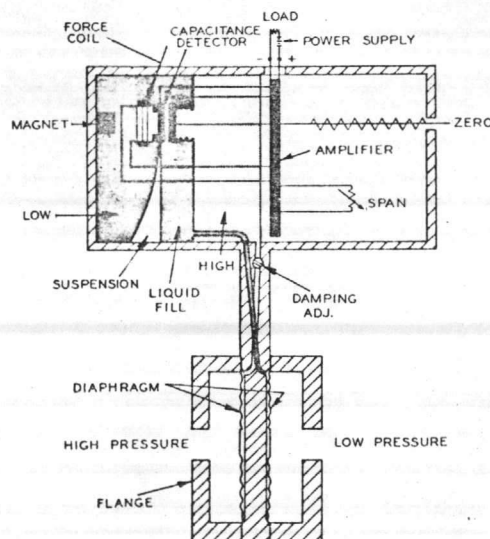
A cross sectional drawing of the *Metatron* 2000 Differential Pressure Transmitter is shown below. The high and low pressure inputs compress their respective diaphragms which activate the two filled systems. The pressure difference across the two systems is detected by a capacitance-type element located inside the filled systems. The change in capacitance is amplified and conditioned by the amplifier to give a 4-20 MA DC signal proportional to the differential pressure. This signal is fed back to the force coil which balances the system. The power supply is connected externally with the output load. The transmitter has 18 inches of two conductor cable for the electrical connections and a 1/2" NPT conduit connector. All process connections are 1/2" NPT female type.

MAKE-UP OF INSTRUMENT MODEL NUMBER



Notes: 1 Range 1 & 2 available with 1500 psi static pressure rating only
 2 Standard on 6000# Body
 3 Not available in Range 1 & 2

CROSS-SECTIONAL VIEW



Bristol Division



DIFFERENTIAL PRESSURE TRANSMITTER SPECIFICATIONS

SPECIFICATION SUMMARY SHEET B220-23b

INPUT RANGES

0-5" to 0-20" H₂O; 0-12" to 0-50" H₂O; 0-50" to 0-200" H₂O; 0-200" to 0-800" H₂O; 0-400" to 0-1600" H₂O.

STATIC PRESSURE

1500 psig standard for 5" to 50" H₂O ranges
3000 psig standard for 50" H₂O to 200 psi ranges
6000 psig optional for 50" H₂O to 200 psi ranges

BODY MATERIALS

Cadmium plated Carbon Steel—standard; 316 SS, Monel, Hastelloy "C", Titanium—optional.

DIAPHRAGM MATERIALS

316 stainless steel—standard; Nickel, Monel, Hastelloy "B", Hastelloy "C", Tantalum—optional.

OVERPRESSURE

To full static rated on either side.

SPAN ADJUSTMENT

4 to 1.

ZERO ADJUSTMENT

Up to 75% of maximum span.

AMBIENT TEMPERATURE

-40° to +200°F Electronic; -40° to +250°F Body.

TEMPERATURE EFFECT

Less than .02%/°F.

ENCLOSURE

Explosion-Proof Design for Class 1 Groups B, C & D Division 1, Factory Mutual approved and Water tight NEMA 4 Classifications.

ACCURACY

0.25% of full scale output for all ranges from 0-12" H₂O to 0-1600" H₂O.

0.5% of full scale output for 0-5" to 0-20" H₂O Range.

This accuracy includes linearity, hysteresis, and repeatability.

POWER SUPPLY

24.5 volts DC or 50 volts DC.

OUTPUT

2 wire, 4-20 MA DC into 500 ohms max. at 24.5 Volts or 4-20 MA DC into 1000 ohms max. at 50 volts.

OUTPUT RIPPLE

0.1% RMS.

OUTPUT TEST POINTS

Standard 20-100 MV.

PROCESS CONNECTION

Standard 2 1/8 inch center, 1/2" NPT.

CONDUIT CONNECTION

1/2 inch NPT.

ELECTRICAL CONNECTION

18 inches of 2 conductor cable—red positive, black negative.

MOUNTING

Wall or pipe, (2")

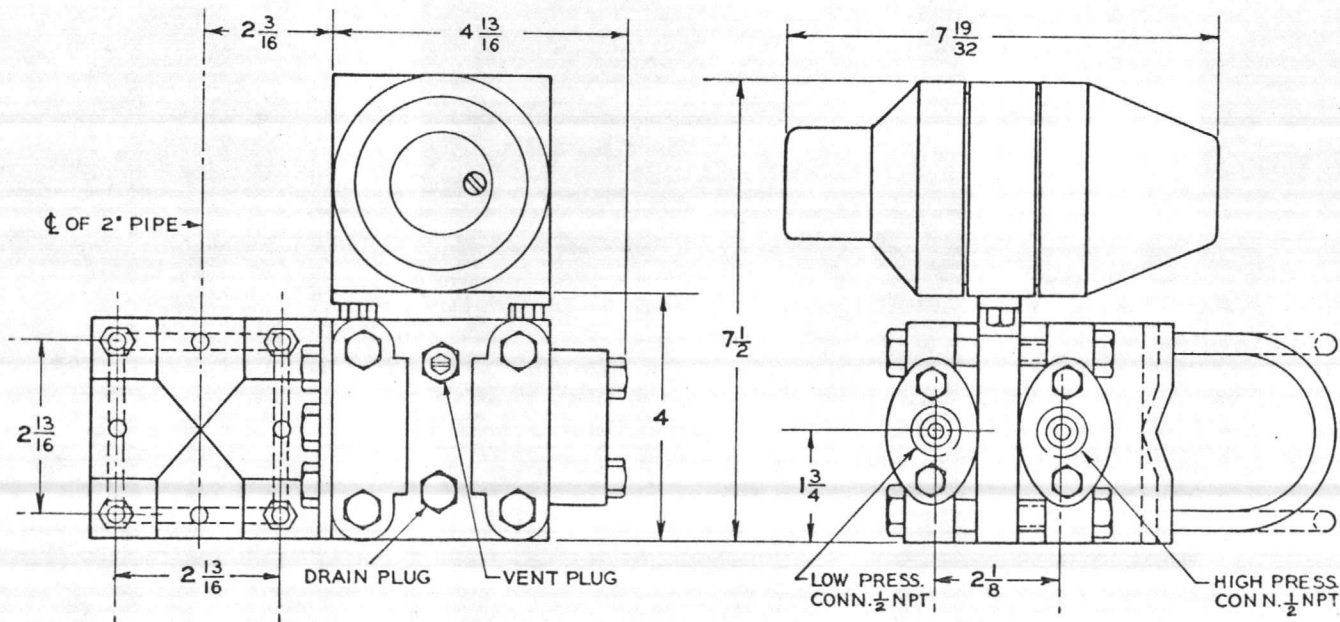
DAMPING

Standard externally adjustable.

WEIGHT

18 pounds.

OVERALL DIMENSIONS



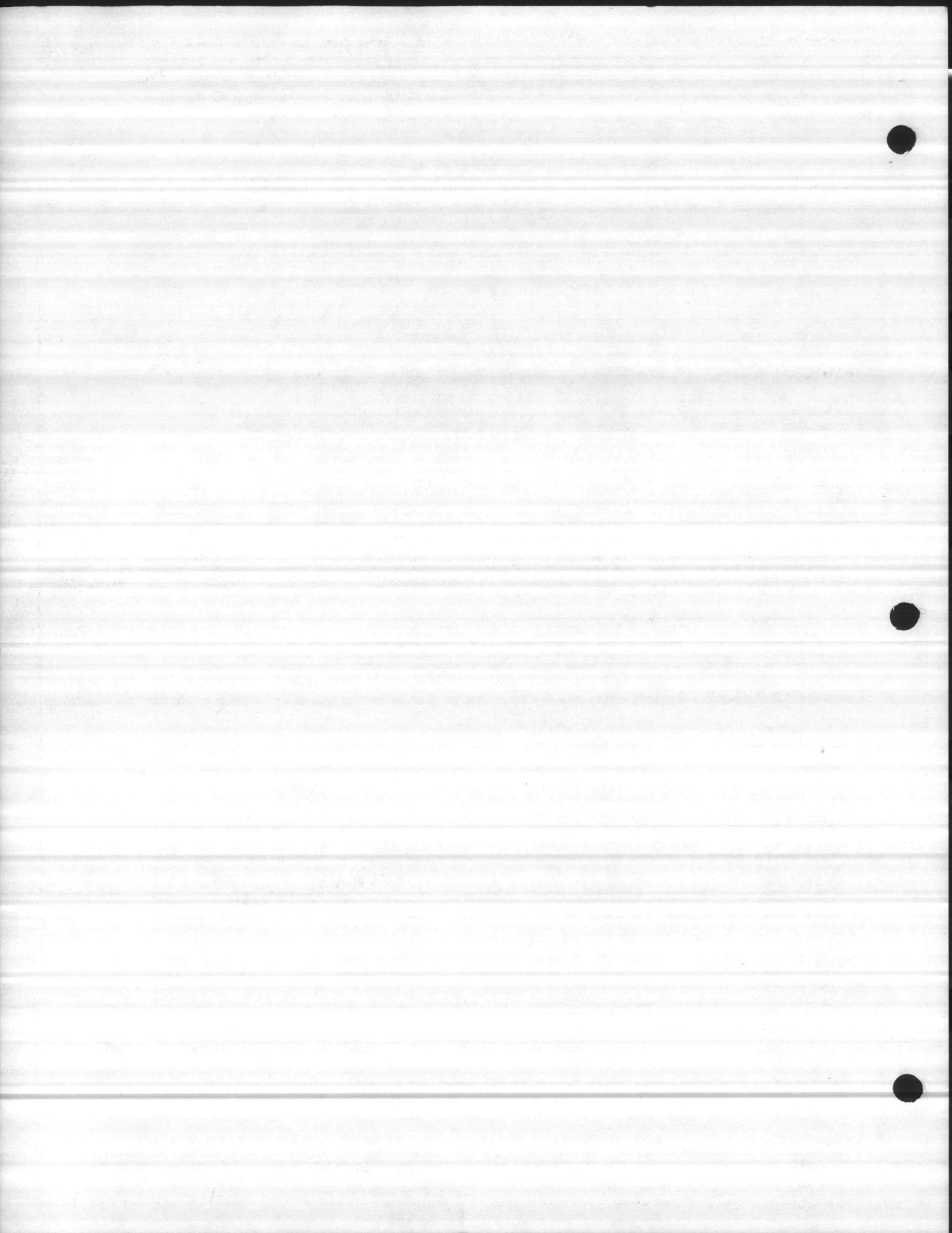
Bristol Division

BRISTOL ROAD, WATERBURY, CONNECTICUT 06720 • (203) 756-4451

AMERICAN CHAIN & CABLE COMPANY, INC.

© AMERICAN CHAIN & CABLE COMPANY, INC. 1974

PRINTED IN U.S.A.
CGD



CEM* CARD CASES

814 CASE (3-CARD)

This case has a capacity for 3 CEM cards. The power supply is self contained, and is removable by extracting three screws. The case is wall mounted and is of NEMA IV construction.

SPECIFICATIONS

MODEL:

MY 814MY—Specify 1, 2, or 3 connectors.

POWER SUPPLY OUTPUT:

±15V D.C. @ 200 ma std.

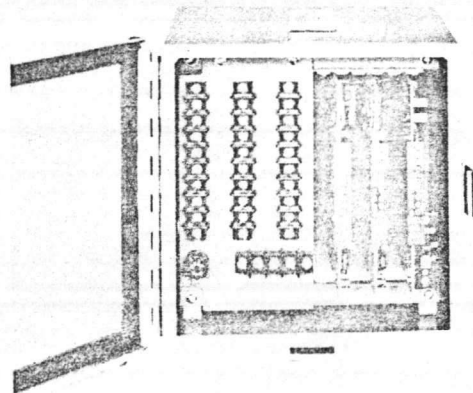
+ 5V D.C. @ 100 ma std.

AMBIENT OPERATING TEMPERATURE:

—20°F to 150°F.

INPUT:

115V A.C. 50-60 Hz.



814 Case

MOUNTING:

Wall

DIMENSIONS:

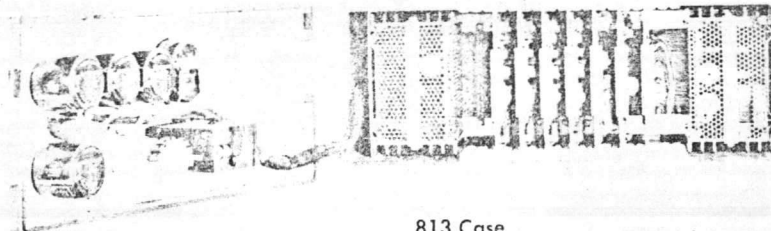
8" x 8" x 8"

CONSTRUCTION:

NEMA IV water tight piano hinged door, gasketed with 3 screw type door latches.

813 CASE (11-CARD)

This case has a capacity for 11 CEM cards providing the loop or transducer power supplies are not used. This case is deeper than the 811 (2 inches) to accommodate pots, counters or switches that might be required on the swinging door.



813 Case

SPECIFICATIONS

MODELS (Typical):

ME 813 MY, MC 813 MY, MY 813 MY.

POWER SUPPLY OUTPUT:

Two power supply models available.—plug-in.

- | | |
|-----------------------|------------|
| 1. ±15V D.C. @ 300 ma | } std. |
| + 5V D.C. @ 150 ma | |
| 2. ±15V D.C. @ 500 ma | } optional |
| + 5V D.C. @ 200 ma | |

MOUNTING:

Relay rack or panel.

CONSTRUCTION:

19" relay rack. Input and output terminals on rear-enclosed. 32 std. 64 optional. Terminal block housing has knockouts. Swinging door with bezel std.

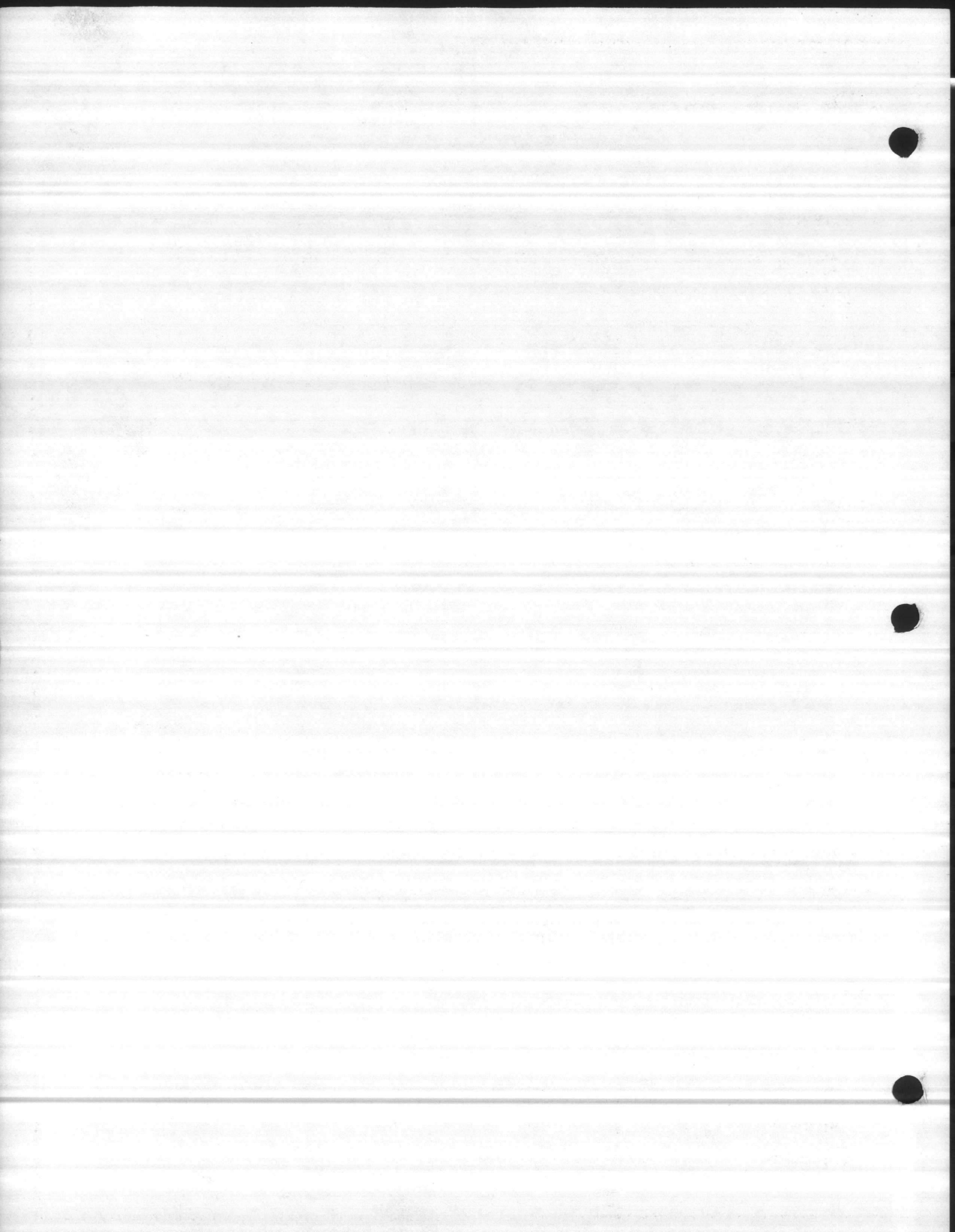
DIMENSIONS:

6⁷/₈" H. x 19" W. x 13¹/₂" deep from panel.
Front projection ²/₃₂".

FINISH:

Case—dark gray. Panel—beige.
Bezel—dark gray.

*A trademark of American Chain & Cable Company, Inc.



CEM* CARD CASES

SPECIFICATION SUMMARY SHEET M1776-2

810/812 CASE (12-CARD)

This case has a capacity for 12 CEM cards when the auxiliary power supplies are not used. 12 additional cards may be added in the middle section behind the swinging panel, provided no meters, switches or pots are required. This is because the card case is 2 inches shallower than an 813 and the cards are almost flush with the front edge of the case.

SPECIFICATIONS

POWER SUPPLY OUTPUT:

Same as 813

MOUNTING:

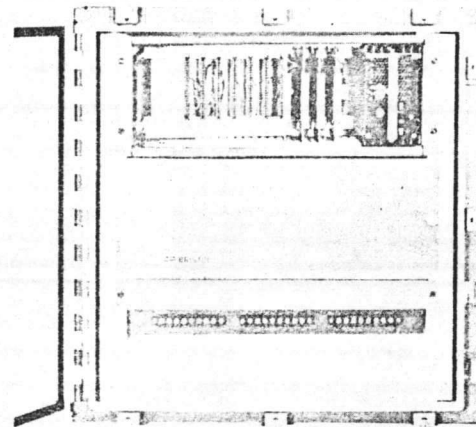
Wall

DIMENSIONS:

24" H. x 24" W. x 9 $\frac{1}{2}$ " Deep.

WEIGHT:

80 lbs.



Model 810 Case

CONSTRUCTION:

NEMA IV gasketed door with 9 screw type door latches.

FINISH:

Case—dark gray, panel beige.

ATTACHMENT:

SC 25B—Hinged swinging panel—813 style.

811 CASE (12-CARD)

SPECIFICATIONS

This case has a capacity for 12 CEM cards when auxiliary power supplies are not used.

POWER SUPPLY OUTPUT:

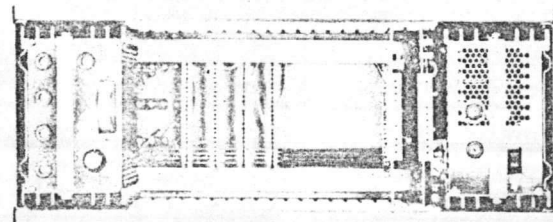
Same as 813

MOUNTING:

Relay rack or panel

WEIGHT:

15 lbs.



811 Case

CONSTRUCTION:

Same as 813 except case is 2 inches shallower.

ATTACHMENT:

SC 25A—Hinged door—813 style.

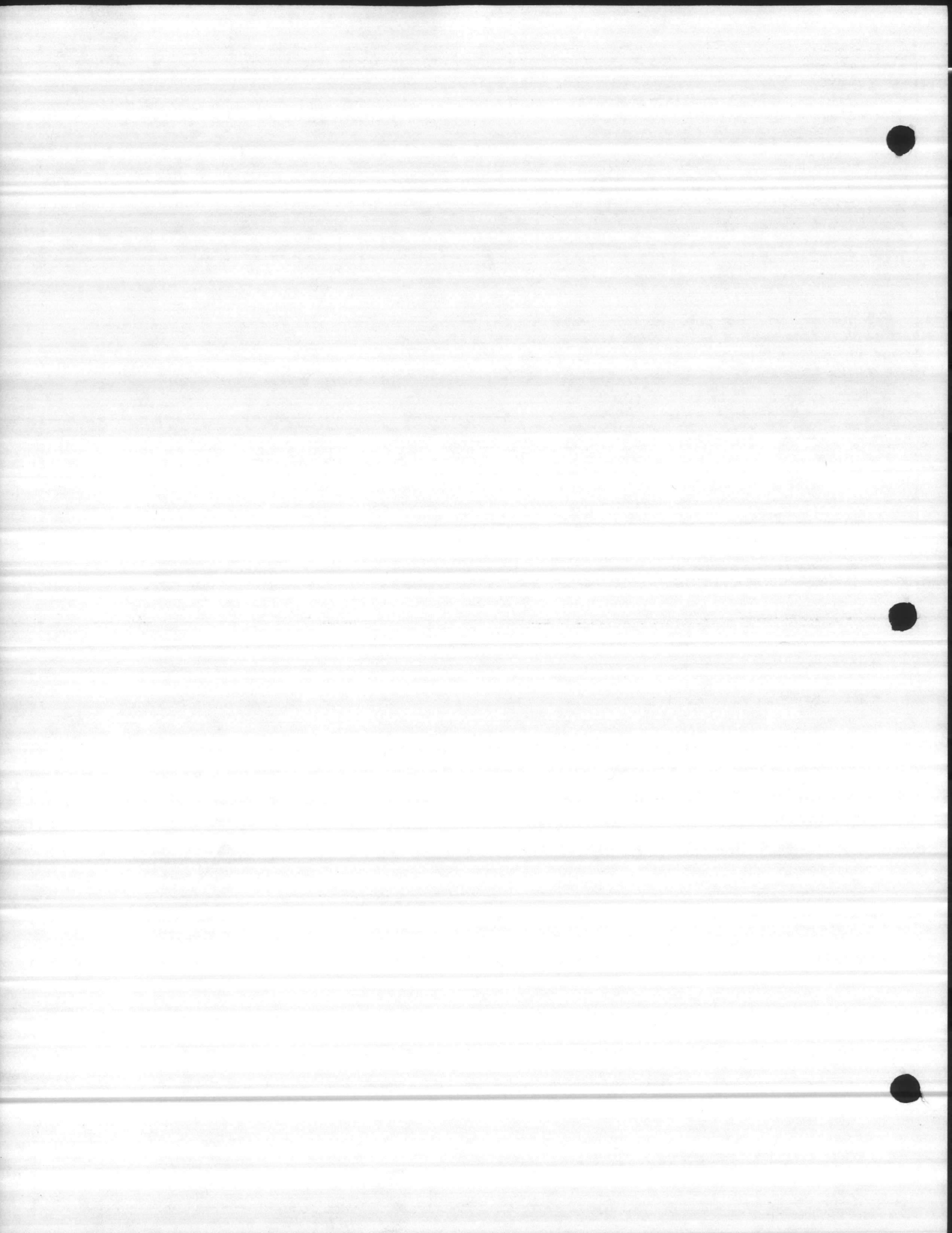
*A trademark of American Chain & Cable Company, Inc.



PRINTED IN U.S.A.

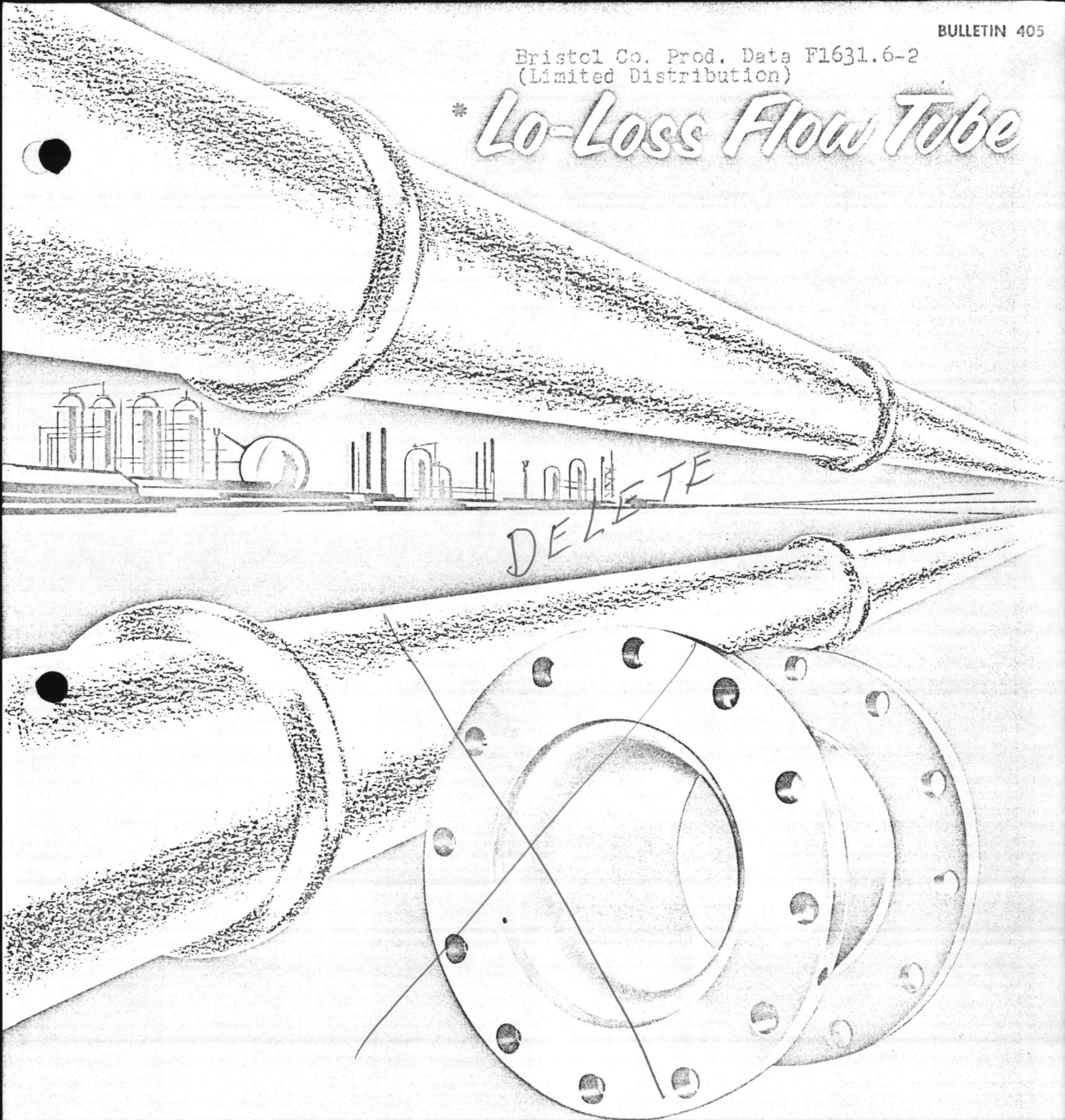
BRISTOL DIVISION
WATERBURY, CONNECTICUT 06720
KGA

©AMERICAN CHAIN & CABLE COMPANY, INC., 1971

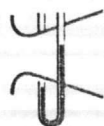


Bristol Co. Prod. Data F1631.6-2
(Limited Distribution)

* Lo-Loss Flow Tube



DELETE



PENN METER COMPANY

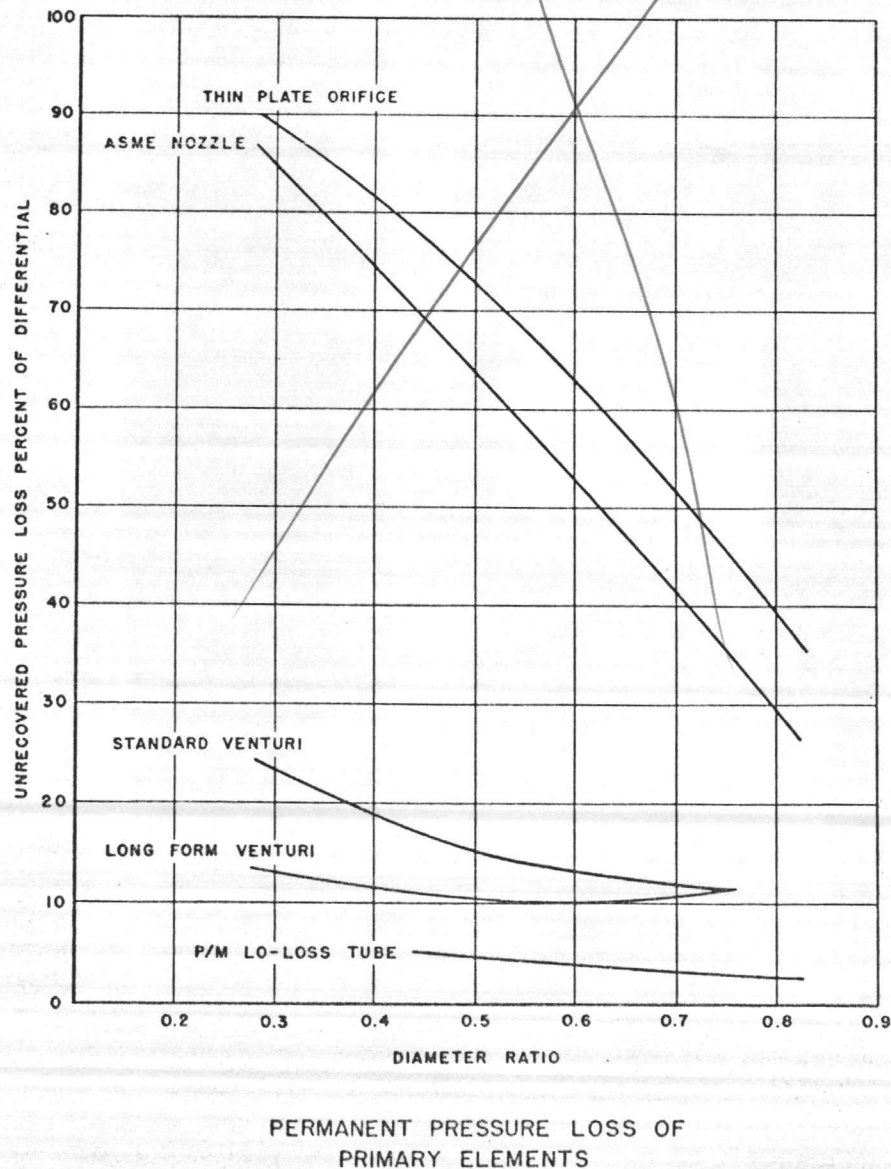
Engineering *FLOW* Manufacturing

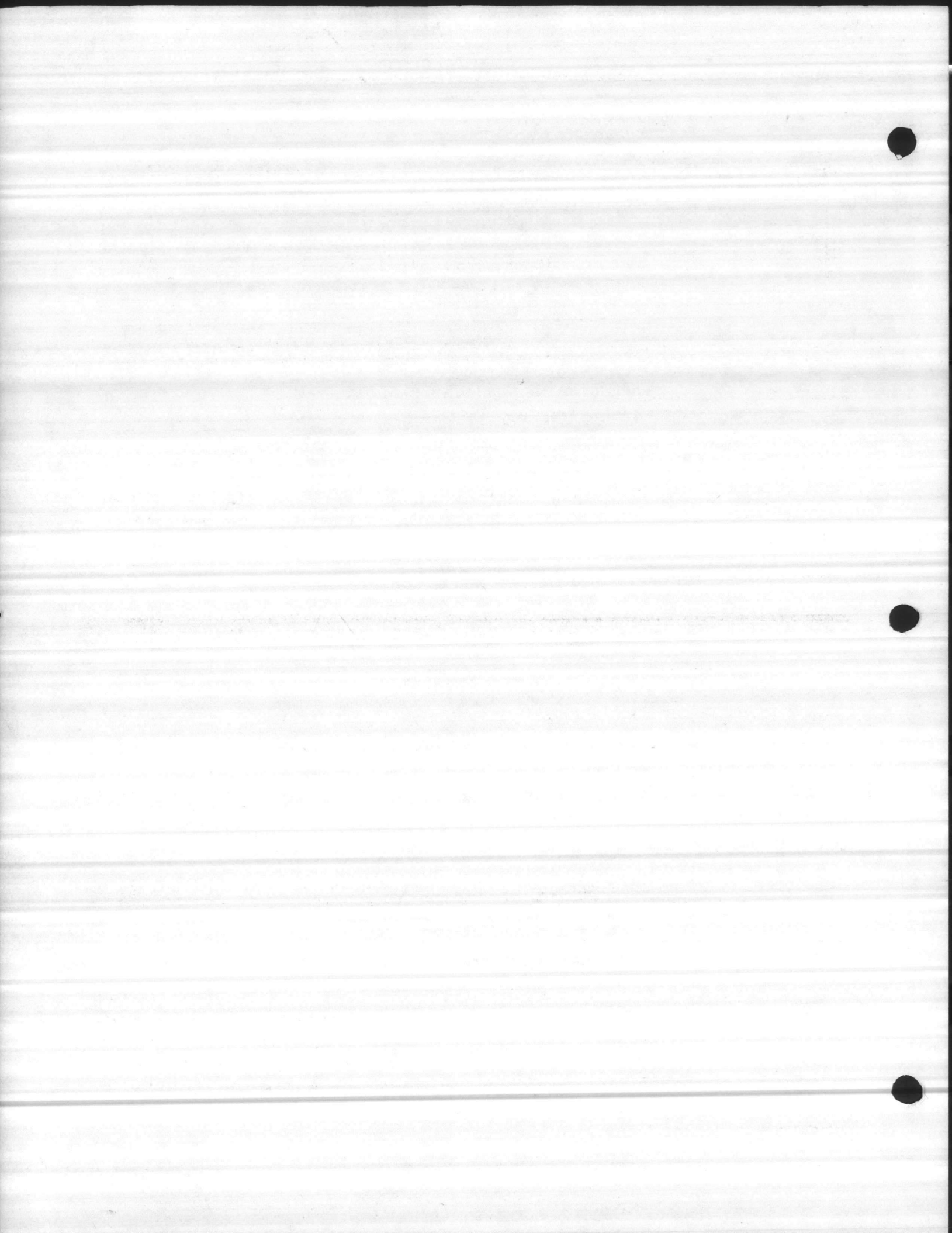


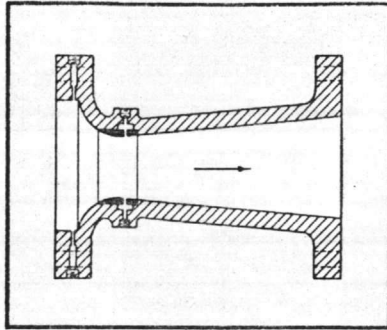
Advantages

1. **WIDE RANGEABILITY**—constant flow coefficients down to unusually low Reynolds number and velocities.
2. **MAXIMUM EFFICIENCY**—sustained metering accuracy—highest recovery.
3. **PIPING ECONOMY**—shorter upstream runs—minimum downstreams requirements.
4. **SHORT LAYING LENGTH**—compact—light weight—easier installation—lower construction costs.
5. **SUPERIOR THROAT**—smooth radius, stable throat—no exposed sharp edges—no channel to clog—no erosion.
6. **LOW COST**—purchase—installation—maintenance.
7. **CHOICE OF MATERIALS**—Cast Iron—stainless steel—bronze—forged steel—MEEHANITE[®]—plastics—other materials available.
8. **ACCURACY**—to within plus or minus 1% of actual flow rate—within ½% when laboratory rated—sustained!
9. **APPLICATIONS**—water, sewage, sludges, slurries, chemicals, steam trade wastes, air and gases. **MANUAL CLEANOUT DEVICES AVAILABLE.**

Comparative Head Loss Characteristics

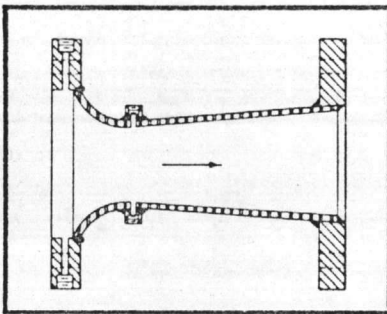






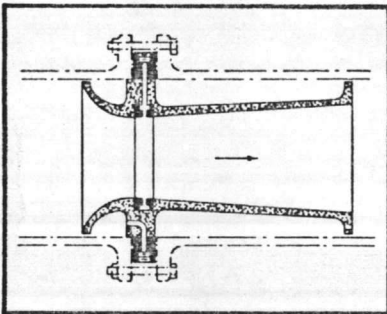
FULL FLANGED CAST.

Heavy Construction conforming to ASTM, AWWA, ASA and Federal specifications. The Insert Throat, with internal averaging annulus, is accurately machined with the body. Flat flange construction minimizes installation and removal labor. Usage includes metering of sewage, sludge and slurries as well as clear liquids and gases.



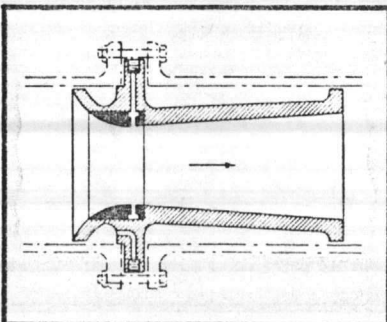
FULL FLANGED—FABRICATED.

A wide selection of materials is offered to meet difficult operating conditions. Recommended for larger diameter line sizes to minimize weight and cost. By eliminating flanges, this style is adapted to weld-in type to suit specific construction requirements. Equally efficient with solids-bearing or clear flows.



INSERT—PLASTIC

Polyester reinforced with heavy fibre glass mat. The body, together with the tapped holding ring and internal-annulus throat are molded as an integral unit. Special materials available for holding ring and throat. The location shoulder assures the necessary concentric centering in the pipe. Applicable where light weight and cost are factors.



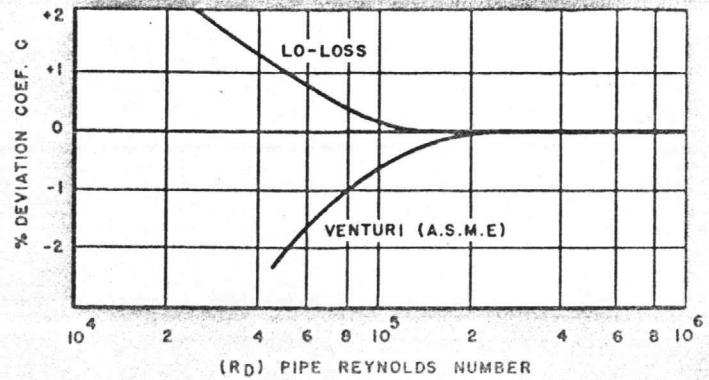
INSERT—CAST OR FORGED

Solid construction in a choice of metals, specially designed to meter under extraordinary temperature, pressure and material requirements. Readily adapted for weld-in applications by reducing the holding ring. Applicable for small as well as large line sizes, particularly when minimum weight and cost are a consideration.



"LO-LOSS" Flow Tube

**Comparative
Rangeability**



"LO-LOSS" FLOW TUBE CAPACITIES

Pipe Size Inches	Throat Diameter	% Head Loss	Laying Length Inches		APPROXIMATE CAPACITIES IN MILLION GALLONS PER DAY Maximum Differential In Inches Of Water							
			Full Length	Insert	18.84"	42.39"	75.36"	117.75"	169.56"	230.79"	301.44"	471.000"
6	2.85	4.8	13	12 1/4	.250	.375	.500	.625	.750	.875	1.000	1.250
	3.59	4.0	9	8 1/4	.400	.600	.800	1.000	1.200	1.400	1.600	2.000
	4.29	3.2	8 3/8	7 7/8	.625	.937	1.250	1.562	1.875	2.187	2.500	3.125
8	3.77	4.7	17 1/2	16 3/4	.437	.656	.875	1.093	1.312	1.531	1.750	2.187
	4.92	3.9	11 1/4	10 1/2	.750	1.125	1.500	1.875	2.250	2.625	3.000	3.750
	6.07	3.0	11 5/8	10 7/8	1.250	1.875	2.500	3.125	3.750	4.375	5.000	6.250
10	4.73	4.7	22	21	.687	1.031	1.375	1.718	2.062	2.406	2.750	3.437
	6.02	3.9	14	13	1.125	1.687	2.250	2.812	3.375	3.937	4.500	5.625
	7.92	2.7	14 15/16	13 15/16	2.125	3.187	4.250	5.312	6.375	7.437	8.500	10.625
12	5.71	4.7	25 1/2	24 1/2	1.000	1.500	2.000	2.500	3.000	3.500	4.000	5.000
	7.24	3.9	17 1/8	16 1/8	1.625	2.437	3.250	4.062	4.875	5.687	6.500	8.125
	9.21	2.9	17 7/16	16 7/16	2.875	4.312	5.750	7.187	8.625	10.062	11.500	14.375
14	6.69	4.7	29	28	1.375	2.062	2.750	3.437	4.125	4.812	5.500	6.875
	8.28	4.0	23	22	2.125	3.187	4.250	5.312	6.375	7.437	8.500	10.625
	10.09	3.2	18 3/4	17 3/4	3.250	4.875	6.500	8.125	9.750	11.375	13.000	16.250
16	11.04	2.7	20 3/8	19 3/8	4.125	6.187	8.250	10.312	12.375	14.437	16.500	20.625
	7.55	4.7	33	32	1.750	2.625	3.500	4.375	5.250	6.125	7.000	8.750
	9.42	4.0	23 11/16	22 11/16	2.750	4.125	5.500	6.875	8.250	9.625	11.000	13.750
18	11.54	3.2	21 7/8	20 7/8	4.250	6.375	8.500	10.625	12.750	14.875	17.000	21.250
	12.74	2.6	23 1/2	22 1/2	5.500	8.250	11.000	13.750	16.500	19.250	22.000	27.500
	8.56	4.7	38	37	2.250	3.375	4.500	5.625	6.750	7.875	9.000	11.250
20	10.62	4.0	26	25	3.500	5.250	7.000	8.750	10.500	12.250	14.000	17.500
	12.83	3.2	24 1/8	23 1/8	5.250	7.875	10.500	13.125	15.750	18.375	21.000	26.250
	14.12	2.8	25 15/16	24 15/16	6.750	10.125	13.500	16.875	20.250	23.625	27.000	33.750
24	9.47	4.7	42	41	2.750	4.125	5.500	6.875	8.250	9.625	11.000	13.750
	12.05	3.9	28 3/4	27 3/4	4.500	6.750	9.000	11.250	13.500	15.750	18.000	22.500
	14.81	3.0	27 1/16	26 1/16	7.000	10.500	14.000	17.500	21.000	24.500	28.000	35.000
30	15.96	2.6	29 1/4	28 1/4	8.625	12.937	17.250	21.562	25.875	30.187	34.500	43.125
	11.77	4.6	44	43	4.250	6.375	8.500	10.625	12.750	14.875	17.000	21.250
	14.20	4.0	35	34	6.250	9.375	12.500	15.625	18.750	21.875	25.000	31.250
36	16.80	3.3	31 1/2	30 1/2	9.000	13.500	18.000	22.500	27.000	31.500	36.000	45.000
	19.02	2.7	34 9/16	33 9/16	12.250	18.375	24.500	30.625	36.750	42.875	49.000	61.250
	14.27	4.7	62	61	6.250	9.375	12.500	15.625	18.750	21.875	25.000	31.250
42	17.04	4.2	47	46	9.000	13.500	18.000	22.500	27.000	31.500	36.000	45.000
	19.40	3.6	36 1/2	35 1/2	12.000	18.000	24.000	30.000	36.000	42.000	48.000	60.000
	24.00	2.6	42	41	19.500	29.250	39.000	48.750	58.500	68.250	78.000	97.500
48	17.60	4.6	71 1/2	70 1/2	9.500	14.250	19.000	23.750	28.500	33.250	38.000	47.500
	22.00	3.9	49	48	15.000	22.500	30.000	37.500	45.000	52.500	60.000	75.000
	25.04	3.3	46 3/8	45 3/8	20.000	30.000	40.000	50.000	60.000	70.000	80.000	100.000
48	28.50	2.8	51 1/4	50 1/4	27.500	41.250	55.000	68.750	82.500	96.250	110.000	137.500
	19.98	4.7	88	86	12.250	18.375	24.500	30.625	36.750	42.875	49.000	61.250
	25.41	4.0	60	58	20.000	30.000	40.000	50.000	60.000	70.000	80.000	100.000
48	28.00	3.5	53 1/4	51 1/4	25.000	37.500	50.000	62.500	75.000	87.500	100.000	125.000
	33.50	2.7	61	59	38.000	57.000	76.000	95.000	114.000	133.000	152.000	190.000
	22.84	4.7	100	98	16.000	24.000	32.000	40.000	48.000	56.000	64.000	80.000
48	28.97	3.9	70	68	26.000	39.000	52.000	65.000	78.000	91.000	104.000	130.000
	34.29	3.2	63	61	37.500	56.250	75.000	93.750	112.500	131.250	150.000	187.500
	38.43	2.6	67	65	50.000	75.000	100.000	125.000	150.000	175.000	200.000	250.000

Additional Sizes Available Upon Request

PENN METER COMPANY

Engineering Manufacturing
4110 HAVERFORD AVENUE - PHILADELPHIA 4, PENNSYLVANIA



Series 534
STANDARD
metameter[®]
TRANSMITTERS

BRISTOL[®]
instruments

SPECIFICATION SUMMARY SHEET M1705-1B

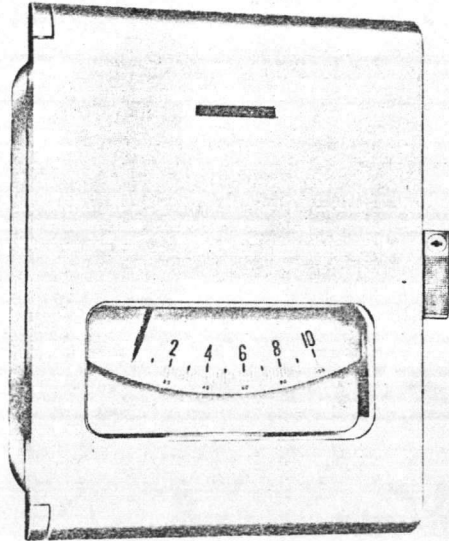
Indicating impulse-duration telemeter transmitters with impulse cycles of 15 or 5 seconds, suitable for d-c transmission or tone transmission.

GENERAL

The Series 534 standard *Metameter* Transmitter is widely used for such measurands as pressure, temperature, and flow. Housed in an aluminum case with a heavily gasketed aluminum door which provides ample protection against moisture, fumes, and dust, the transmitter can be panel or wall mounted.

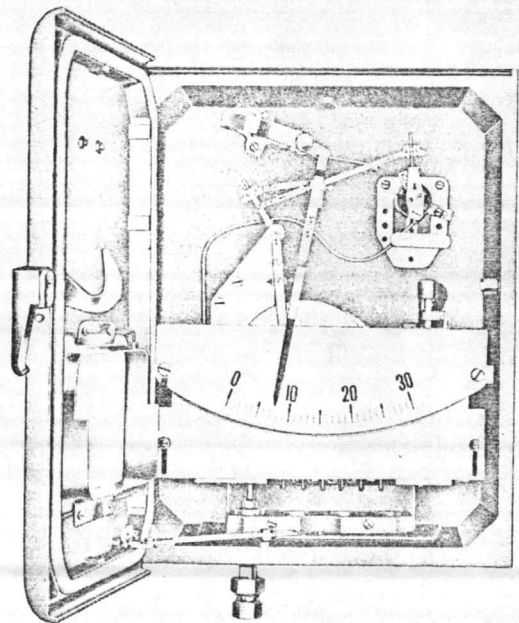
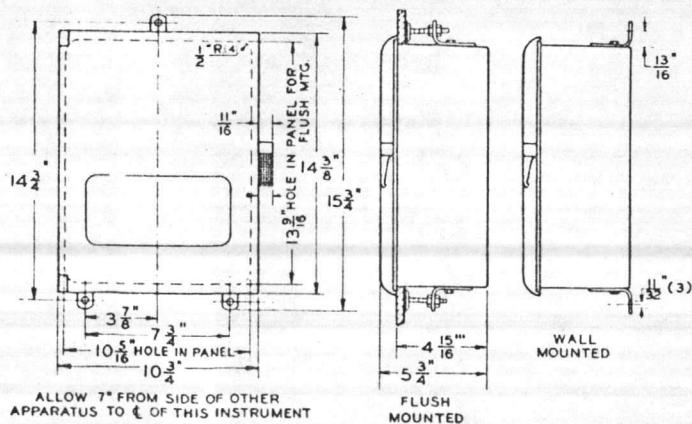
In this simple, electro-mechanical device, the duration of each transmitted impulse, which is proportional to the measured quantity, is governed by the measuring-element-controlled position of a cam follower; the portion of the constant-speed cam cycle that the rider is off the cam represents the value of the measurand.

As part of a *Metameter* telemetering system, the transmitter may be placed in any location and connected to a receiver via any two-wire circuit, such as leased telephone lines, microwave line, transmission line carrier channel, or private lines.



Series 534 standard *Metameter* Transmitter.

OVERALL DIMENSIONS



Transmitter with door open showing placement of pressure element.



Bristol Division



Series 534
STANDARD
TRANSMITTERS
SPECIFICATIONS

SPECIFICATION SUMMARY SHEET M1705-1b

GENERAL SPECIFICATIONS

CASE

Rectangular, die-cast aluminum case with gasketed aluminum door. Designed for interchangeable flush-panel or surface mounting. Gray enamel finish standard. Pin-tumbler lock optional.

CASE DIMENSIONS

10 $\frac{3}{4}$ " wide x 14 $\frac{3}{4}$ " high x 5 $\frac{3}{4}$ " deep.

PANEL CUTOUT

10 $\frac{3}{8}$ " wide x 13 $\frac{3}{8}$ " high.

WEIGHT

Approximately 12 pounds with pressure measuring element.

ELECTRICAL CONNECTIONS

$\frac{1}{2}$ -inch conduit, at bottom or back of case.

SCALES

Segmental, 5-inch calibrated width standard for all models listed below.

PRIMARY POWER

120 volts a-c (60 or 50 Hz.) (*12 or 24 volts d-c.)
Stepdown transformers available for operation at 240 volts, 60 or 50 Hz.

*Use attachments R31 or R31A

OPERATING CHARACTERISTICS

CALIBRATED ACCURACY

Standard: $\pm 0.5\%$ of full-scale value.
Optional: $\pm 0.3\%$ of full-scale value.

REPRODUCIBILITY

$\pm 0.25\%$ of span.

SENSITIVITY

$\pm 0.1\%$ of span.

IMPULSE CYCLE

15 second cycle standard (pulse duration signal varies from 3 to 12 seconds for full-scale span);
5 second cycle optional.

AMBIENT TEMPERATURE LIMITS

40 to 140°F for rated accuracy. Internal resistance-type heaters (with or without thermostats) available for operation below 40°F.

EFFECT OF SUPPLY VOLTAGE CHANGES

Transmitter accuracy is unaffected by changes of $\pm 10\%$ in supply voltage.

POWER CONSUMPTION

6 watts at 120 volts, 60 or 50 Hz.

MODELS AND RANGES

Variable	Measuring Element	Ranges	Model Number
TEMPERATURE	Class 1, 2, 3 or 5 Filled Thermal system	-300 to +1200°F	OT534M
PRESSURE and VACUUM	Capsular Element	0-3" H ₂ O to 0-200 psig	OG534M-14
	Helical element	0-31 to 0-15,000 psig	
FLOW and DIFFERENTIAL PRESSURE*	Mercury U-tube manometer	0-10 to 0-800" H ₂ O	OF534M-45 or -18*
	Dri-flo manometer	0-20 to 0-400" H ₂ O	OER534M-45 or -18
	Barton Model 199 meter body	0-20" H ₂ O to 0-50 psi	OEP534M-15 or -18
LIQUID LEVEL	Float and tape system	0-2" to 0-100'	OKC534M-15
	Direct pressure system	0-3" to 0-10,000' H ₂ O	OG534M-14
	Diaphragm bulb system	0-6" to 0-100' H ₂ O	OG534M-16
	Bubbler system	0-3" to 0-300' H ₂ O	OG534M-15

Suffix (-45) for flow and (-18) for DP.

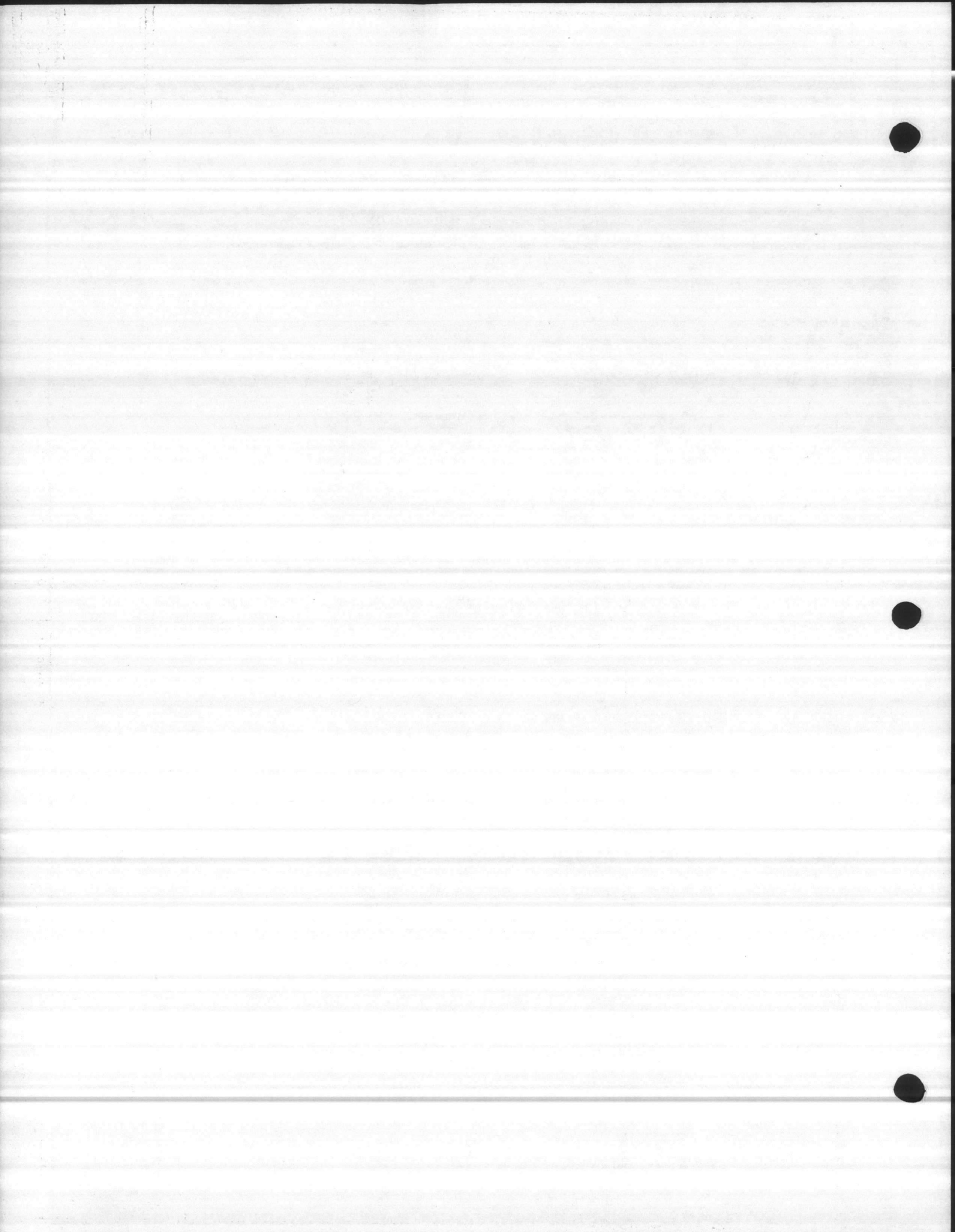


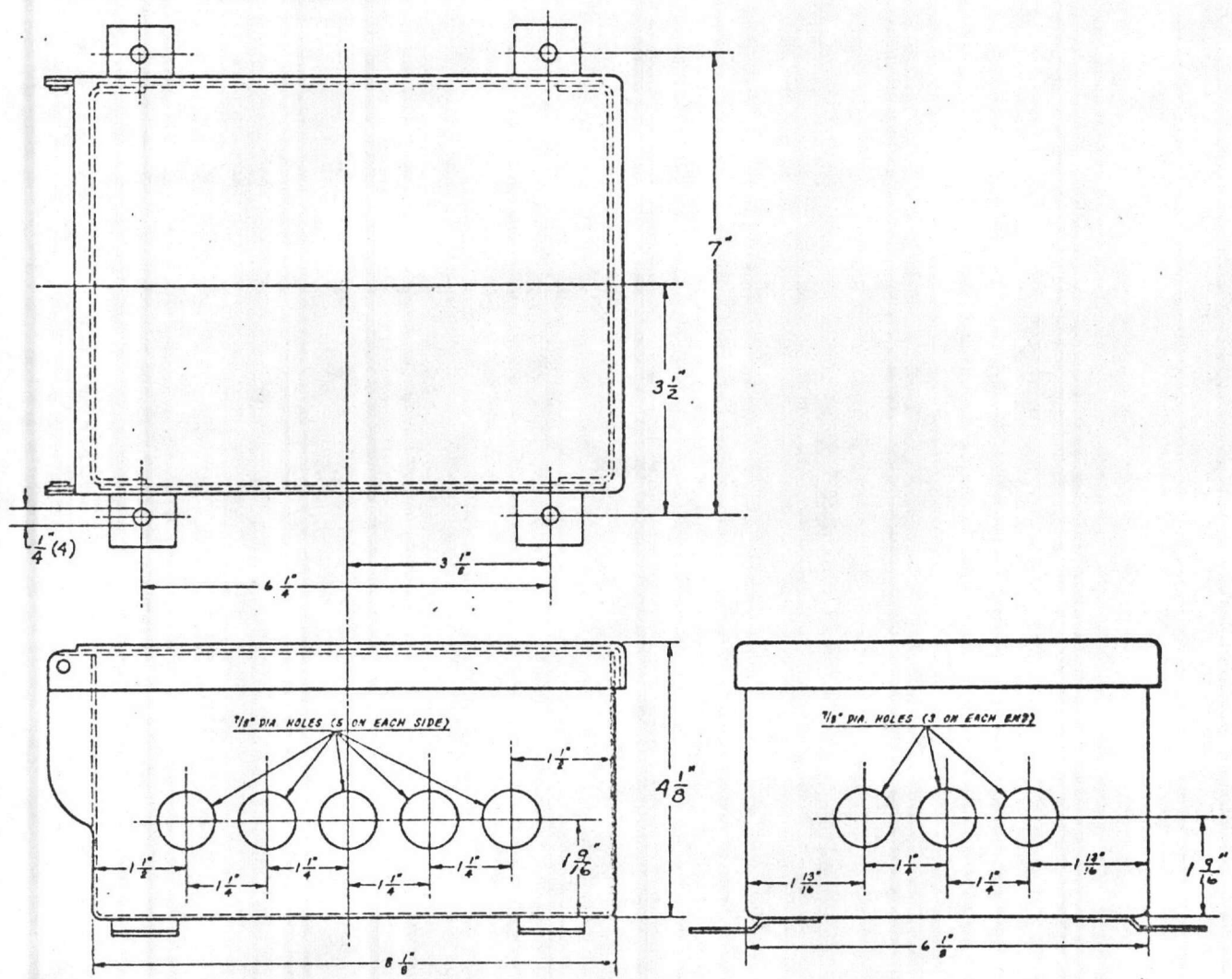
PRINTED IN U.S.A.

BRISTOL DIVISION
WATERBURY, CONNECTICUT 06720

CGA

©AMERICAN CHAIN & CABLE COMPANY, INC., 1971



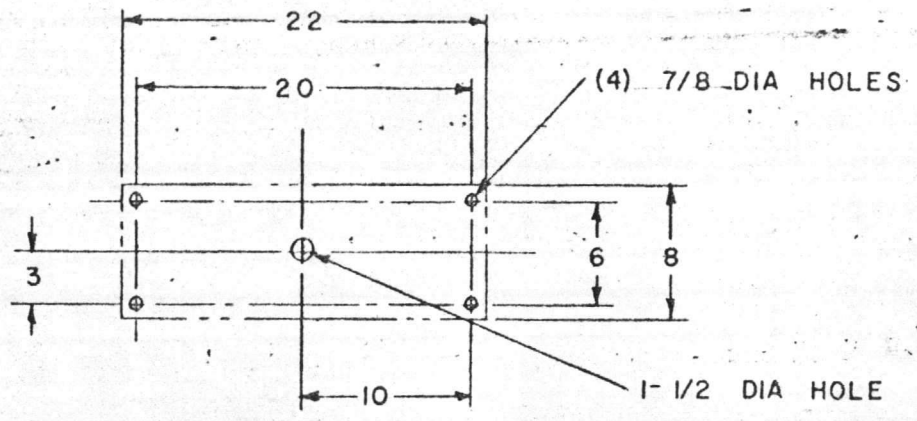


NO. 922081-10-1

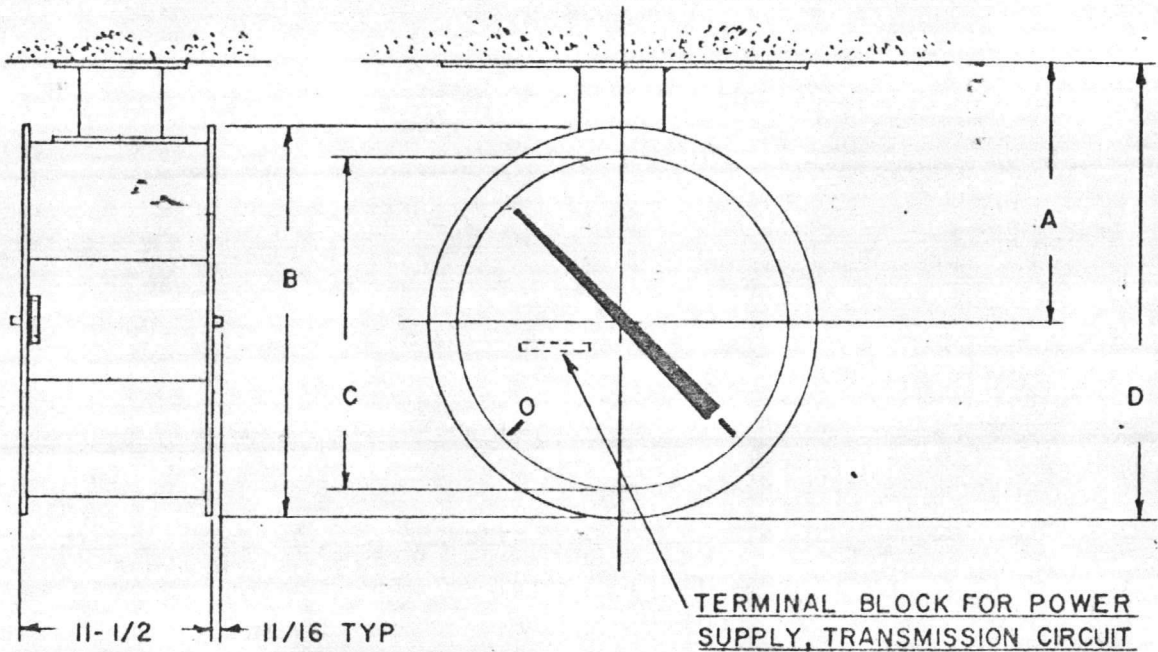
SUPPLEMENTAL DRAWINGS

OVERALL DIMENSIONS FOR POWER SUPPLY 9J1 OR 9J2
KNOCKOUT BOX 8" WIDE, 6" HIGH, 4" DEEP.





PLAN VIEW MTG DIMENSIONS



TERMINAL BLOCK FOR POWER SUPPLY, TRANSMISSION CIRCUIT & LIGHT CIRCUIT—SEE WIRING DIAGRAM

DIAL READS
0-12 THOUSAND G.P.M.
WASH WATER

DIAL—WHITE PLEXIGLASS
 MARKINGS—BLACK
 CASE—BLACK

OUTLINE

ILLUMINATED DOUBLE FACE,
 SINGLE POINTER—270° IND.
 TYPE GW RECEIVER
 CEILING MOUNTED

DIM.	TYPE		
	GW0	GWB	GWV
A	15 1/2	18 1/2	21 1/2
B	23 1/2	29 1/2	35 1/2
C	18	24	30
D	27 1/4	33 1/4	39 1/4

ITEM "A"
 1-REQ'D
 ST PAUL MINNESOTA
 LS-1524

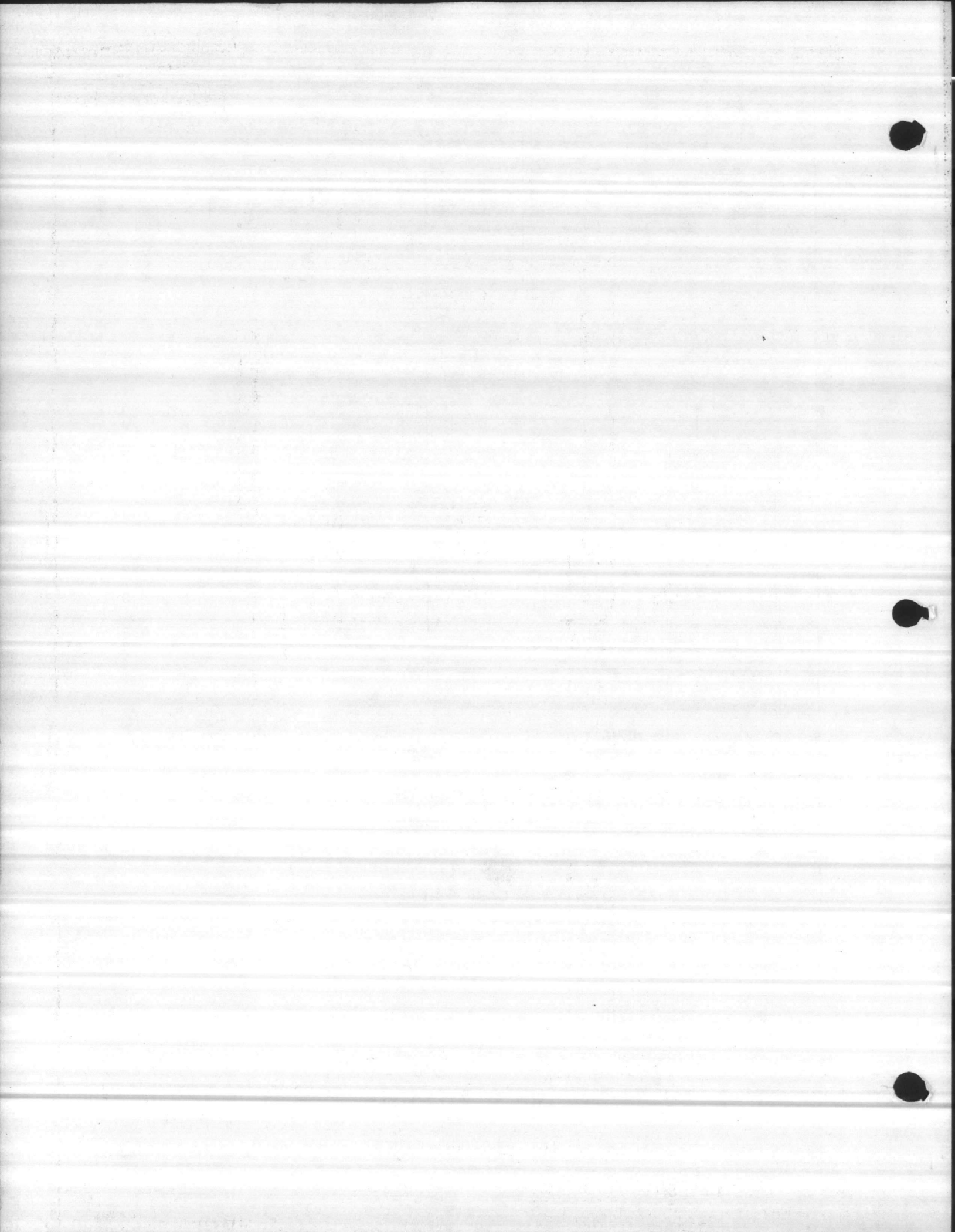
SCALE ∞ DATE

501-51421

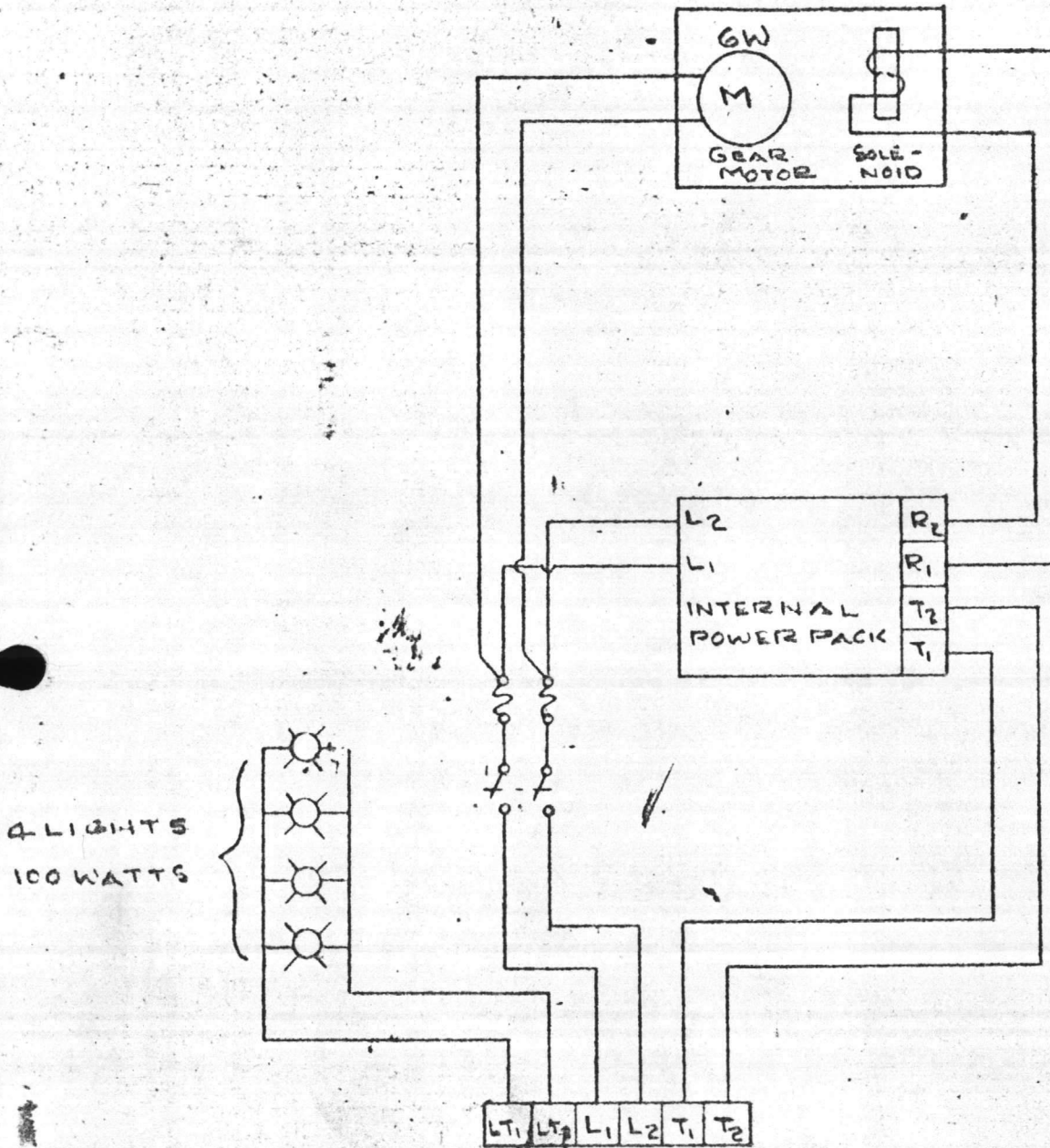
MADE BY L... CHECKED... 1/0L

D.E.S.
 9-24-75

TAG: FI-4



PARTS LIST-
 ASSY. DWG.-

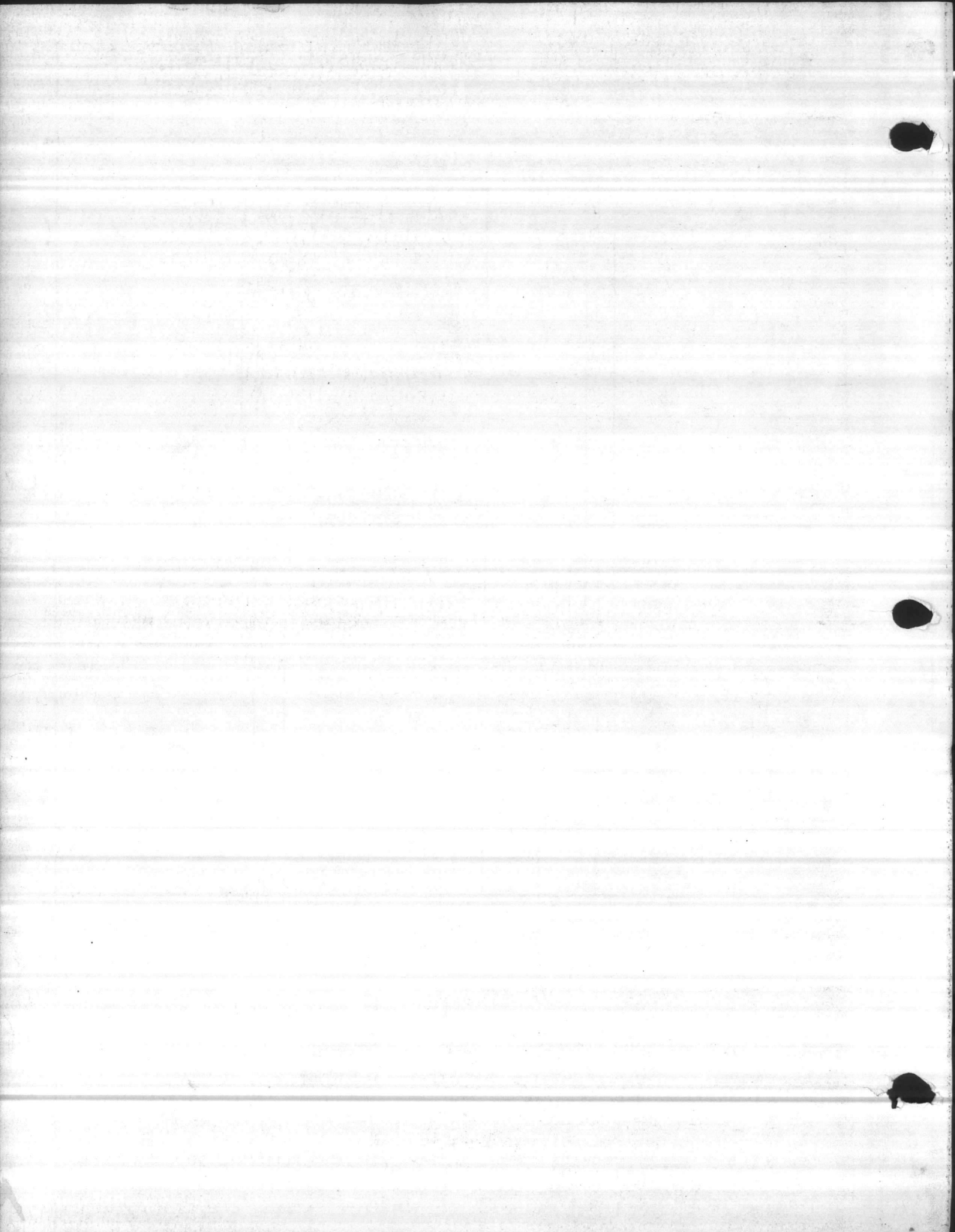


ITEM "A"

THIS DRAWING IS SENT YOU SUBJECT TO RETURN UPON DEMAND, AND WITH THE UNDERSTANDING THAT IT IS NOT TO BE REPRODUCED, COPIED OR USED, DIRECTLY OR INDIRECTLY, IN ANY WAY DETRIMENTAL TO OUR INTERESTS. ALL PATENT RIGHTS RESERVED.

REVISION	<u>WIRING DIAGRAM</u> <u>FOR "GW" GAUGE WITH</u> <u>INTERNAL POWER PACK</u> ST. PAUL, MINNESOTA LS-1524	F. B. LEOPOLD CO. INC. ZELIENOPLE, PA.
1		
2		
3		

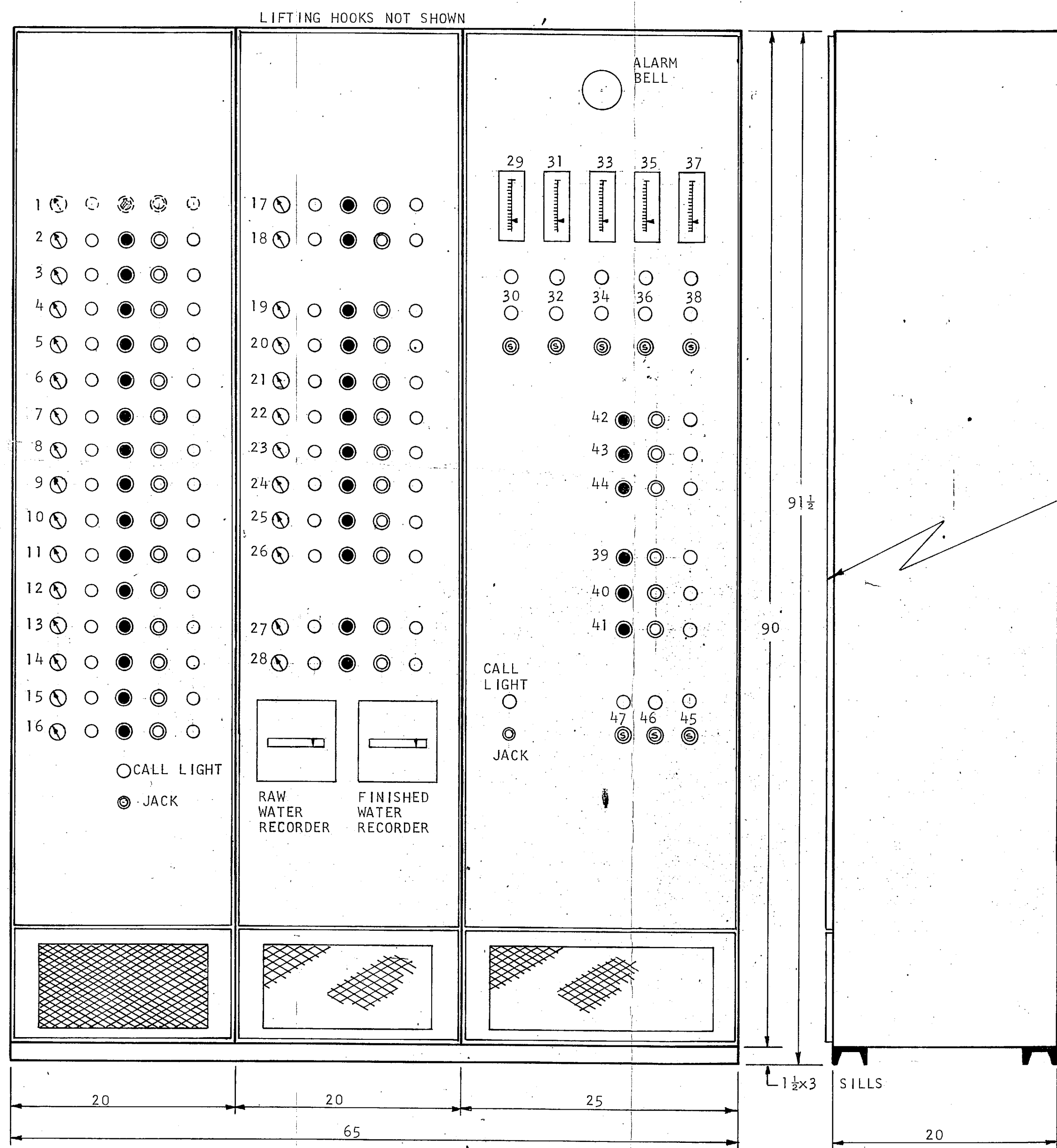
DRAWN BY	CHECKED BY	DATE	SCALE	DWG. NO.
D.E.S.		9-24-75		501-53403



A B C D E F G H I J L M N O P Q R S T U

REV.	CO. NO.	DATE	DESCRIPTION	CHK.	APP.
A	3723	8/8/75	RELEASED		TWM
B	HJG	2-20-76	CUST'S. CHANGES		Sum

- SYMBOLS:
- STOP PUSHBUTTON
 - START PUSHBUTTON
 - ⊙ SILENCE PUSHBUTTON
 - INDICATING LIGHT
 - ⊙ TELEPHONE JACK
 - ⊙ SELECTOR SWITCH

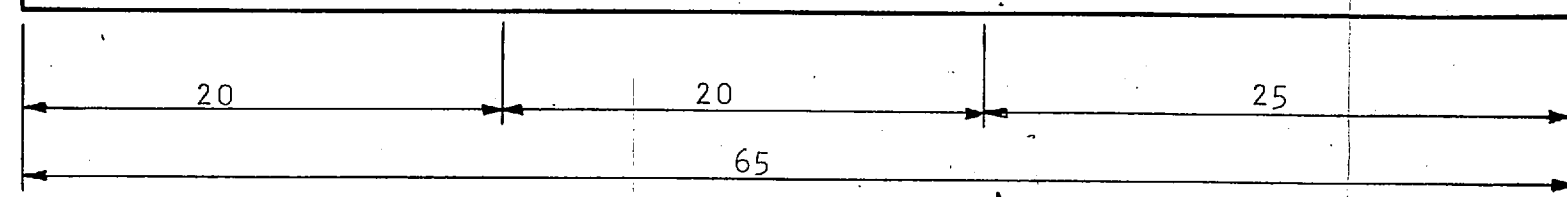


FILTERED OPENINGS (BOTTOM FRONT)
(TOP REAR)

HINGED REAR DOOR

FIXED FRONT PANELS
NO SCREWS SHOWING

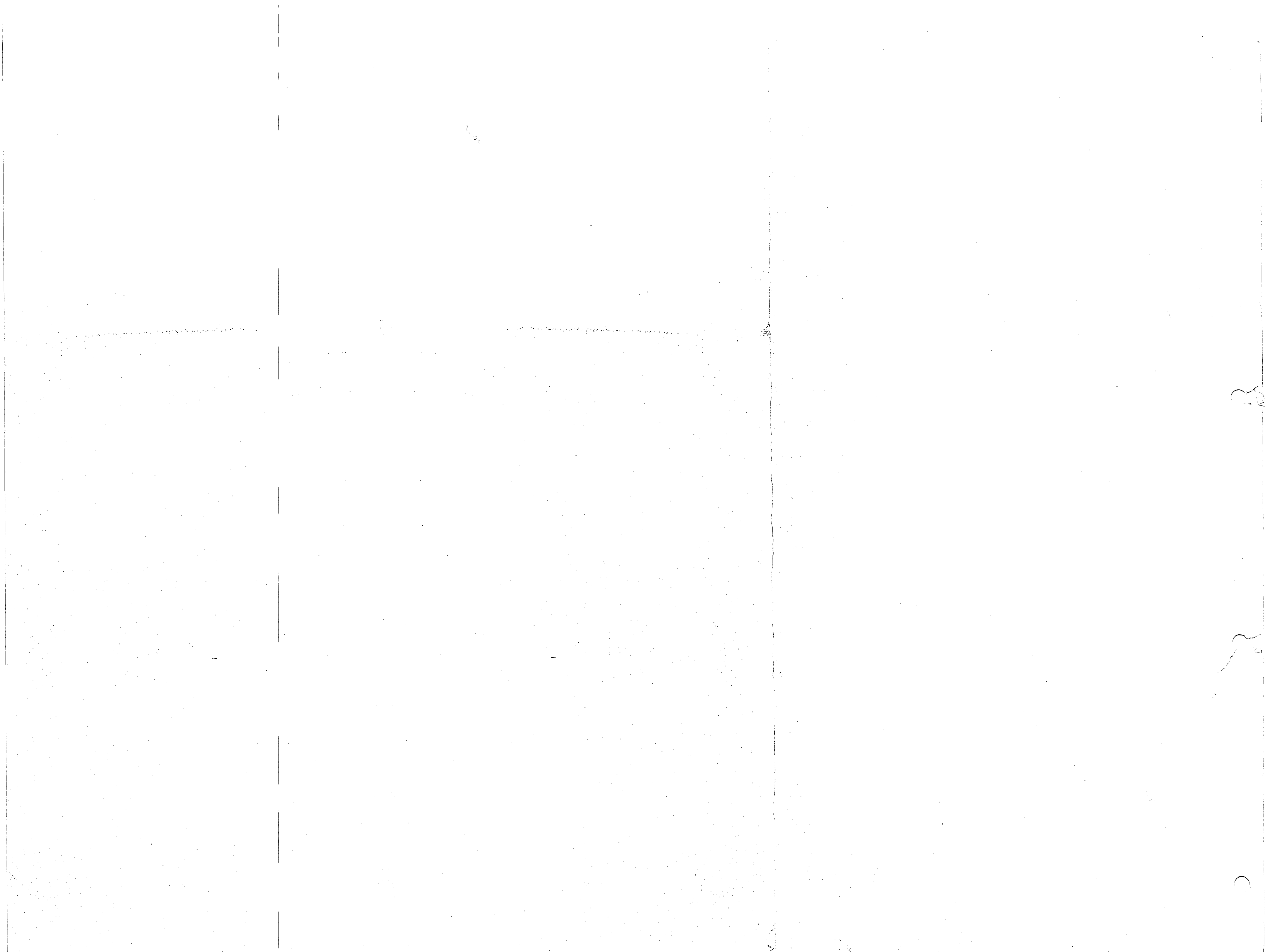
91 1/2
90



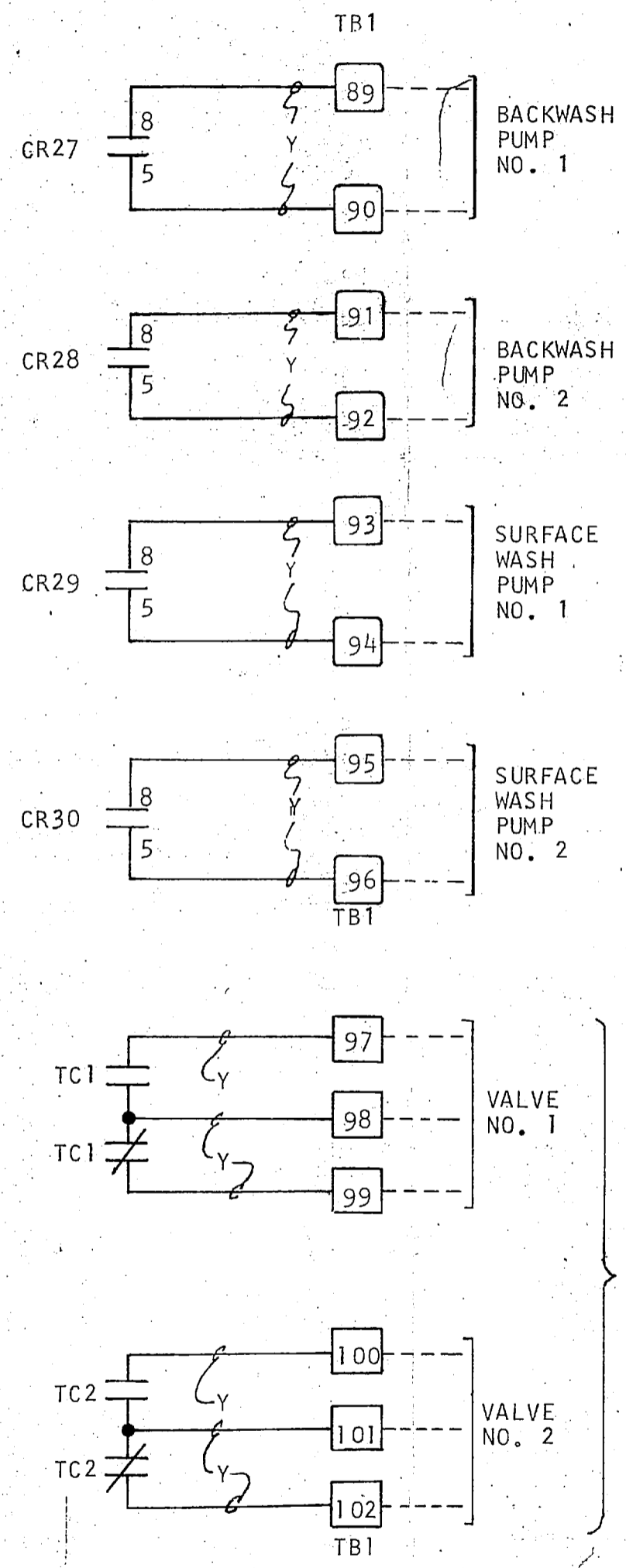
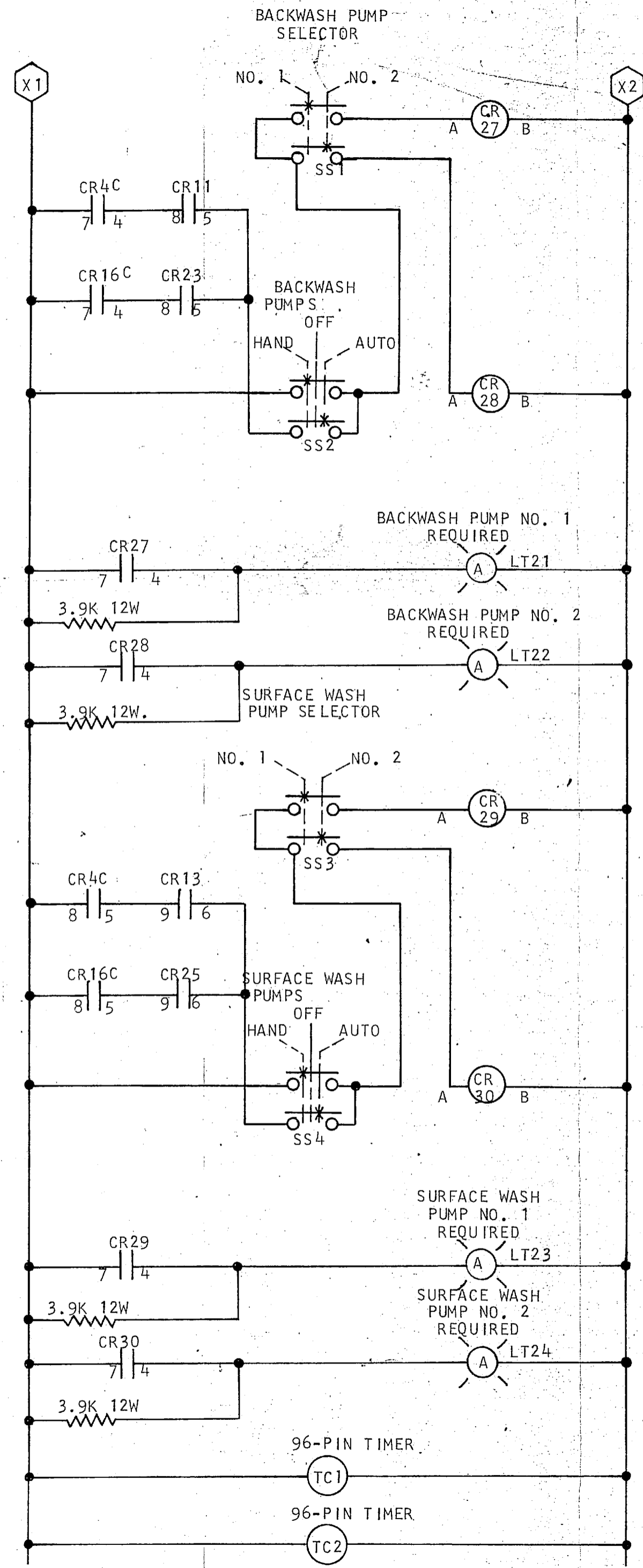
SWING-OUT
ELECTRONIC
EQUIPMENT
FRAME IN
THIS UNIT

NOTE: PAGE 2 IS 'B' SIZE.

TITLE: DIMENSIONS AND ARRANGEMENT MAIN CONTROL ENCLOSURE - NEMA 1 NEW RIVER WATER TREATMENT PLANT		ITEM "M" PAGE 1 OF 2	
SHOP ORDER 15726	JOB NAME JACKSONVILLE, N.C.	MATERIAL 12 GA. C.R.S.	
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		FINISH GRAY HAMMERTONE	
TOLERANCES: UNLESS OTHERWISE SPECIFIED. TWO PLACE DEC. ± .010. THREE PLACE DEC. ± .005. FRACTIONS ± 1/64. ANGULAR.		DESIGNED TWM DATE 8-8-75	DRAWN HJG 8/6/75 CHECKED Sum
DO NOT SCALE		DRAWING NO. IM01121	REV. B



REV	C.O. NO.	DATE	DESCRIPTION	CHK	APR
A	3723	8/7/75	RELEASED		
B	HJG	2-10-76	CUST'S. CHANGES		
C	HJG	3-9-76	CUST'S. CHANGES		



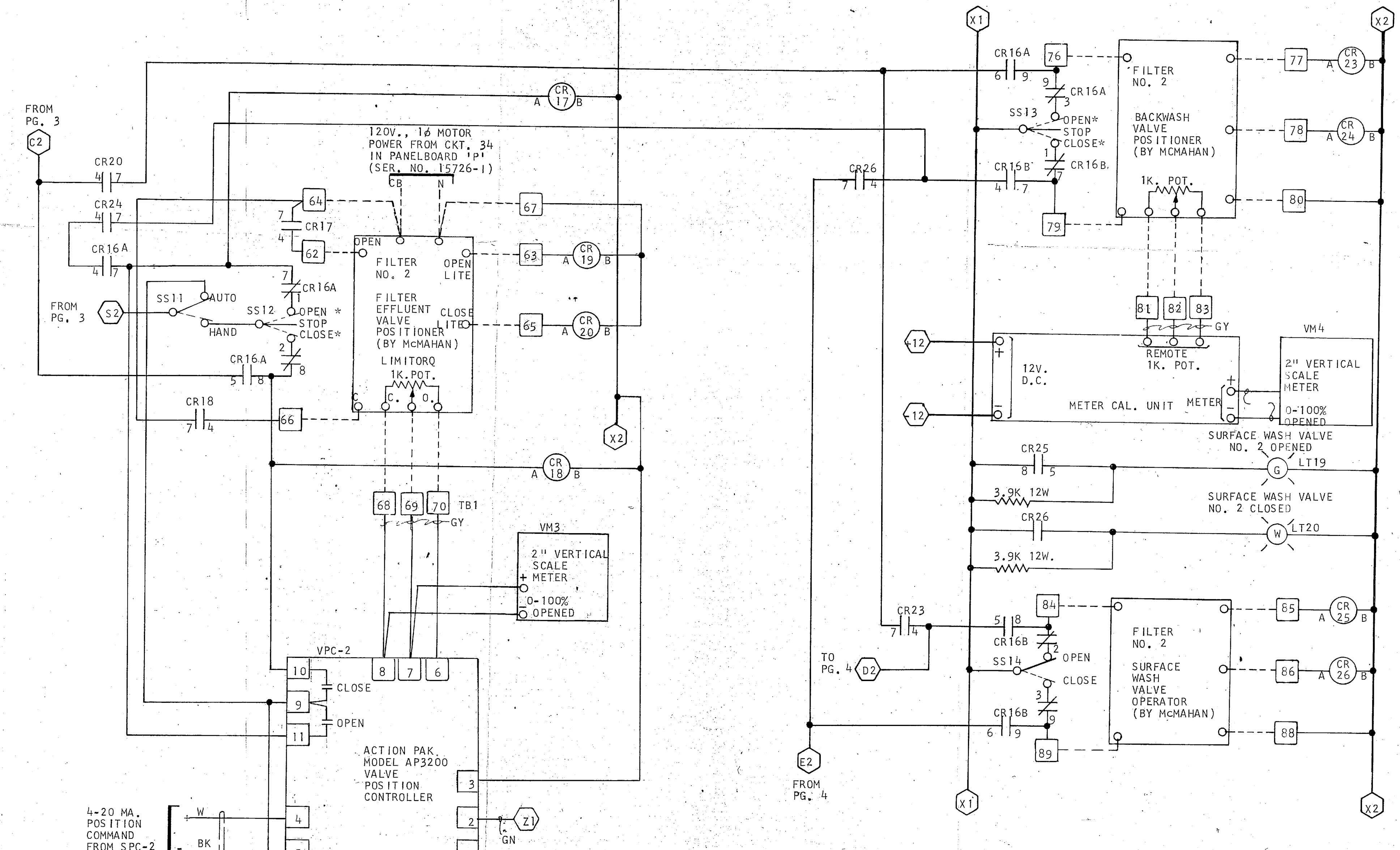
UNPOWERED CONTACTS TO MOTOR STARTER PILOT CIRCUITS

CONTACTS RATED 10 AMPS @ 240 V.AC

UNPOWERED CONTACTS RATED 20A. @ 230V. AC 5A. @ 460V. AC FOR CONTROL OF SLUDGE BLOW-DOWN SOLENOID VALVES

TITLE:		WIRING DIAGRAM, FILTER CONSOLE CAMP GEIGER SEWAGE TREATMENT PLANT		S.O. ITEM "K"	
SHOP ORDER	15726	JOB NAME	JACKSONVILLE, N.C.		
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107				PAGE 6 OF 6	
TOLERANCES: UNLESS OTHERWISE SPECIFIED: TWO PLACE DEC. ± .010. THREE PLACE DEC. ± .005. FRACTIONS ± 1/64. ANGULAR.		DO NOT SCALE	DESIGNED: TWIM DATE: 7-29-75	DRAWN: HJG 7/18/75 CHECKED: [Signature]	DRAWING NO.: 902069-01
					REV. C

REV	C.O. NO.	DATE	DESCRIPTION	CHK	APR
A	3723	8/7/75	RELEASED		
B	HJG	2-10-76	CUST'S. CHANGES		
C	HJG	3-9-76	CUST'S. CHANGES		



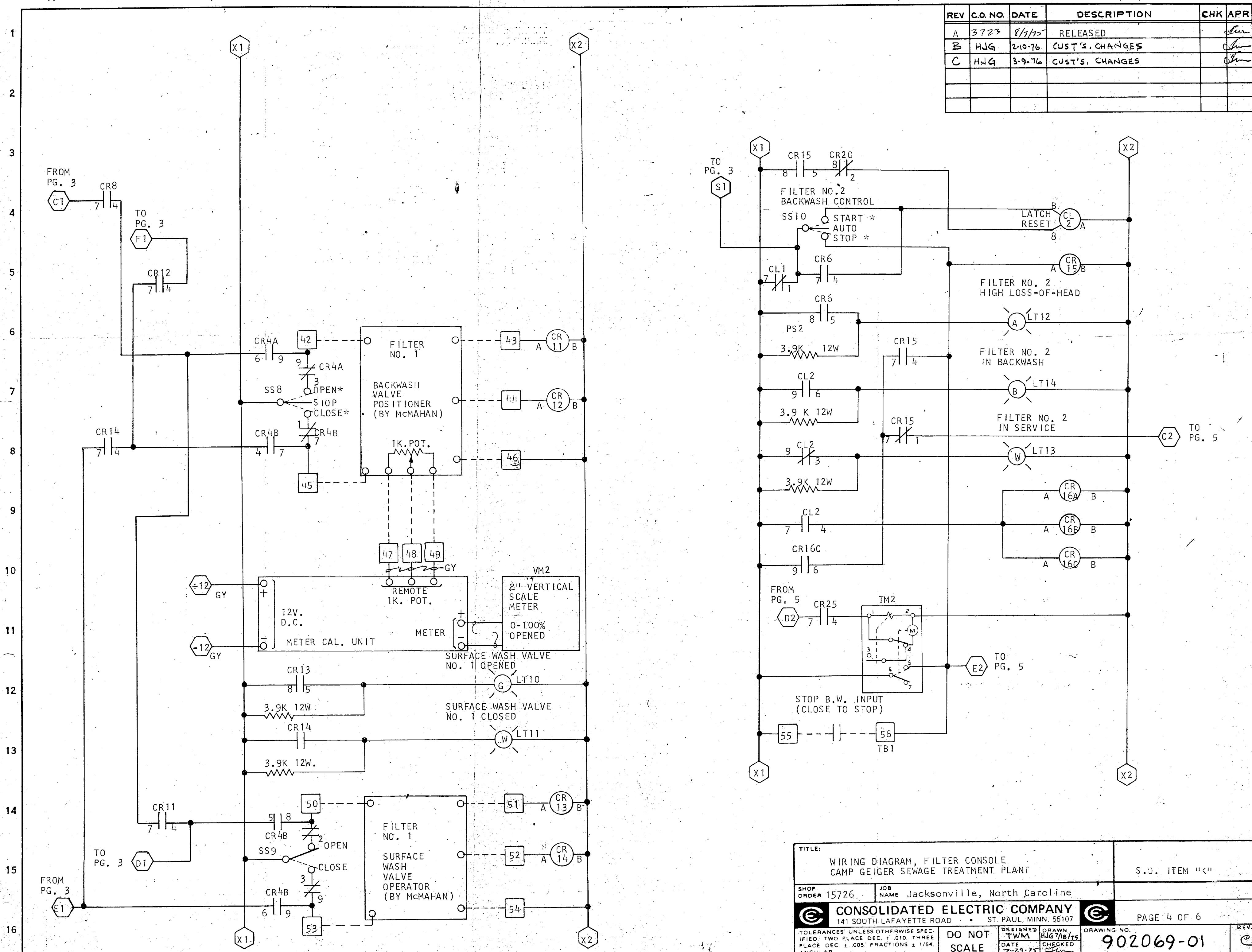
TITLE: WIRING DIAGRAM, FILTER CONSOLE CAMP GEIGER SEWAGE TREATMENT PLANT		"SHOP ORDER ITEM "K"
SHOP ORDER 15726	JOB NAME JACKSONVILLE, NORTH CAROLINA	
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		PAGE 5 OF 6
TOLERANCES: UNLESS OTHERWISE SPECIFIED. TWO PLACE DEC. ± .010. THREE PLACE DEC. ± .005. FRACTIONS ± 1/64. ANGULAR.	DO NOT SCALE	DRAWING NO. 902069-01
DESIGNED TWM	DRAWN HJG 7/18/75	REV. e
DATE 7-29-75	CHECKED	

C

C

C

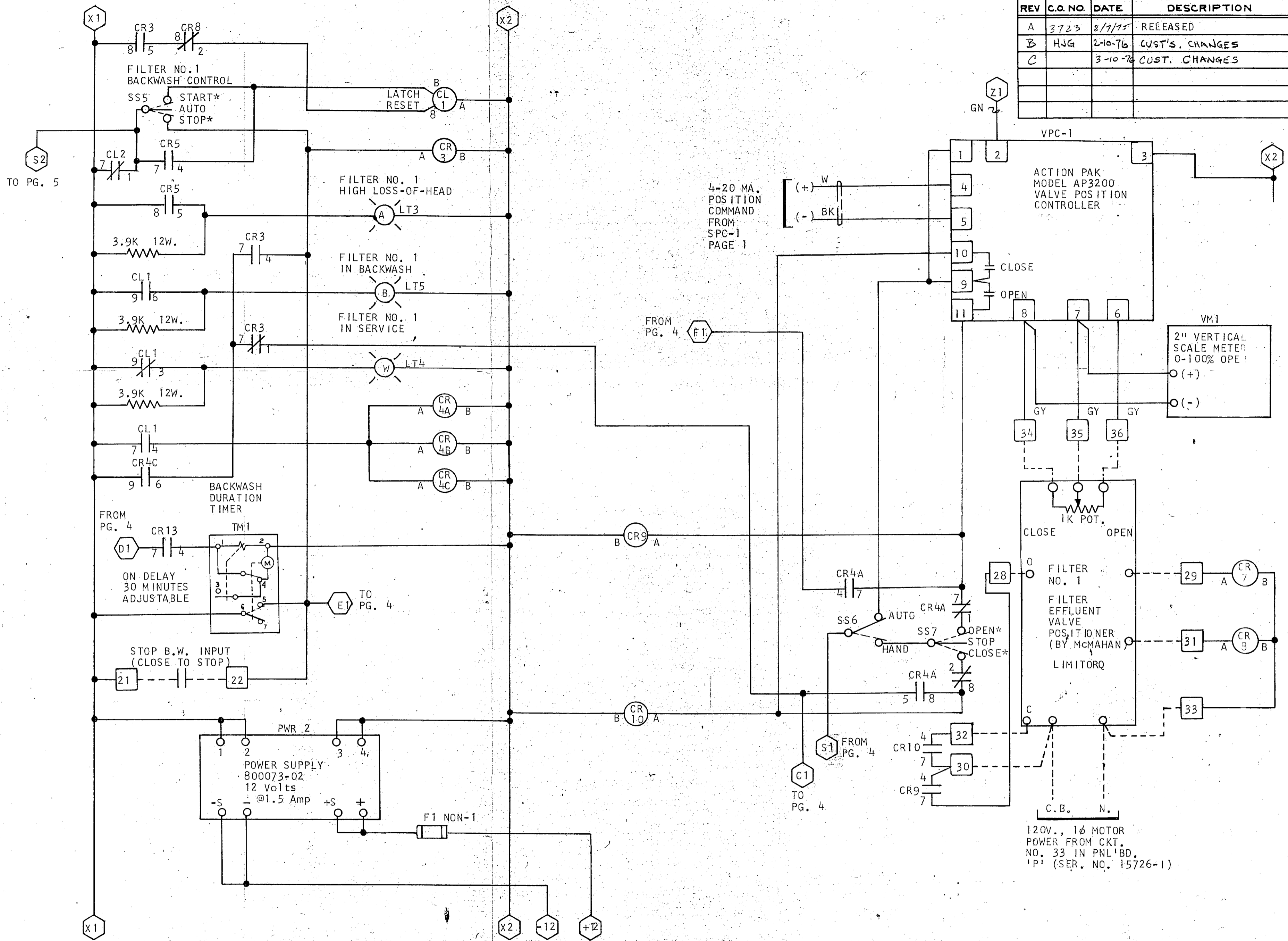
REV	C.O. NO.	DATE	DESCRIPTION	CHK	APR
A	3723	8/7/75	RELEASED		
B	HJG	2-10-76	CUST'S. CHANGES		
C	HJG	3-9-76	CUST'S. CHANGES		



TITLE: WIRING DIAGRAM, FILTER CONSOLE CAMP GEIGER SEWAGE TREATMENT PLANT		S.J. ITEM "K"	
SHOP ORDER 15726	JOB NAME Jacksonville, North Carolina		
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		PAGE 4 OF 6	
TOLERANCES UNLESS OTHERWISE SPECIFIED: TWO PLACE DEC. ± .010, THREE PLACE DEC. ± .005, FRACTIONS ± 1/64, ANGULAR.		DO NOT SCALE	DESIGNED TWM DRAWN HJG 7/18/75 DATE 7-29-75 CHECKED <i>[Signature]</i>
DRAWING NO. 902069-01			REV. <i>[Signature]</i>

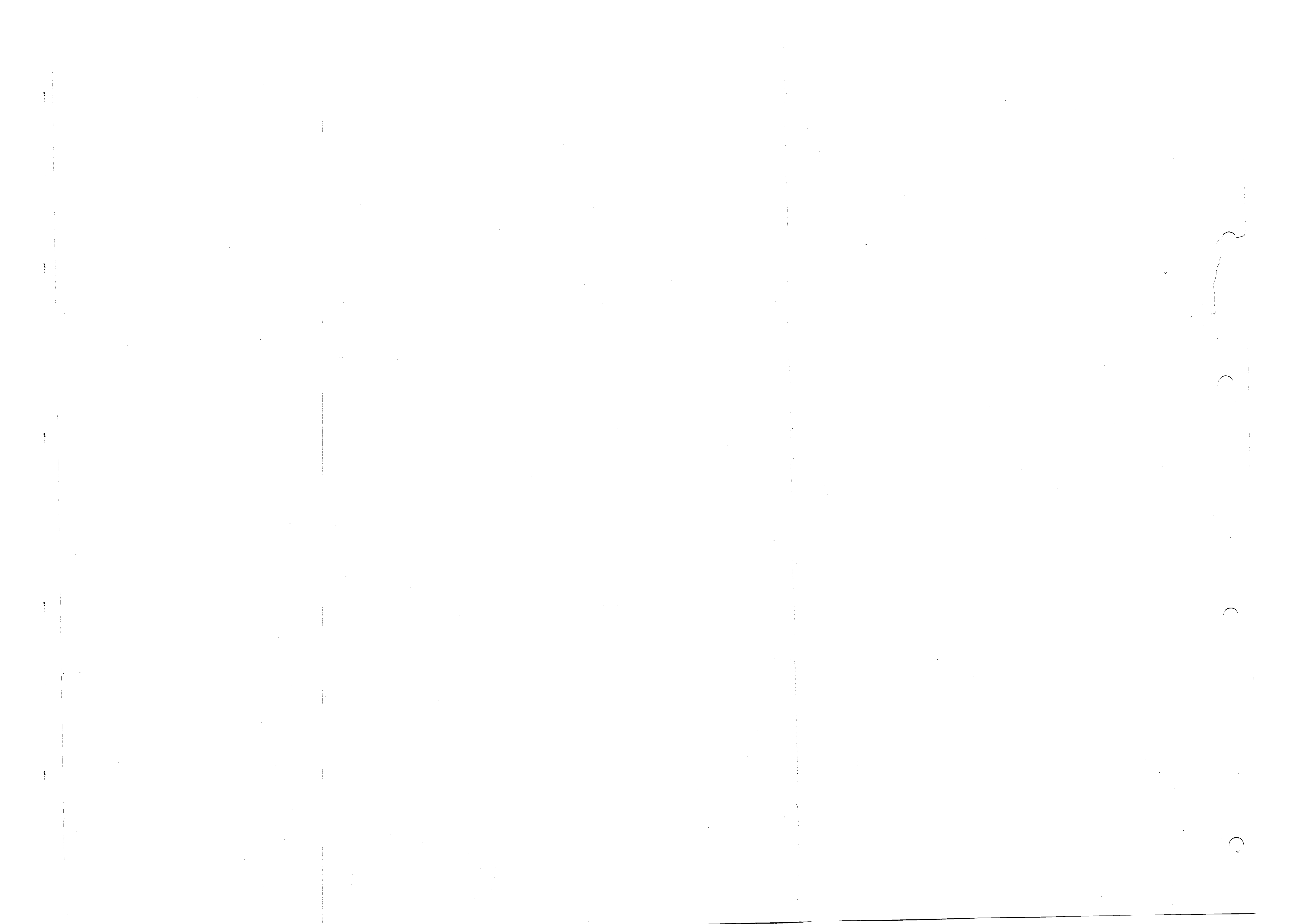


REV	C.O. NO.	DATE	DESCRIPTION	CHK	APR
A	3723	8/7/75	RELEASED		Sum
B	HJG	2-10-76	CUST'S. CHANGES		Sum
C		3-10-76	CUST. CHANGES		Sum

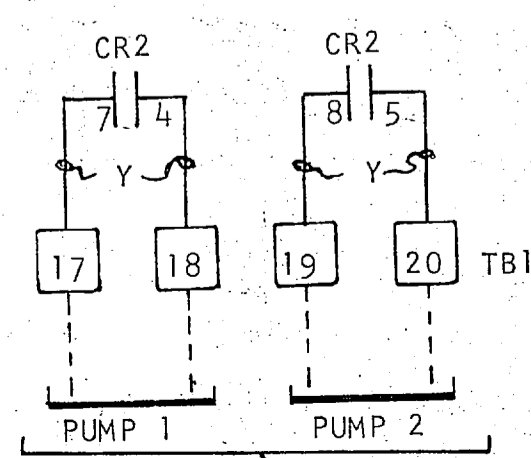
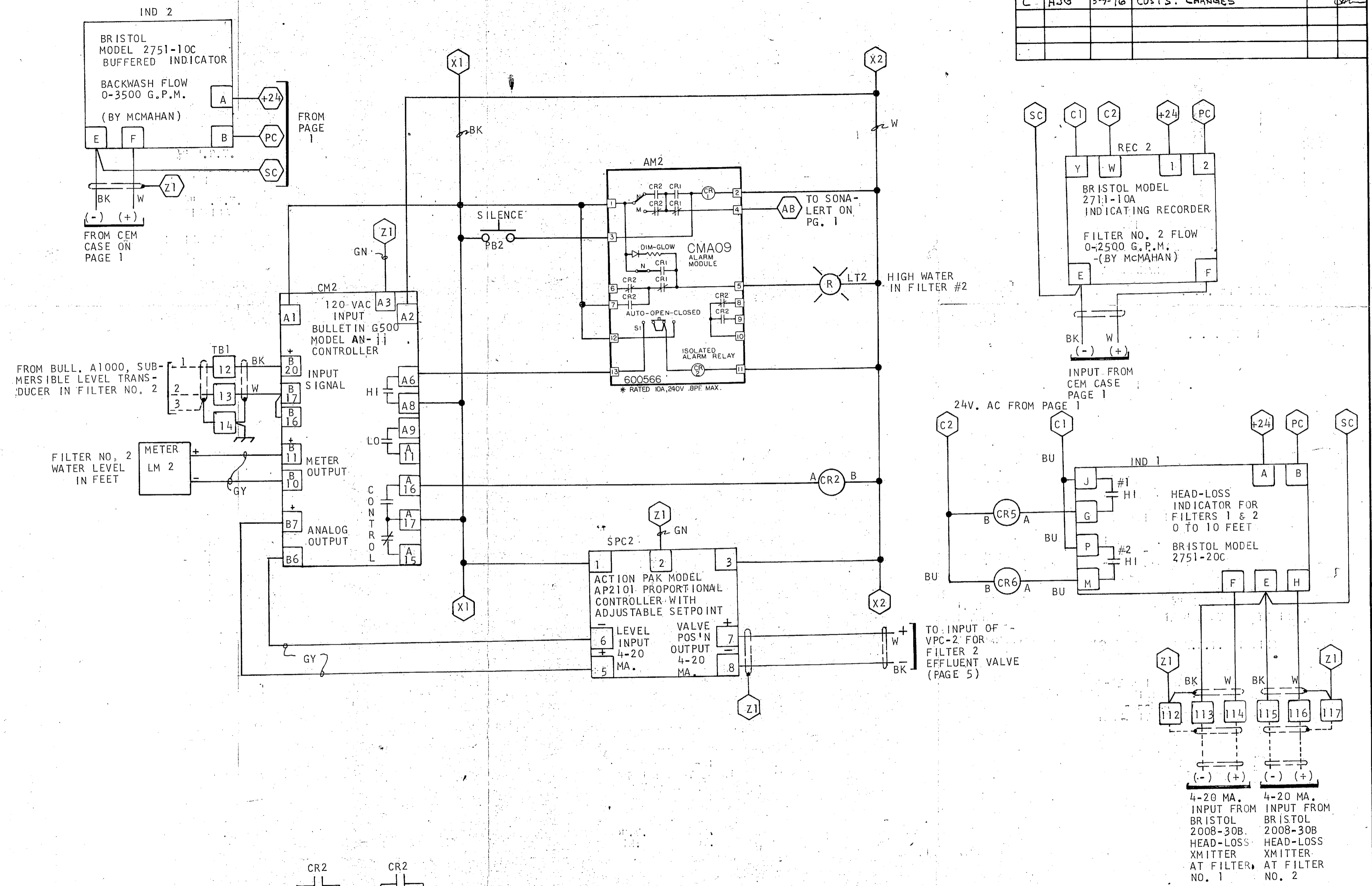


* MOMENTARY SWITCH POSITION

TITLE: WIRING DIAGRAM, FILTER CONSOLE CAMP GEIGER SEWAGE TREATMENT PLANT		S.O. ITEM "K"	
SHOP ORDER 15726	JOB NAME JACKSONVILLE, N.C.		
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		PAGE 3 OF 6	
TOLERANCES: UNLESS OTHERWISE SPECIFIED. TWO PLACE DEC. ± .010. THREE PLACE DEC. ± .005. FRACTIONS ± 1/64 ANGULAR.	DO NOT SCALE	DESIGNED TWM DATE 7-29-75	DRAWN HJG 7/18/75 CHECKED Sum
DRAWING NO. 902069-01			REV. C



REV	C.O. NO.	DATE	DESCRIPTION	CHK	APR
A	3723	8/1/75	RELEASED		
B	HJG	2-10-76	CUST'S. CHANGES		
C	HJG	3-9-76	CUST'S. CHANGES		



UNPOWERED CONTACTS TO BE WIRED IN SERIES (BY OTHERS) WITH M.S. PILOT CIRCUITS FOR FILTER EFFLUENT PUMPS. CONTACTS OPEN ON LOW WATER LEVEL IN FILTER. CONTACTS RATED 10 AMPS. @ 240V. AC.

TITLE: WIRING DIAGRAM, FILTER CONSOLE CAMP GEIGER SEWAGE TREATMENT PLANT		S.O. ITEM "K"	
SHOP ORDER 15726	JOB NAME JACKSONVILLE, N.C.	PAGE 2 OF 6	
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		DRAWING NO. 902069-01	
TOLERANCES UNLESS OTHERWISE SPECIFIED: TWO PLACE DEC. ± .010. THREE PLACE DEC. ± .005. FRACTIONS ± 1/64. ANGULAR.	DO NOT SCALE	DESIGNED TWM DATE 7-29-75	DRAWN HJG 7/8/75 CHECKED

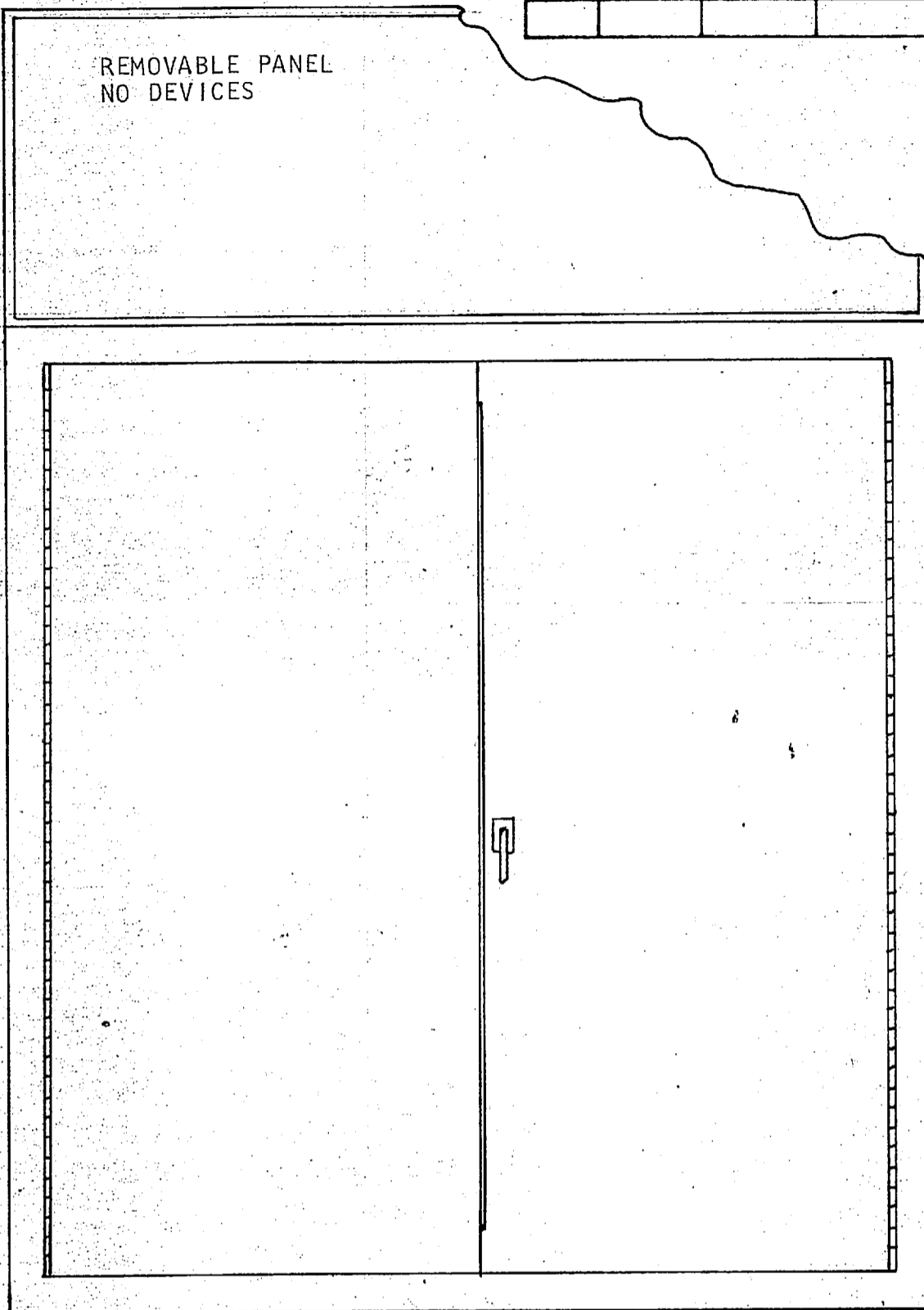
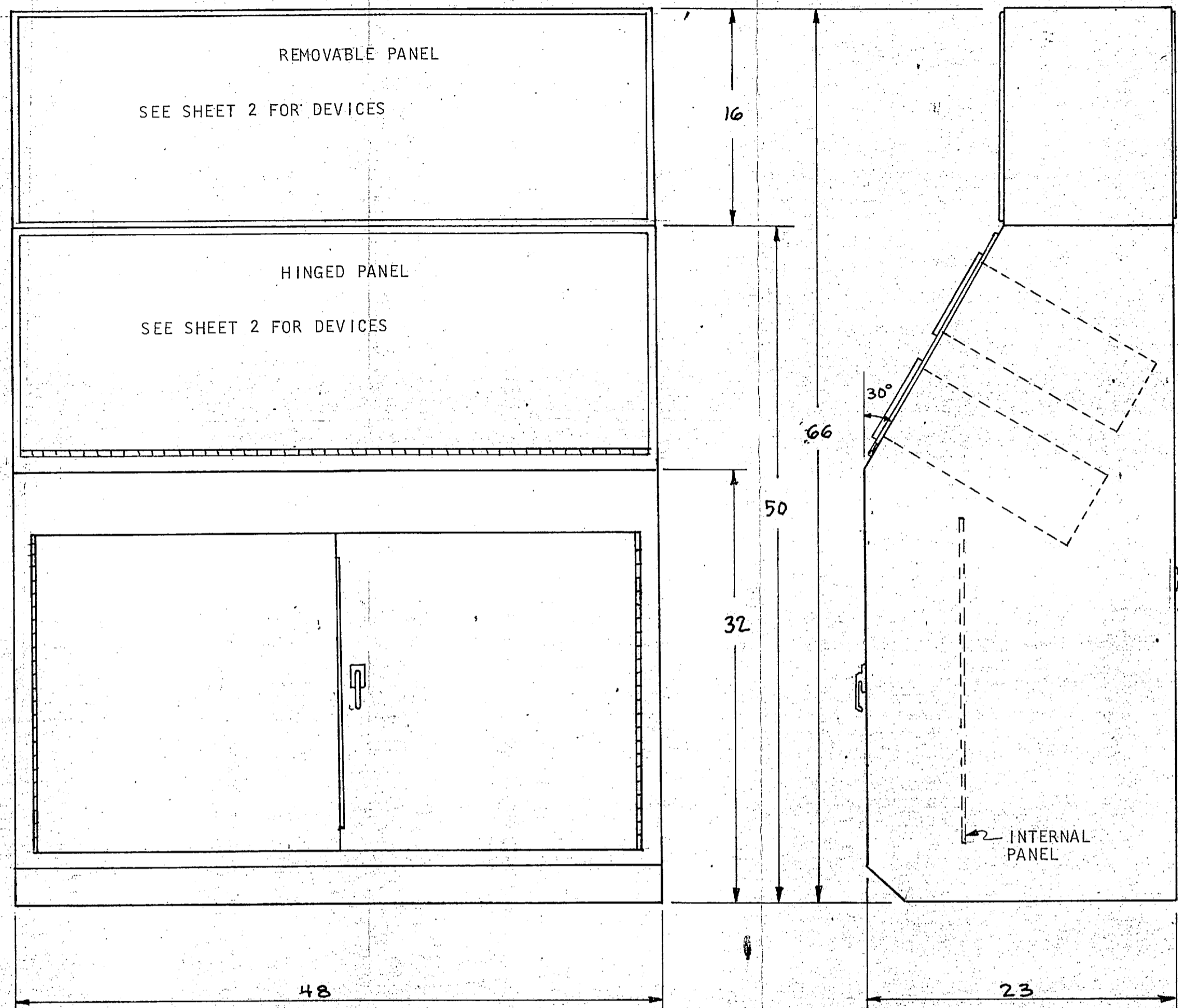
17

18

19

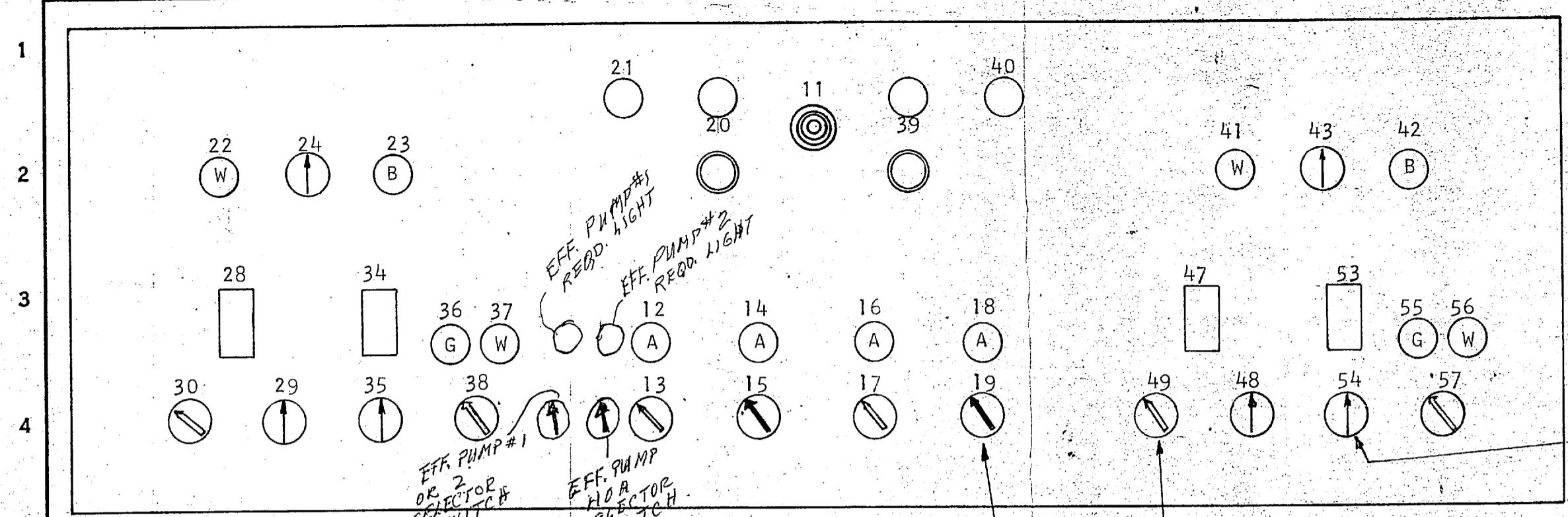
REV.	CO. NO.	DATE	DESCRIPTION	CHK.	APP.
A	3723	8/7/75	RELEASED		
B	HJG	2-11-76	CUST'S. CHANGES		
C	HJG	3-8-76	INSTRUMENT CHANGES		

NOTE: HINGED PANEL WILL NOT PIVOT OPEN WITH DEEP DEPTH DEVICES INSTALLED



TITLE: DIMENSION DIAGRAM AND ARRANGEMENT FILTER CONSOLE - NEMA 1 CAMP GEIGER SEWAGE TREATMENT PLANT		ITEM "K" SHEET 1 OF 2	
SHOP ORDER 15726	JOB NAME JACKSONVILLE, NORTH CAROLINA	MATERIAL 14GA (.075) CRS	
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		FINISH GRAY HAMMERTONE	
TOLERANCES: UNLESS OTHERWISE SPECIFIED: TWO PLACE DEC. ± .010, THREE PLACE DEC. ± .005, FRACTIONS ± 1/64. ANGULAR.		DO NOT SCALE	DESIGNED TWM DATE 7-30-75 DRAWN HJG 8/23/75 CHECKED [Signature]
		DRAWING NO. IM01119	REV. C

REV.	CO. NO.	DATE	DESCRIPTION	CHK.	APP.
A	3723	8/7/75	RELEASED		
B	HJG	2-11-76	CUST'S. CHANGES		
C	HJG	3-8-76	INSTRUMENT CHANGES		

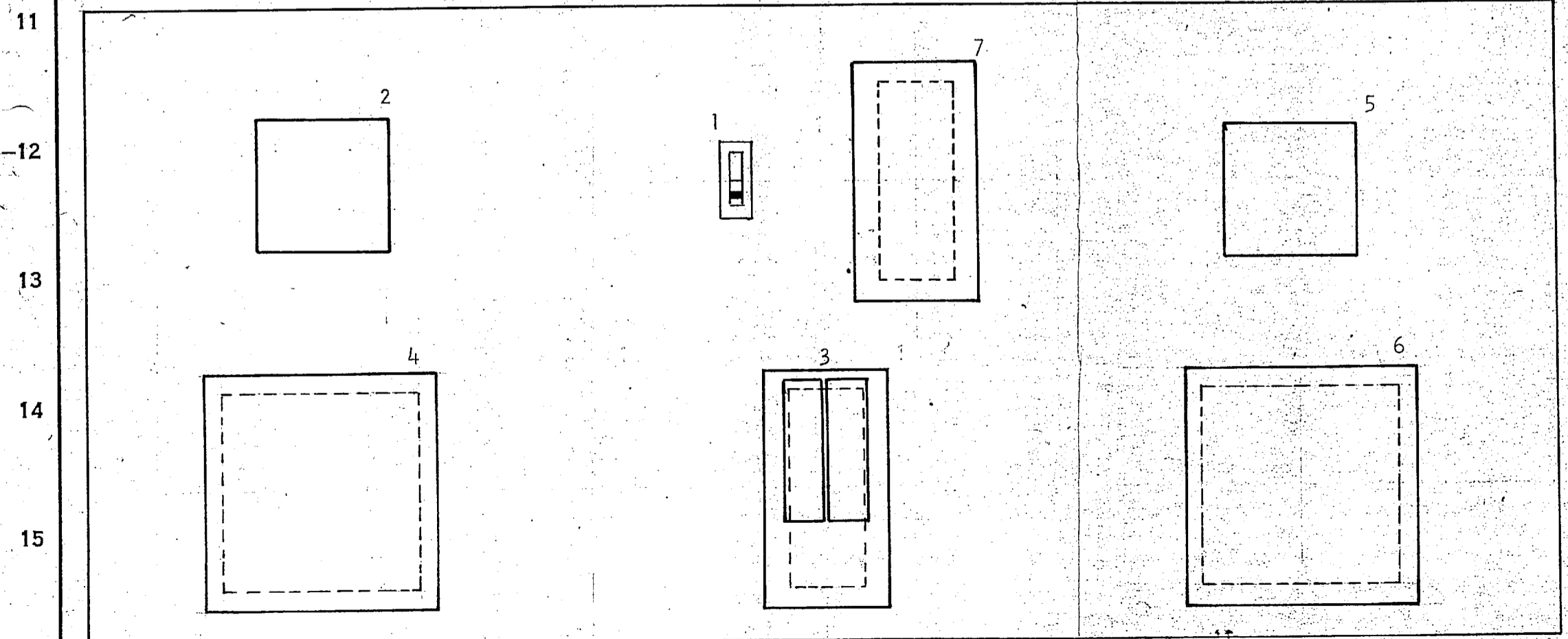


- TOP FRONT REMOVABLE PANEL
DEVICE AND/OR NAMEPLATE
- 11 SONALERT ALARM
 - 12 BACKWASH PUMP 1 REQUIRED LIGHT
 - 13 BACKWASH PUMP 1 OR 2 SELECTOR SWITCH
 - 14 BACKWASH PUMP 2 REQUIRED LIGHT
 - 15 BACKWASH PUMPS H-O-A SELECTOR SWITCH
 - 16 SURFACE WASH PUMP 1 REQUIRED LIGHT
 - 17 SURFACE WASH PUMP 1 OR 2 SELECTOR SWITCH
 - 18 SURFACE WASH PUMP 2 REQUIRED LIGHT
 - 19 SURFACE WASH PUMPS H-O-A SELECTOR SWITCH

- ALL FILTER NO. 1
- 20 RED INDICATING LIGHT - HIGH LEVEL & ALARM SILENCE PUSHBUTTON
 - 21 AMBER INDICATING LIGHT - HIGH LOSS OF HEAD
 - 22 WHITE INDICATING LIGHT - FILTER IN SERVICE
 - 23 BLUE INDICATING LIGHT - FILTER IN BACKWASH
 - 24 BACKWASH CONTROL SELECTOR SWITCH
-
- 28 EFFLUENT VALVE PERCENT OPENED METER
 - 29 EFFLUENT VALVE CONTROL SELECTOR SWITCH - OPEN-STOP-CLOSE
 - 30 EFFLUENT VALVE CONTROL SELECTOR SWITCH - HAND/AUTO
-
- 34 BACKWASH VALVE PERCENT OPENED METER
 - 35 BACKWASH VALVE POSITIONER CONTROL SWITCH
 - 36 GREEN INDICATING LIGHT - SURFACE WASH VALVE OPENED
 - 37 WHITE INDICATING LIGHT - SURFACE WASH VALVE CLOSED
 - 38 SURFACE WASH VALVE OPERATOR CONTROL SWITCH - OPEN/CLOSE

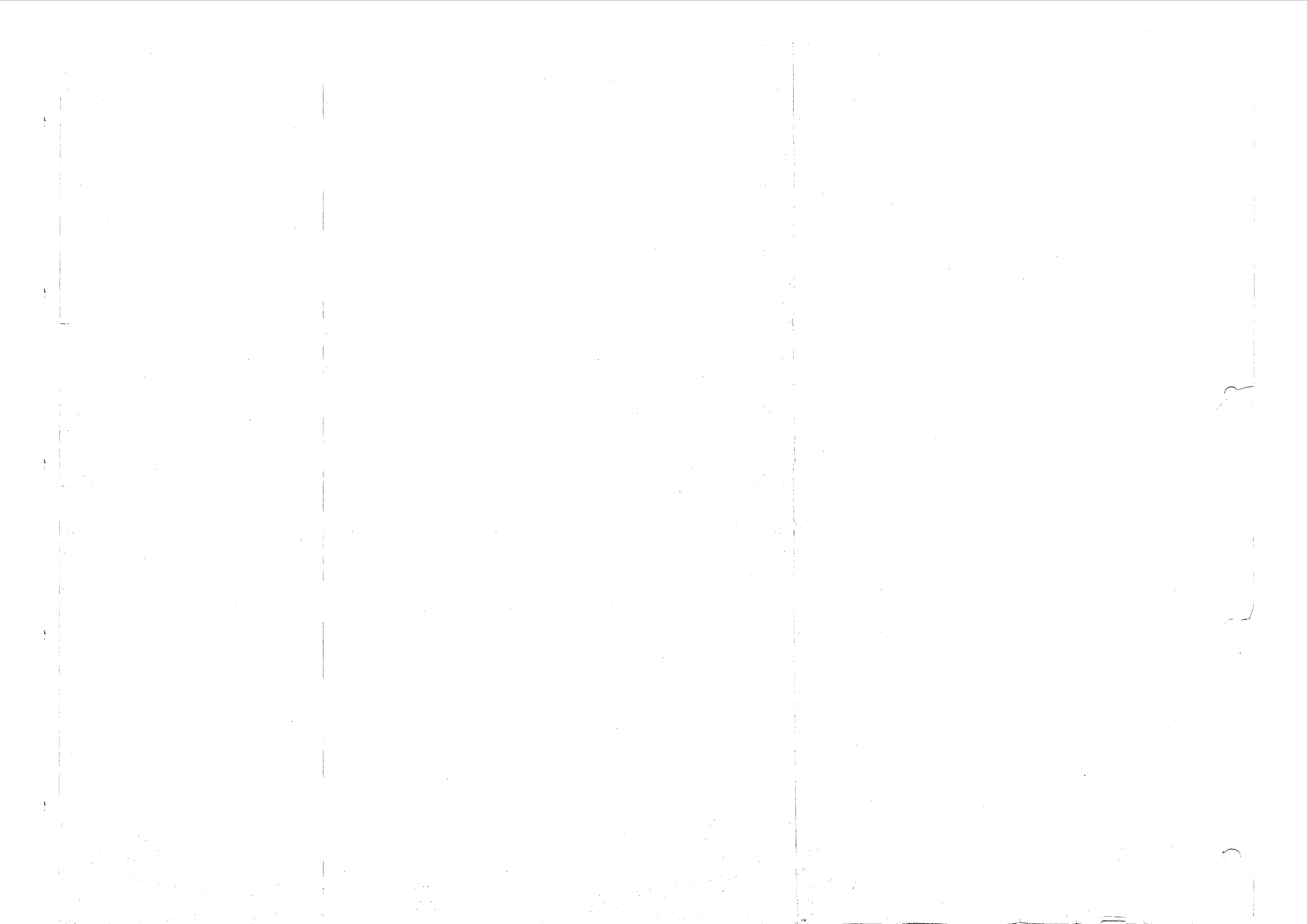
3 POSITION MAINTAINED
2 POSITION MAINTAINED

- ALL FILTER NO. 2
- 39 RED INDICATING LIGHT - HIGH LEVEL & ALARM SILENCE PUSHBUTTON
 - 40 AMBER INDICATING LIGHT - HIGH LOSS OF HEAD
 - 41 WHITE INDICATING LIGHT - FILTER IN SERVICE
 - 42 BLUE INDICATING LIGHT - FILTER IN BACKWASH
 - 43 BACKWASH CONTROL SELECTOR SWITCH
-
- 47 EFFLUENT VALVE PERCENT OPENED METER
 - 48 EFFLUENT VALVE CONTROL SELECTOR SWITCH - OPEN-STOP-CLOSE
 - 49 EFFLUENT VALVE CONTROL SELECTOR SWITCH - HAND/AUTO
-
- 53 BACKWASH VALVE PERCENT OPENED METER
 - 54 BACKWASH VALVE POSITIONER CONTROL SWITCH
 - 55 GREEN INDICATING LIGHT - SURFACE WASH VALVE OPENED
 - 56 WHITE INDICATING LIGHT - SURFACE WASH VALVE CLOSED
 - 57 SURFACE WASH VALVE OPERATOR CONTROL SWITCH - OPEN/CLOSE

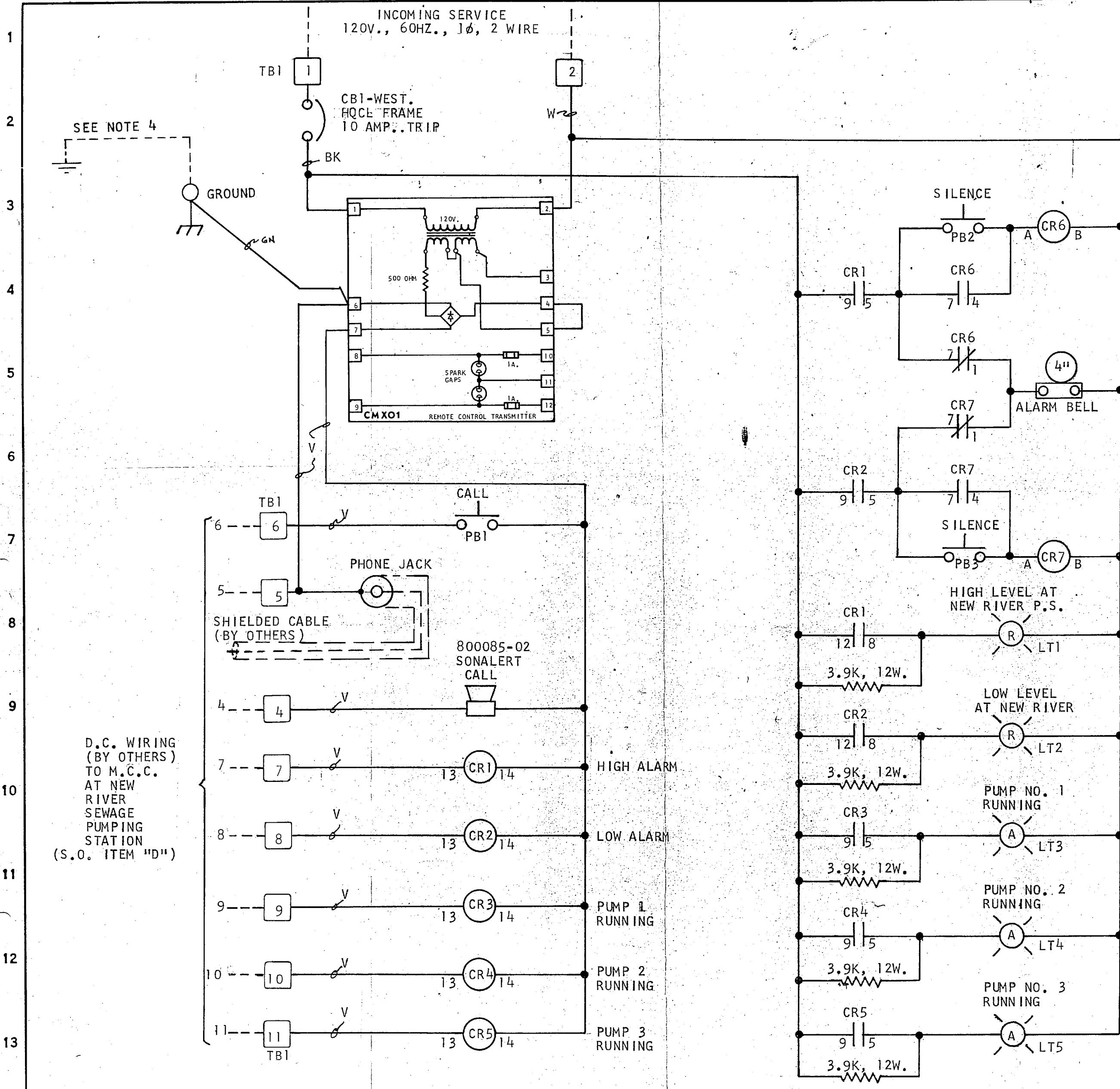


- HINGED (SLANTED) PANEL
DEVICE AND/OR NAMEPLATE
- 1 - CONTROL POWER CIRCUIT BREAKER
 - 2 - FILTER NO. 1 METER - WATER LEVEL (IN FEET)
 - 3 - FILTER NO. 1 AND NO. 2 INDICATOR - LOSS OF HEAD
 - 4 - FILTER NO. 1 INDICATING FLOW RECORDER
 - 5 - FILTER NO. 2 METER - WATER LEVEL (IN FEET)
 - 6 - FILTER NO. 2 INDICATING FLOW RECORDER
 - 7 - BACKWASH FLOW INDICATOR

TITLE: DIMENSION DIAGRAM & ARRANGEMENT FILTER CONSOLE - NEMA 1 CAMP GEIGER SEWAGE TREATMENT PLANT		ITEM "K" SHEET 2 OF 2	
SHOP ORDER 15726	JOB NAME JACKSONVILLE, NO. CAR.	MATERIAL 14 GA (.075) CRS	
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		FINISH GRAY HAMMERTONE DRAWING NO. IM01119	
TOLERANCES: UNLESS OTHERWISE SPECIFIED. TWO PLACE DEC. ± .010. THREE PLACE DEC. ± .005. FRACTIONS ± 1/64. ANGULAR.		DO NOT SCALE	DESIGNED TWM DRAWN HJG DATE 7-30-75 CHECKED <i>[Signature]</i>



REV	C.O. NO.	DATE	DESCRIPTION	CHK	APR
A	3723	8/1/75	RELEASED		



D.C. WIRING (BY OTHERS) TO M.C.C. AT NEW RIVER SEWAGE PUMPING STATION (S.O. ITEM "D")

- 5. FOR PARTS LIST SEE 201898-01.
- 4. GROUNDING LUG TO BE GROUNDED BY CUSTOMER AS PER N.E.C.
- 3. WIRE COLOR ABBREVIATIONS:
 BLACK-BK GRAY-GY
 WHITE-W BROWN-BR
 ORANGE-OR BLUE-BU
 YELLOW-Y VIOLET-V
 RED-R PINK-P
 GREEN-GN
- 2. ALL WIRING IS RED UNLESS NOTED. ALL RED WIRING IS 16 GA. AND ALL ELSE IS 14 GA.
- 1. ALL DASHED WIRING IS DONE BY OTHERS.

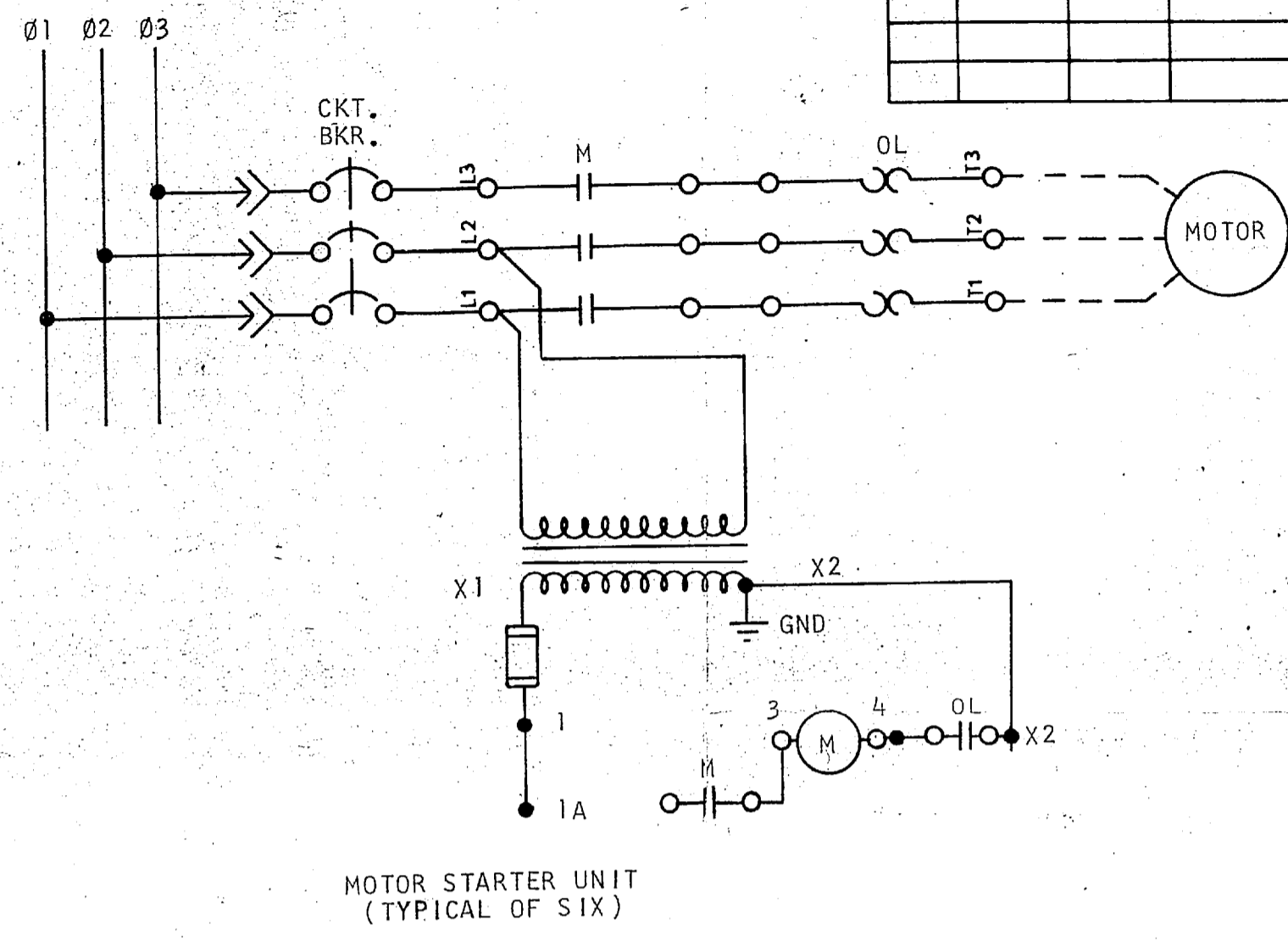
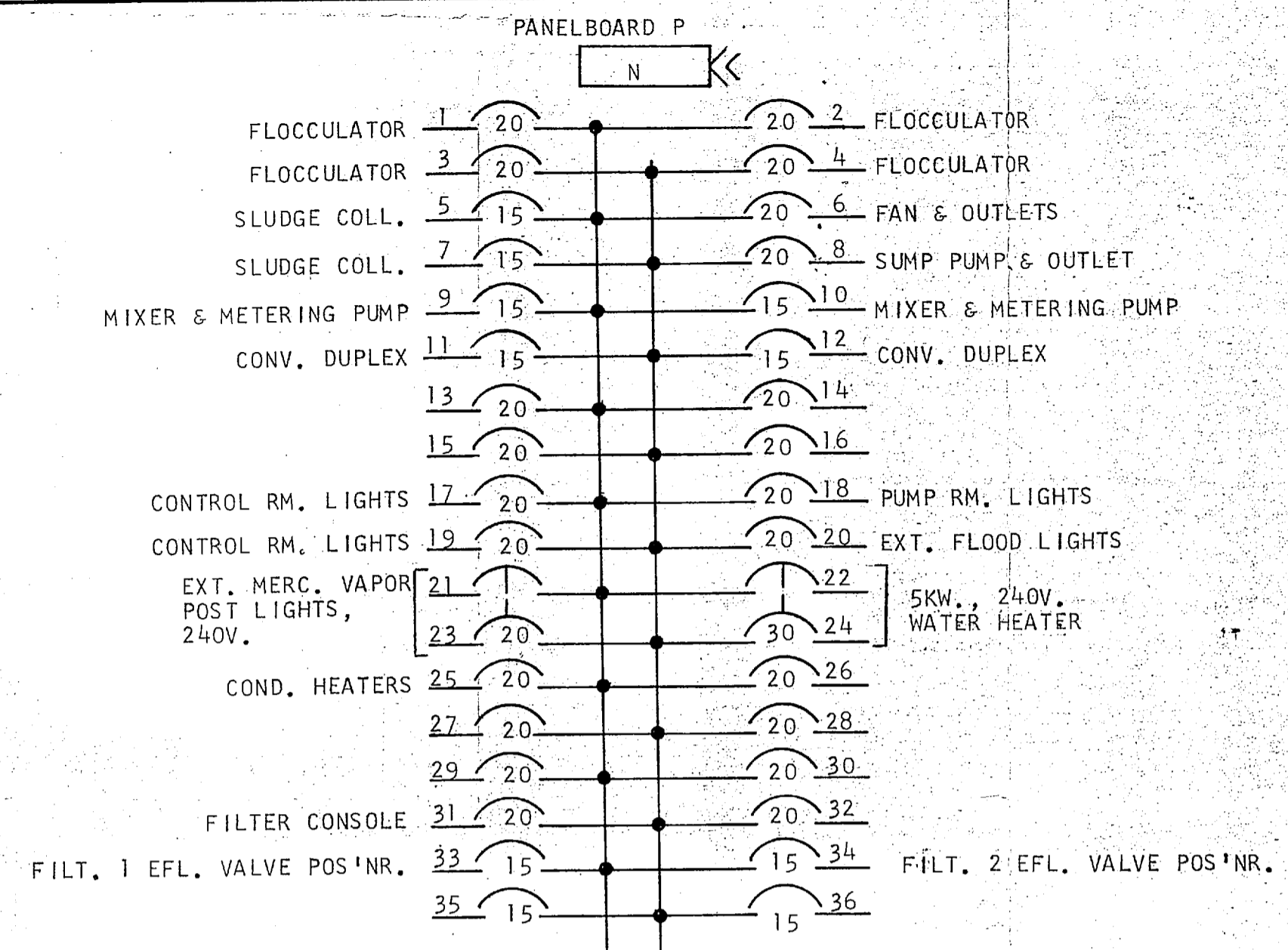
TITLE: WIRING DIAGRAM, ANNUNCIATOR PANEL FOR GEIGER SEWAGE TREATMENT PLANT		S.O. ITEM "J"	
SHOP ORDER 15726	JOB NAME JACKSONVILLE, N.C.		
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		PAGE 1 OF 1	
TOLERANCES: UNLESS OTHERWISE SPECIFIED, TWO PLACE DEC. ± .010, THREE PLACE DEC. ± .005, FRACTIONS ± 1/64. ANGULAR.	DO NOT SCALE	DESIGNED TWM DRAWN HJG 7/1/75 DATE 7-30-75 CHECKED	DRAWING NO. 902068-01 REV. A

C

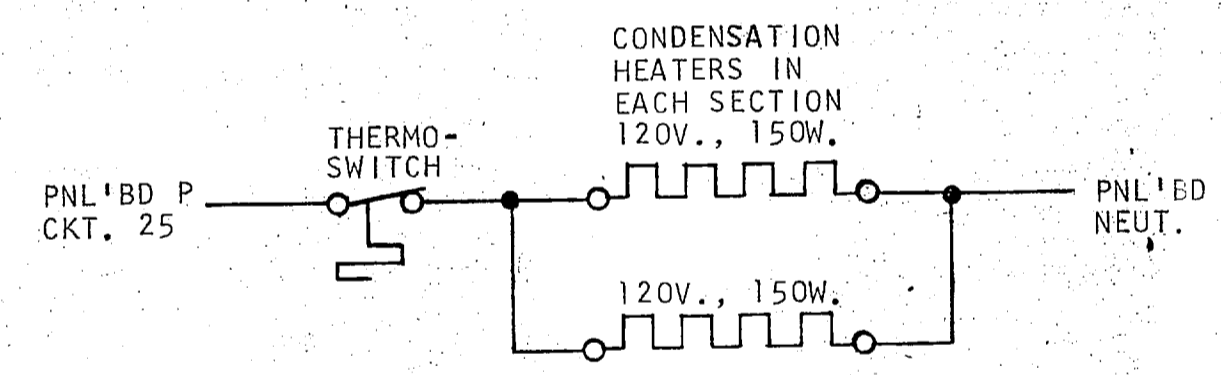
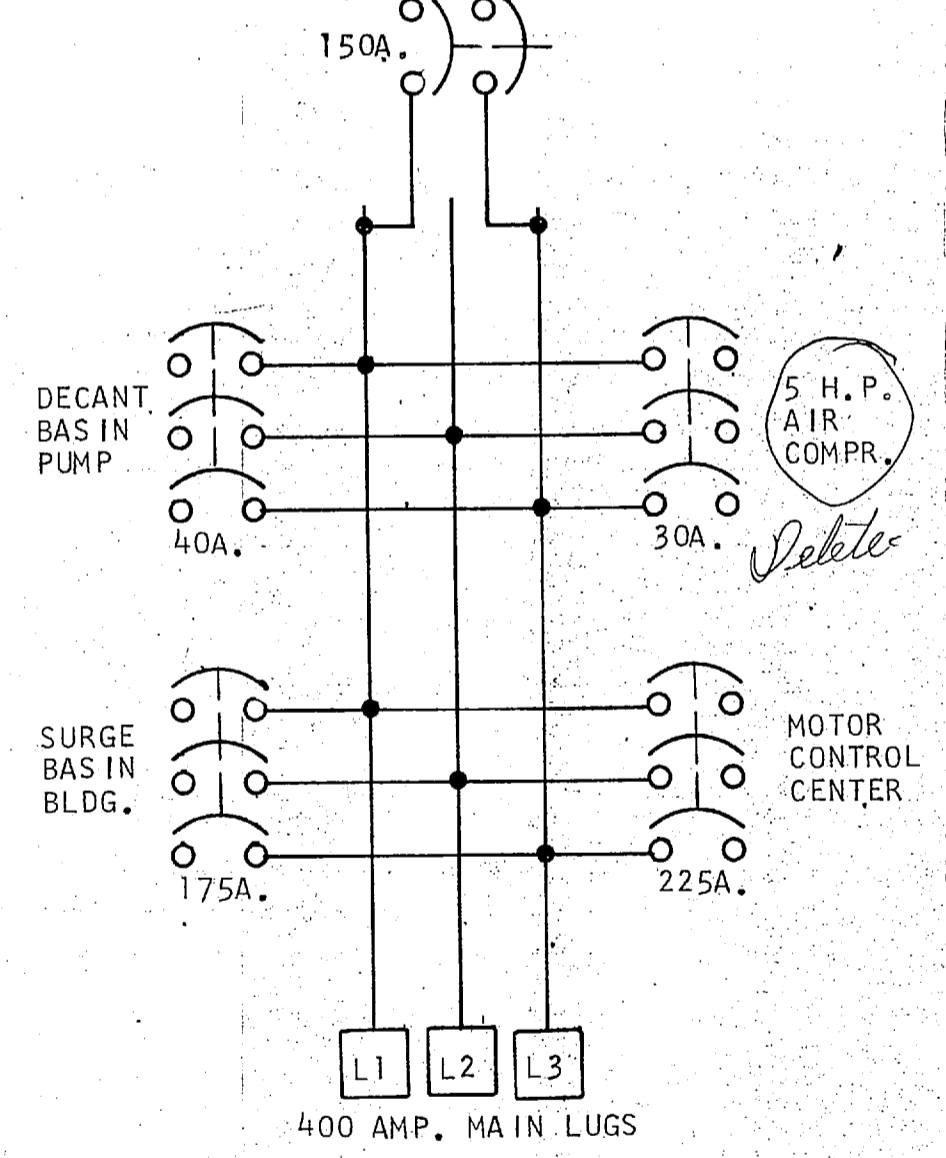
C

C

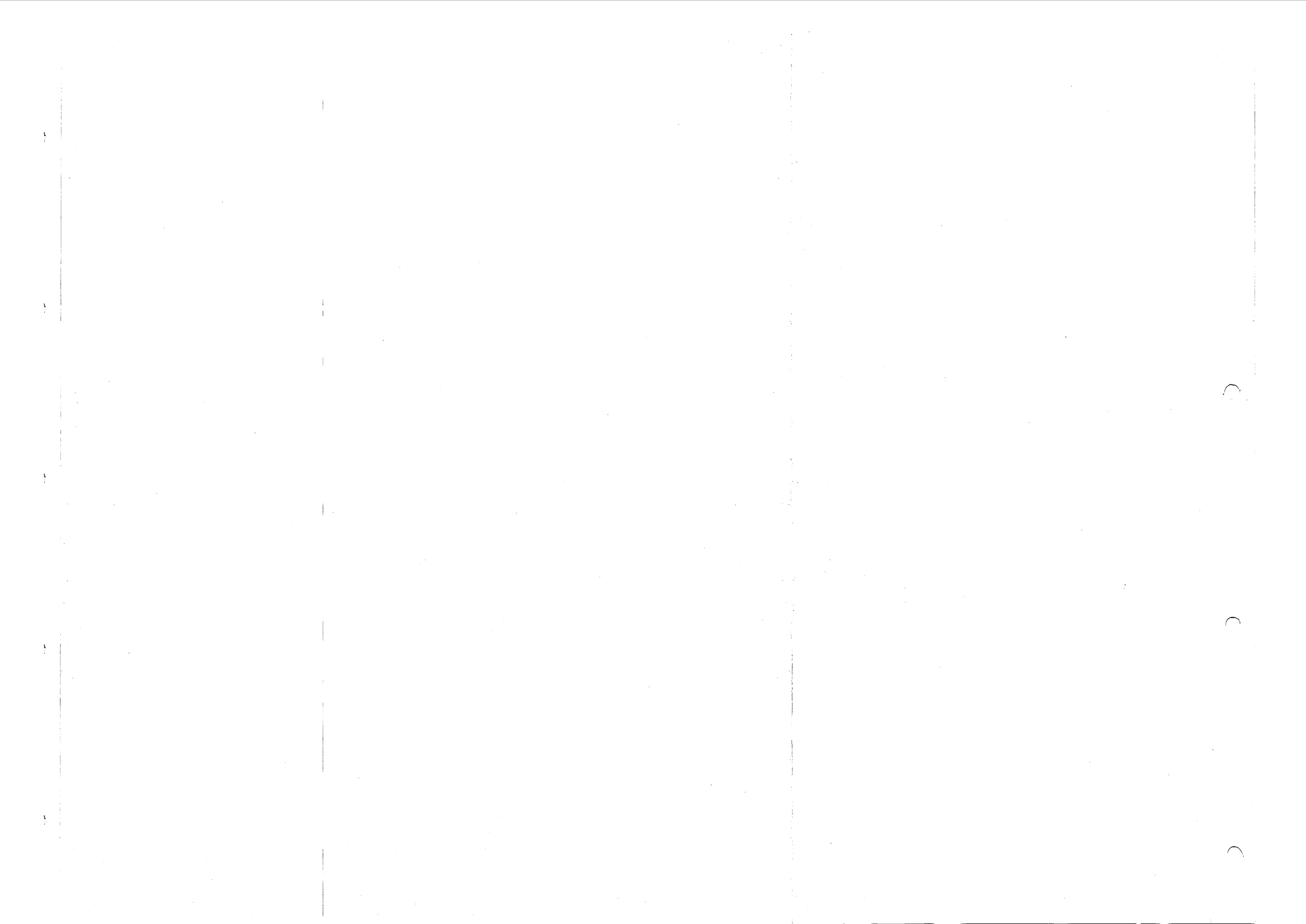
REV	C.O. NO.	DATE	DESCRIPTION	CHK	APR
A	3723	8/7/75	RELEASED		
B	HJG	3-8-76	LABEL FILTER CKTS		

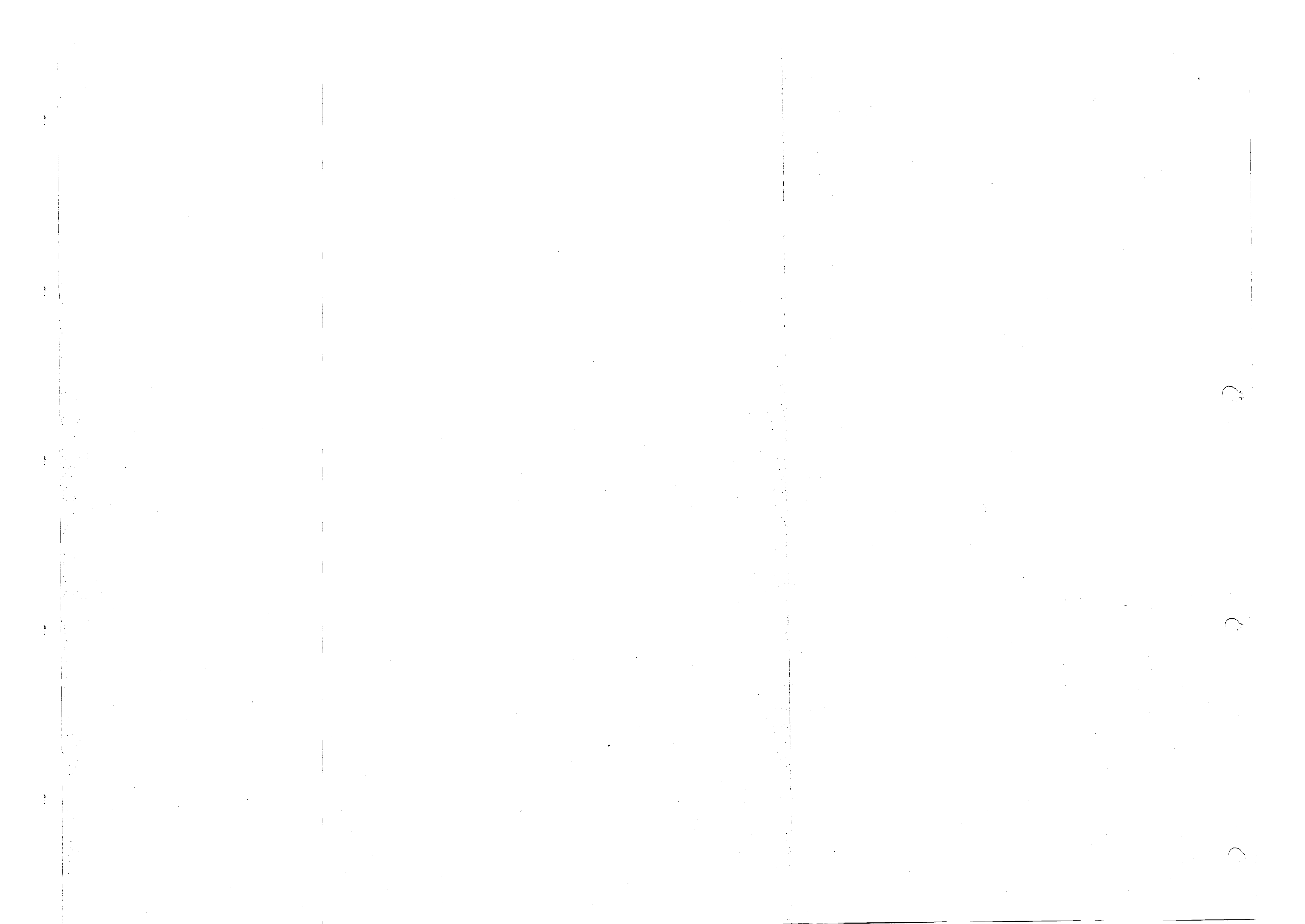


MOTOR STARTER UNIT (TYPICAL OF SIX)



TITLE: WIRING DIAGRAM, POWER AND CONTROL CENTER, CAMP GEIGER SEWAGE TREATMENT PLANT		S.O. ITEM "I"	
SHOP ORDER 15726	JOB NAME JACKSONVILLE, N.C.		
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		PAGE 1 OF 1	
TOLERANCES UNLESS OTHERWISE SPECIFIED. TWO PLACE DEC. ± .010. THREE PLACE DEC. ± .005. FRACTIONS ± 1/64 ANGULAR.	DO NOT SCALE	DESIGNED TWM DATE 7-30-75 DRAWN HJG CHECKED 7-1-75	DRAWING NO. 902067-01 REV. B





GENERAL ORDER: [] ITEM: []
 MCC TITLE: JACKSONVILLE, N.C. (P. 40)
 CUSTOMER: CONSOLIDATED ELECTRIC CO.
 LOCATION: ST. PAUL, MINN.
 PREPARED BY: L. Hillquist DATE: 7-10-75

ELECTRICAL STANDARDS
 NATIONAL CODES
 NEMA (STANDARD)
 ANSI

LOCAL CODES
 STATE OF CALIFORNIA
 CITY OF CHICAGO
 CITY OF LOS ANGELES
 CITY OF PORTLAND

DRAWINGS FOR
 CONSTRUCTION
 CUSTOMER APPROVAL

ENCLOSURE - NEMA
 INDOOR NEMA
 1 (STANDARD) 2 DRIP PROOF
 1A (GASKETED) 12 INDUSTRIAL DUST TIGHT

OUTDOOR
 JR NON WALK IN WALK IN TUNNEL VENT
 WALK IN FRONT VENT WALK IN TUNNEL GASK
 WALK IN FRONT GASK

STRUCTURE
 DEPTH 15 20
 WIREWAY WIDTH 4 9
 LOCATION LEFT CENTER RIGHT
 MAST TERM. BLK. LOCATION BOTTOM (9") TOP (15")
 UNIT MOUNTING FRONT ONLY FRONT & REAR
 SHIPPING SPLIT

MAIN HORIZONTAL BUS
 MATERIAL
 ALUMINUM (STANDARD) COPPER WITH SILVER PLATE
 COPPER BARE

RATING - AMPERES
 600 1000 1400 2000
 800 1200 1600 2500

VERTICAL BUS
 MATERIAL
 COPPER (STANDARD) ALUMINUM

RATING
 300 FMO STD. 600 FRONT MTG ONLY
 500 BR STD.

BUS BRACING
 SYMMETRICAL VALUES
 22,000 50,000 (CU ONLY)
 25,000 65,000 (CU ONLY)
 42,000

INCOMING LINE
 ENTRY TOP BOTTOM
 No. PER PHASE 2
 SIZE #6-350MCM

FINISH
 TWO TONE GRLY (STANDARD)
 SPECIAL

NAMEPLATES
 SIZE 1 x 2- 1 x 3-
 COLOR BLACK, WHITE LETTERS WHITE, BLACK LETTERS
 LETTER SIZE 1/8" 1/4" 3/8"

INSULATED BUS
 BUS TYPE HORIZONTAL TAPE WRAPPED
 VERTICAL

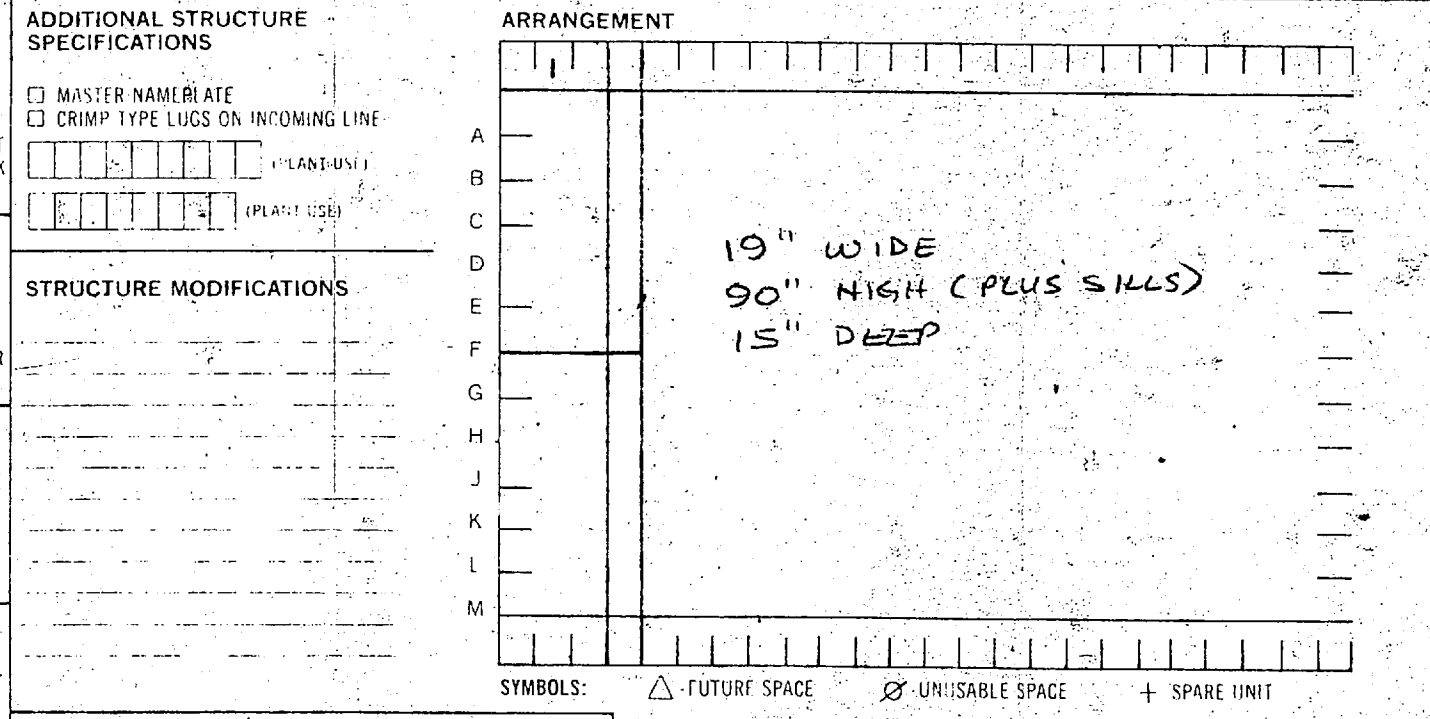
ISOLATED VERTICAL BUS BARRIER
 FRONT ONLY BOTTOM
 FRONT AND REAR PHASE TO PHASE

GROUND BUS
 MATERIAL ALUMINUM (STANDARD) COPPER
 RATING - AMPERES 300

TERMINAL SIZE #6-350MCM 500MCM

NEUTRAL BUS
 MATERIAL AND RATING - AMPERES
 ALUMINUM (STANDARD) (600)
 COPPER (500)

TERMINAL SIZE #6-350MCM 500MCM



SPACE HEATER YES NO THERMOSTAT YES NO

VOLTAGE 115 230

SOURCE PANEL BOARD SEPARATE

SERVICE BY REACTOR

FEED BY	RATING - AMPERES	OHMIC VALUE
INCOMING LINE (PHS)	<input type="checkbox"/> 600 <input type="checkbox"/> 1200	<input type="checkbox"/> 0.15 <input type="checkbox"/> 0.20
BUS DUCT	<input type="checkbox"/> 600 <input type="checkbox"/> 1000	<input type="checkbox"/> 0.20 <input type="checkbox"/> 0.25

PULLBOX YES NO STRUCTURE LOCATION

HEIGHT 12 18 24

MATCH UP TO EXISTING ON

TYPE W SPHIC LH RH

11.000 TRANSITION G.O. No. ITEM

CHANNEL SILLS YES NO

BOTTOM PLATES YES GASKETED

NEMA CLASS 1 2

WIRE TYPE A B C

WIRING DIAGRAMS STANDARD SPECIAL (CUSTOMER SCHEMATIC ATTACHED)

SERVICE VOLTAGE
 480 600 600 PHASE 4 WIRE
 240 50

CONTROL VOLTAGE 115 480

SOURCE TRANSFORMER LINE SEPARATE

ADDITIONAL UNIT SPECIFICATIONS
 PLUG IN TERMINAL BLOCKS
 SPECIAL TERMINAL BLOCKS
 EXTRA # _____
 WIRE TONGUE LUGS WIRE MARKERS
 PRIMARY FUSE ON CONTROL TRANSFORMER
 PUSH TO TEST INDICATING LIGHTS

STARTER CLASS IDENTIFICATION

FVNR	BREAKER TYPE	FUSE TYPE, BKR WITH C/L
FVNR	A 206	A-208 A-207
FVNR	A-216	A-214 A-217
RVNR RESISTOR	A 406	A-404 A-407
RVNR ACTO TX	A 606	A 504 A-607
RVNR PART WIND	A 706	A 704 A-707
FVNR 2-SPEED	A 906	A 904 A-907
OTHER		

OVERLOAD PROTECTION
 HEATERS NOT INCLUDED IF ORDERED AND FULL LOAD CURRENT NOT PROVIDED. OVERLOAD RELAY HEATERS WILL BE SELECTED ON THE BASIS OF AVERAGE VALUES OF CURRENT (1975 NEC) FOR 1800 RPM MOTORS HAVING A SERVICE FACTOR OF 1.0 (NEW NEMA STD) ALLOWING 115% FULL LOAD PROTECTION.
 HEATERS SUPPLIED BY: GED CHICAGO OTHER
 POLES 3 (STD) AMBIENT COMPENSATED (S1D) YES NO
 SERVICE FACTOR OF TOTALLY ENCLOSED MOTOR YES NO

CONTROL DEVICE CODE
 PUSH BUTTONS IND LIGHT SEL SWITCH
 L START S-GR (OFF) W-2 POSITION
 M STOP T-RI (ON) X 3 POSITION
 N MAIN CONT U-AMB'R Y
 O FAST STOP V
 P-FWD REV Q-RED (OFF)
 R Z-GN (ON)

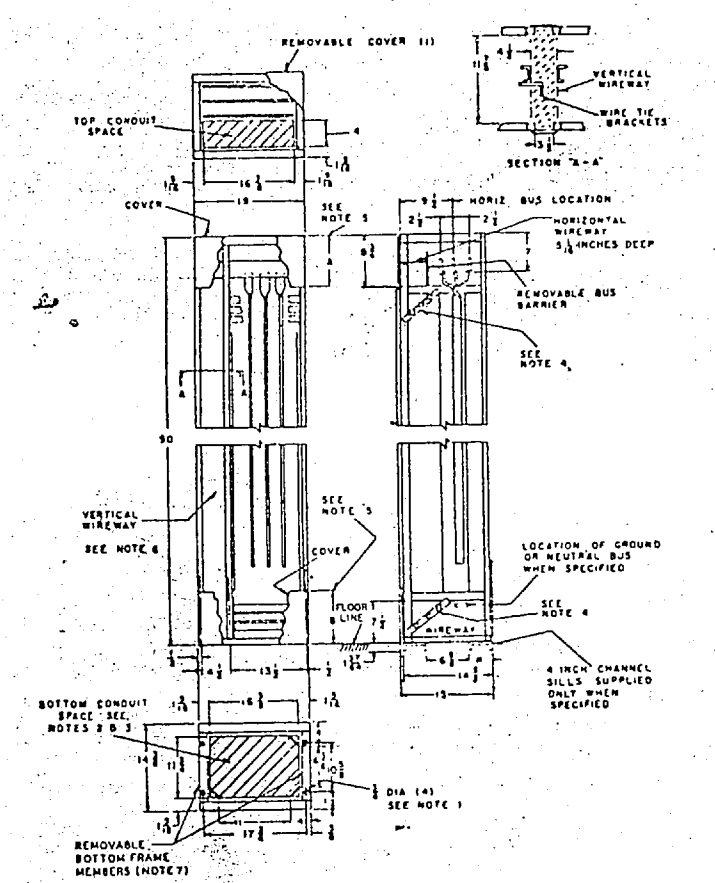
BREAKER OR SWITCH MOD CODE
 A AMB COMP C CURRENT LIMITER S-SAF T-VUE
 1 ALARM SWITCH F-FUNGUS PROOF T THUNT TRIP
 2-AUX SW 1ND M-MAGNETIC ONLY R UN VOLT TRIP
 3-AUX SW 1ND N-NON AUTO V-50°C CALIBRATION
 3-AUX SW 1NG INC P-TRI PACK

BREAKER TYPE
 MCF (STANDARD) THERMAL-MAGNETIC MAGNETIC ONLY MARK 25

FUSES
 FUSE TYPE
 1G 000 ONE TIME FUSE H1 K5 DUAL TL 200,000 H5
 R2 CUR LIMIT H2 CUR LIMIT J1
 R1 CUR LIMIT RE H3 CUR LIMIT RD J2
 K5 DUAL E 100,000 H4
 SUPPLIED BY CUSTOMER OR OTHER GED CHICAGO
 BRAND B BUSSMAN C CHAS. SHAW
 CATALOG TYPE _____

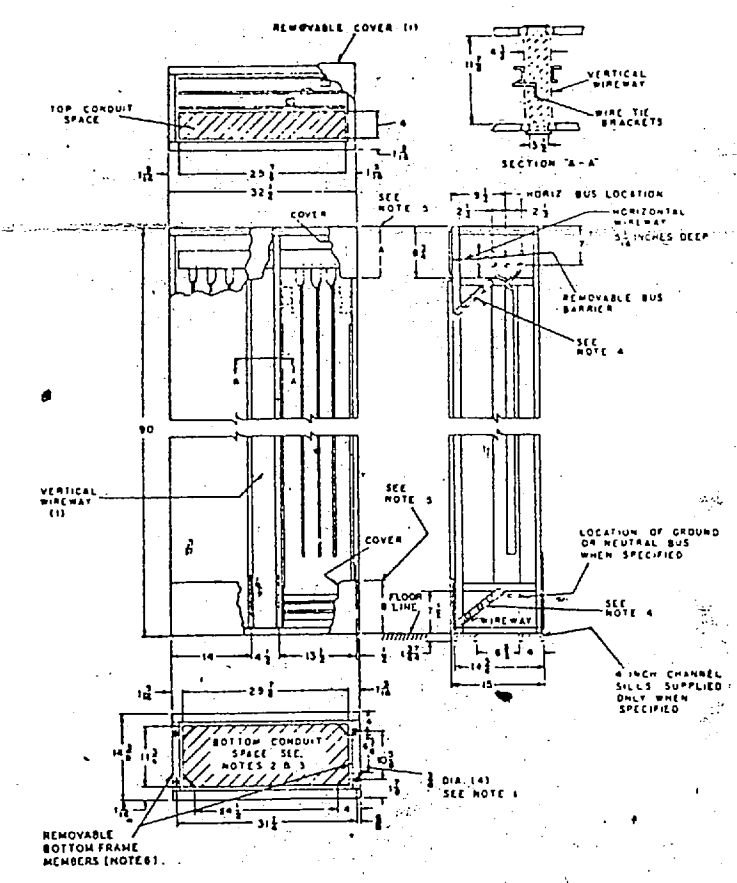
UNIT NO.	CLASS OR DESCRIP-TION	SIZE	HORSE POWER	FLA OR HEATER CODE	CONTROL DEVICE CODE	SW OR BREAKER TYPE	P O L E S	CLIP ON STRIP	OR SW MOD.	FUSE SIZE	INTENS. TOTAL NC	EXTRA VA	NAMEPLATE ENGRAVING	WIRING DIAGRAM	COMBINATION TABLE	SPECIAL UNIT	SPECIAL DOOR	UNIT MOD
IF	A204	4	40		L,M	200	3	200		125	1	1	PUMP NO. 1					
IM	A204	4	40		L,M	200	3	200		125	1	1	PUMP NO. 2					

Type W Control Centers Outline and Floor Plans



- Notes:
1. Min. length of anchor bolt 2 inches (1/4-13 recommended).
 2. Recommended max. conduit height above floor line 3 1/2 inches.
 3. Max. conduit space with channel sills 16 1/2 x 6 1/2 inches.
 4. Master terminal block assembly furnished for Type C wiring only. When location not specified MTB supplied at the bottom.
 5. Standard structure arrangement—Master terminal block at bottom. "A & B" dim. - 9 inches. Alternate arrangement—Master terminal block at top. "A" dim. - 15 inches; "B" dim. - 3 inches.
 6. Vertical wire trough may be on right or left; for special sections wire trough may be omitted.
 7. For multiple structure assemblies, either one or both of these members may be removed to provide maximum un-restricted conduit space at bottom.

STANDARD 1 VERTICAL SECTION 15 INCHES DEEP.



- Notes:
1. Min. length of anchor bolt 2 inches (1/4-13 recommended).
 2. Recommended max. conduit height above floor line 3 1/2 inches.
 3. Max. conduit space with channel sills 29 1/2 x 6 1/2 inches.
 4. Master terminal block assembly furnished for Type C wiring only. When location not specified MTB supplied at the bottom.
 5. Standard structure arrangement—Master terminal block at bottom. "A & B" dim. - 9 inches. Alternate arrangement—Master terminal block at top. "A" dim. - 15 inches; "B" dim. - 3 inches.
 6. For multiple structure assemblies, either one or both of these members may be removed to provide maximum un-restricted conduit space at bottom.

STANDARD 2 VERTICAL SECTION 15 INCHES DEEP.

REV.	CO. NO.	DATE	DESCRIPTION	CHK.	APP.
A	3723	8/1/75	RELEASED		
B	HJG	3-4-76	CUST'S CHANGES		

TITLE: DIMENSION AND ARRANGEMENT M.C.C. FOR GEIGER WATER DISTRIBUTION PUMPS S.O. ITEM "H"

SHOP ORDER: 15726 JOB NAME: JACKSONVILLE, N.C.

CONSOLIDATED ELECTRIC COMPANY
 141 SOUTH LAFAYETTE ROAD ST. PAUL, MINN. 55107

PAGE 1 OF 1

TOLERANCES UNLESS OTHERWISE SPECIFIED: TWO PLACE DEC. 1/10 THIRDE PLACE DEC. 1/100 FRACTIONS 1/64. ANGULAR.

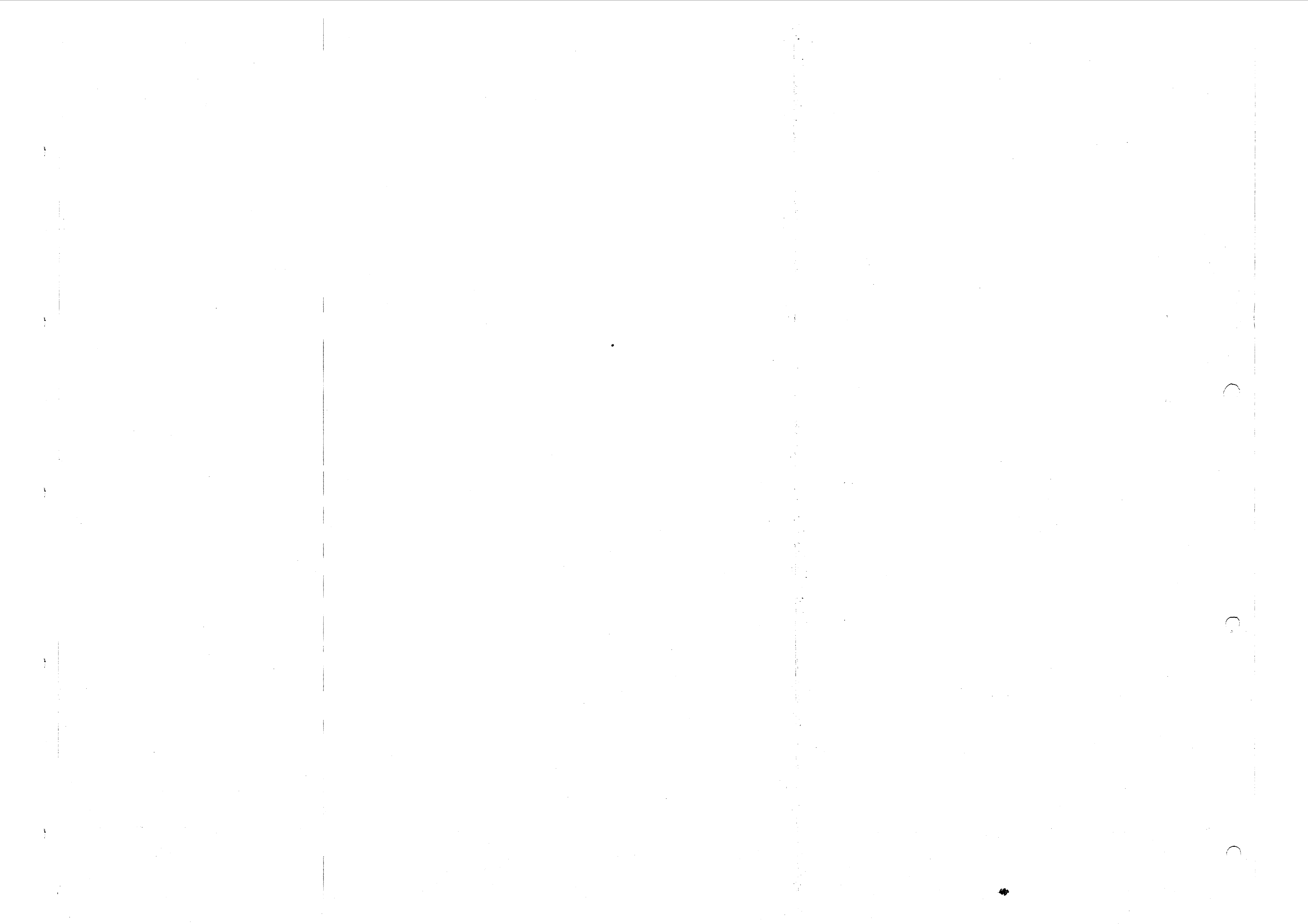
DO NOT SCALE

DESIGNED TWM DATE 7-25-75

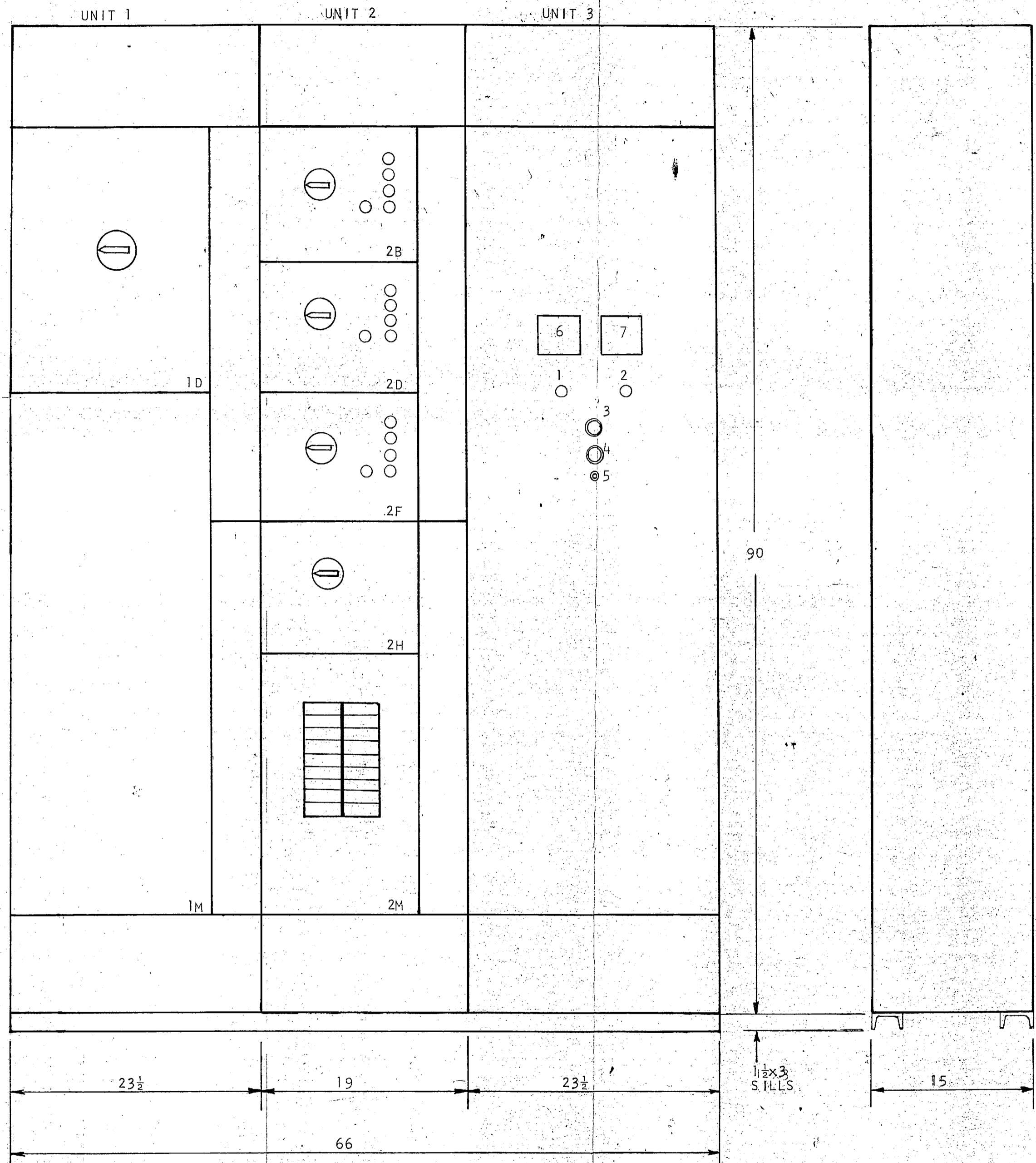
DRAWN CHECKED

DRAWING NO. IM011:6

REV. B



REV.	CO. NO.	DATE	DESCRIPTION	CHK.	APP.
A	3723	8/7/75	RELEASED		
B	HJG	2-16-76	CUST'S CHANGES		



- UNIT
- 1D INCOMING LINE MAIN BREAKER
 - 1M TRANSFER SWITCH
 - 2B COMBINATION STARTER - PUMP NO. 1
 - 2D COMBINATION STARTER - PUMP NO. 2
 - 2F COMBINATION STARTER - PUMP NO. 3
 - 2H LIGHTING PANEL CIRCUIT BREAKER
 - 2M LIGHTING PANEL - 18 CIRCUIT
 - 3M CECO CONTROL
 - 1 - RED "HIGH LEVEL" INDICATING LIGHT
 - 2 - RED "LOW LEVEL" INDICATING LIGHT
 - 3 - AUDIBLE CALL TONE
 - 4 - CALL PUSHBUTTON SWITCH
 - 5 - TELEPHONE JACK
 - 6 - FLOW INDICATING RECORDER
 - 7 - WET WELL LEVEL INDICATOR

TITLE: DIMENSION AND ARRANGEMENT M.C.C. FOR NEW RIVER SEWAGE PUMPING STATION ENCLOSURE - NEMA 12		S.O. ITEM "D" PAGE 1 OF 2	
SHOP ORDER 15726	JOB NAME JACKSONVILLE, N.C.	MATERIAL 14GA. (.075) C.R.S.	
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		FINISH TWO-TONE GRAY ENAMEL	
TOLERANCES: UNLESS OTHERWISE SPEC. HOLE TWO PLACE DEC. ± .010. THREE PLACE DEC. ± .005. FRACTIONS ± 1/64. ANGULAR:	DO NOT SCALE	DESIGNED TWM DATE 7-30-75	DRAWN HJG 7/29/75 CHECKED [Signature]
DRAWING NO. IM01112			REV. B

3

2

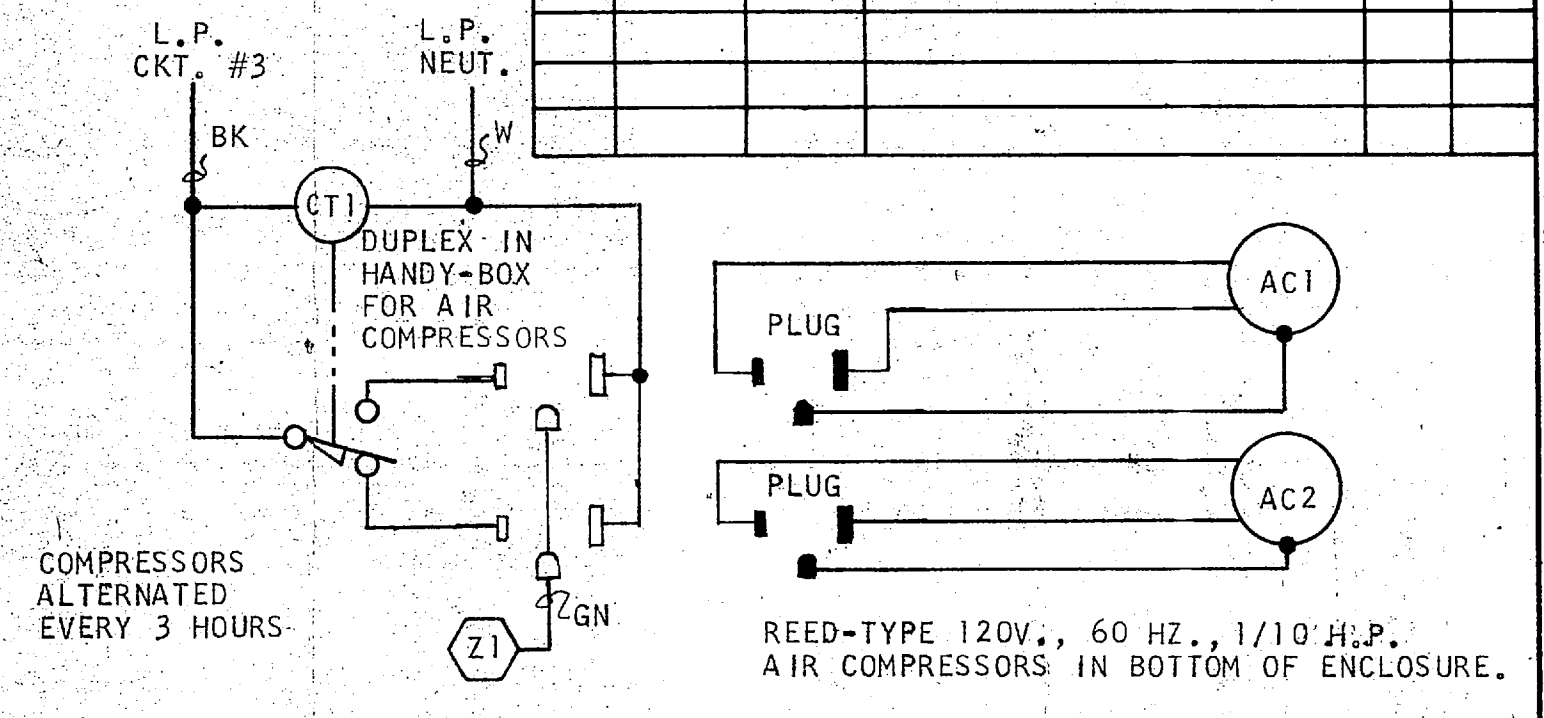
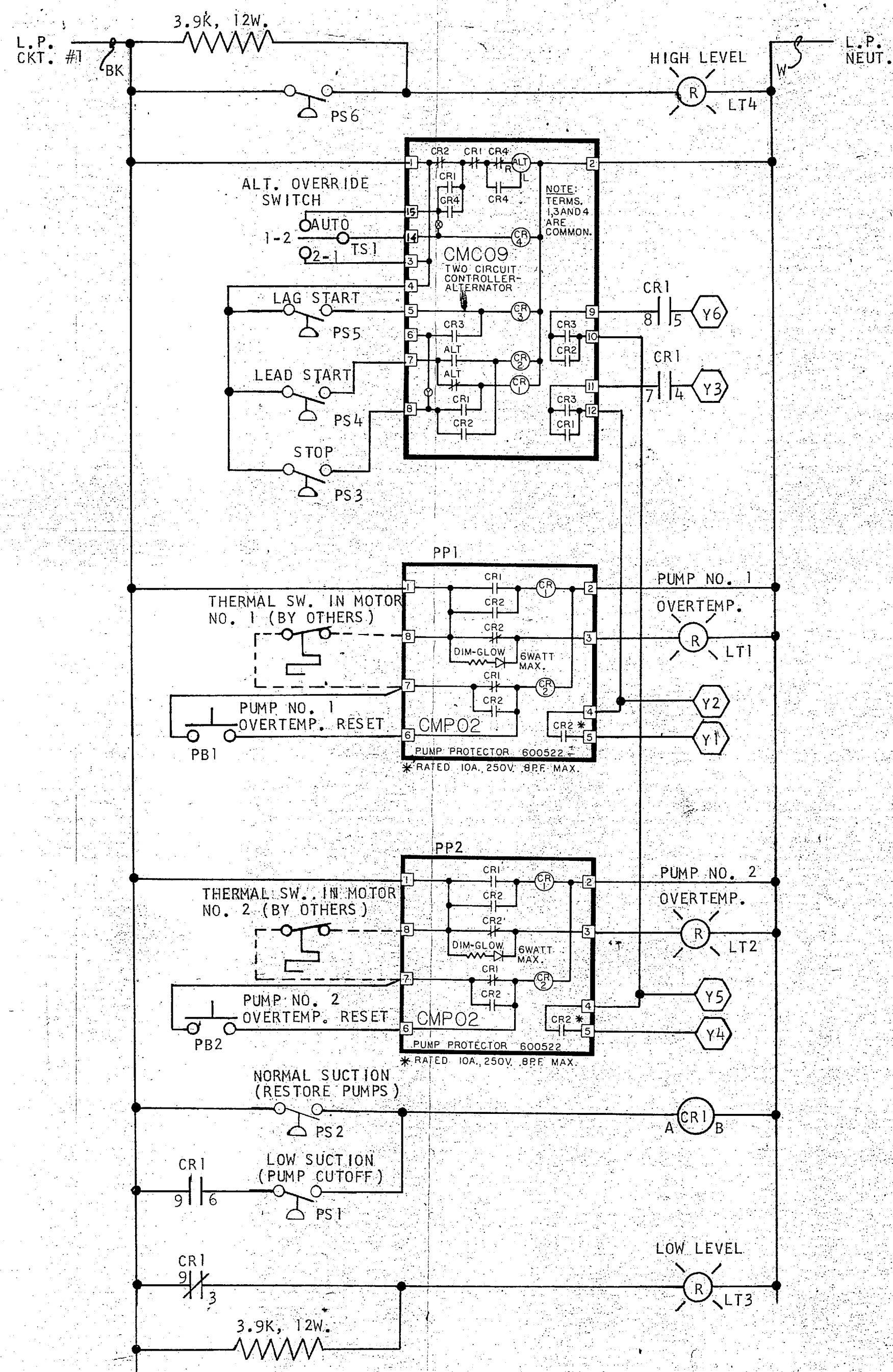
1

2

2

3

REV	C.O. NO.	DATE	DESCRIPTION	CHK	APR
A	3723	8/7/75	RELEASED		
B	HJG	2-10-76	CUST'S. CHANGES		



HYDRAULIC DIAGRAM

TITLE: WIRING DIAGRAM, A700 POWERPACK FOR MABS-26 SEWAGE LIFT STATION		S.O. ITEM "A"	
SHOP ORDER 15726	JOB NAME JACKSONVILLE, N.C.		
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		PAGE 2 OF 2	
TOLERANCES: UNLESS OTHERWISE SPECIFIED, TWO PLACE DEC. ± .010, THREE PLACE DEC. ± .005, FRACTIONS ± 1/64, ANGULAR.	DO NOT SCALE	DESIGNED TWM DATE 7-30-75	DRAWN HJG 6/27/75 CHECKED [Signature]
DRAWING NO. 902059-01			REV. B

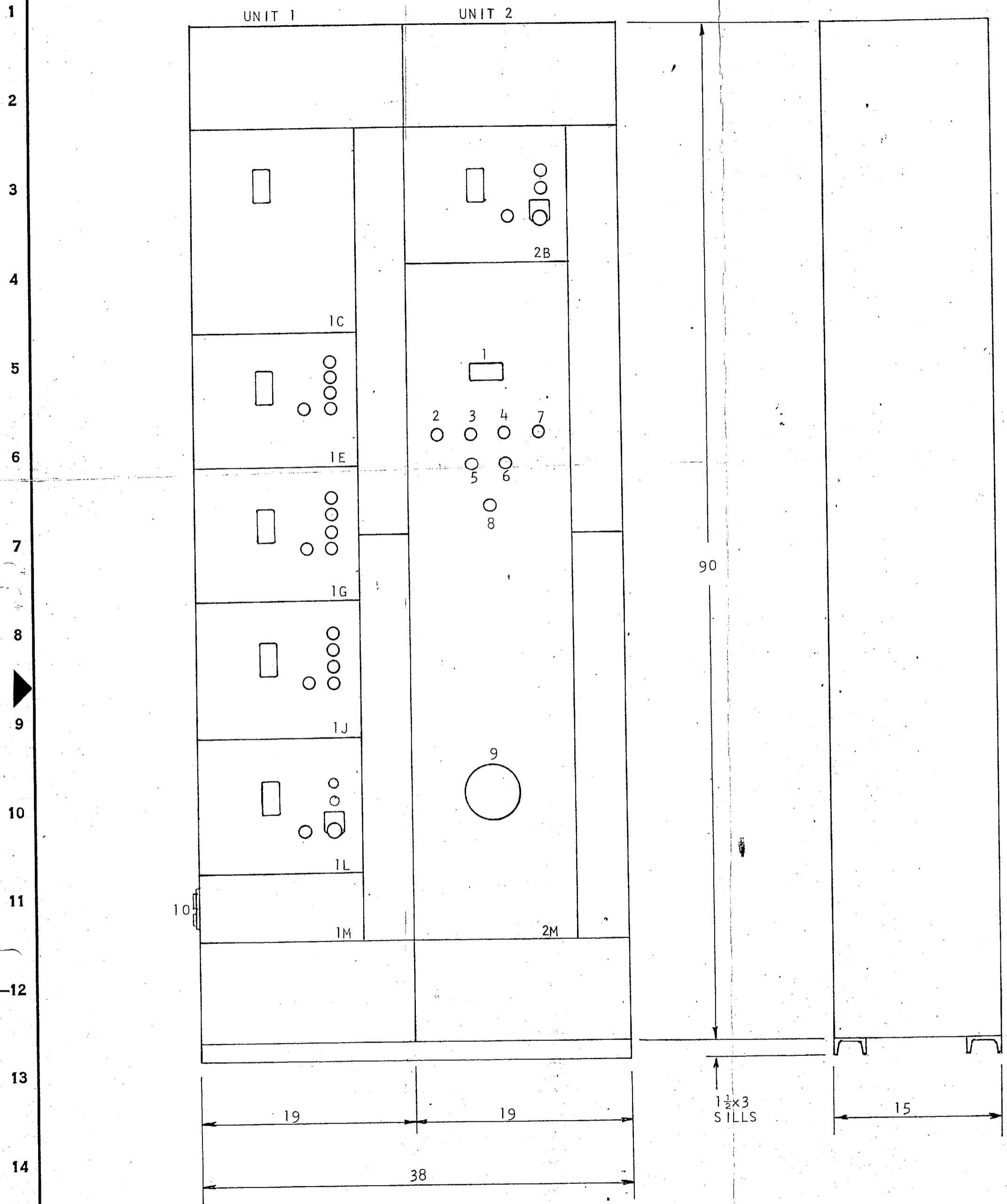
C

C

C

A B C D E F G H I J L M N O P Q R S T U

REV.	CO. NO.	DATE	DESCRIPTION	CHK.	APP.
A	3723	8/7/75	RELEASED		
B	HJG	2-10-76	CUSTS. CHANGES		



- UNIT**
- 1C - MAIN BREAKER - INCOMING LINE
 - 1E - COMB. STARTER - FLOATING AERATOR NO. 1
 - 1G - COMB. STARTER - FLOATING AERATOR NO. 2
 - 1J - COMB. STARTER - FLOATING AERATOR NO. 3
 - 1L - COMB. STARTER - PUMP NO. 1
 - 1M - SPACE
 - 2B - COMB. STARTER - PUMP NO. 2
 - 2M - BULLETIN A700 CONTROL
1. LIGHTING PANEL
 2. LOW LEVEL RED INDICATING LIGHT
 3. OVER-TEMP. RED INDICATING LIGHT - PUMP NO. 1
 4. OVER-TEMP. RED INDICATING LIGHT - PUMP NO. 2
 5. OVER-TEMP. RESET SWITCH - PUMP NO. 1
 6. OVER-TEMP. RESET SWITCH - PUMP NO. 2
 7. HIGH LEVEL RED INDICATING LIGHT
 8. MANUAL SEQUENCE OVER-RIDE SWITCH
 9. WET WELL LEVEL GAUGE - 3 1/2"
 10. DUPLEX RECEPTACLE, WEATHERPROOF

TITLE: DIMENSIONS & ARRANGEMENT NEMA 12 ENCLOSURE MCC FOR SURGE BASIN EFFLUENT STATION		ITEM "B" PAGE 1 OF 2	
SHOP ORDER 15726	JOB NAME JACKSONVILLE, N.C.	MATERIAL 14GA. (.075) CRS	
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		FINISH TWO TONE GRAY	
		DRAWING NO. IM0110	
TOLERANCES: UNLESS OTHERWISE SPECIFIED. TWO PLACE DEC. ± .010. THREE PLACE DEC. ± .005. FRACTIONS ± 1/64. ANGULAR.		DO NOT SCALE	DESIGNED TWM DRAWN HJG 8/20/75 DATE 7-30-75 CHECKED [Signature]



1

2

3

TYPE W M CONTROL CENTER ORDER SPECIFICATION WESTINGHOUSE ELECTRIC CORPORATION GENERAL DIVISION CHICAGO, ILLINOIS

GENERAL INFORMATION
 MCC TITLE: JACKSONVILLE, N.C. - SURGE BASIN MCC (P. 14)
 CUSTOMER: CONSOLIDATED ELECTRIC CO.
 LOCATION: ST. PAUL, MINN.
 PREPARED BY: HILLQUIST DATE: 5-19-75

STANDARDS
 NEMA (STANDARD)
 ANSI

LOCAL CODES
 STATE OF CALIFORNIA
 CITY OF CHICAGO
 CITY OF LOS ANGELES
 CITY OF PORTLAND

DRAWINGS FOR
 CONSTRUCTION
 CUSTOMER APPROVAL

ENCLOSURE - NEMA
 INDOOR NEMA
 STANDARD
 1A (GASKETED)
 12 INDUSTRIAL DUST TIGHT

ADDITIONAL STRUCTURE SPECIFICATIONS
 MASTER NAMEPLATE
 CRIMP TYPE LUGS ON INCOMING LINE

ARRANGEMENT
 38" WIDE
 90" HIGH (PLUS SILLS)
 15" DEEP

STRUCTURE MODIFICATIONS
 STRUCTURE #2 TO HAVE BUS CUT OFF JUST BELOW UNIT ZB. SUPPLY BACKPAN & FULL HEIGHT DOOR FOR ZM. BACKPAN TO BE AT REAR OF STRUCTURE.

MAIN HORIZONTAL BUS
 MATERIAL
 ALUMINUM (STANDARD)
 COPPER WITH SILVER PLATE
 COPPER BARE

VERTICAL BUS
 MATERIAL
 COPPER (STANDARD)
 ALUMINUM

SERVICE BY REACTOR
 FEED BY
 INCOMING LINE LUGS
 BUS DUCT

PULL BOX
 YES
 NO

CHANNEL SILLS
 YES

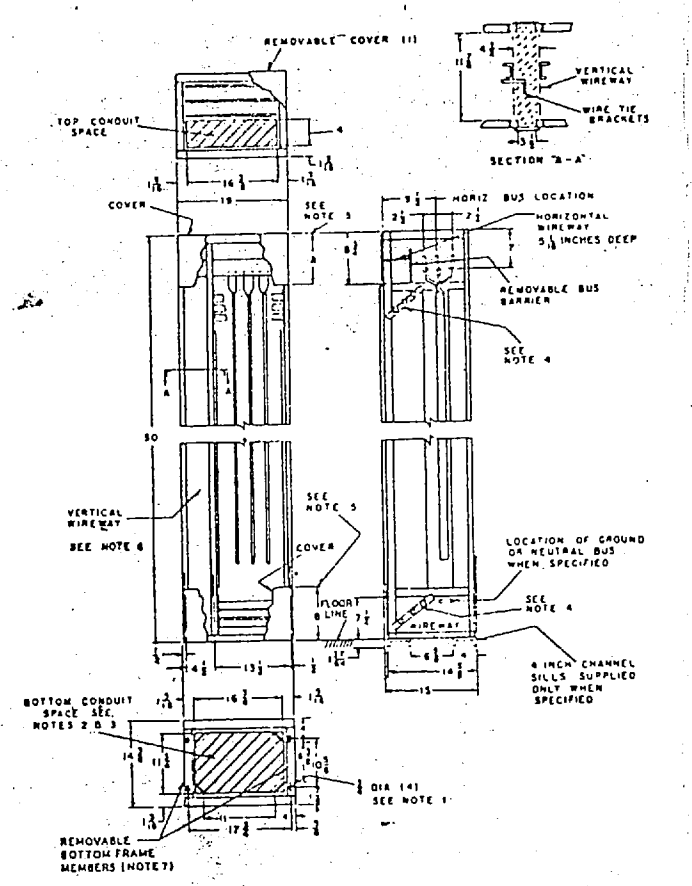
GROUND BUS
 MATERIAL
 ALUMINUM (STANDARD)
 COPPER

NEUTRAL BUS
 MATERIAL AND RATING - AMPERES
 ALUMINUM STANDARD (600)
 COPPER (500)

UNIT	CLASSIFICATION	NO. OF POLES	FLA OR HEATER CODE	CONDUCTOR SIZE	SW. SIZE	TERMINAL SIZE	PLANT USE	WIRING DIAGRAM	COMBINATION TABLE	SPECIAL UNIT	SPECIAL DOOR	UNIT MOD.
1C	MAIN CIRCUIT BREAKERS	5										
1E	AZ06 1.5	14.6	1.9	MCP	3	30						
1G	SAME AS 1E											
1J	SAME AS 1E											
1L	AZ06 2.15	48.4	X.S.T	MCP	3	30						
1M												
ZB	SAME AS 1L											
ZM	BLANK FOR CECO USE											

REV.	CO. NO.	DATE	DESCRIPTION	CHK.	APP.
A	3723	8/7/75	RELEASED		
B	HJG	2-10-76	CUST'S. CHANGES		

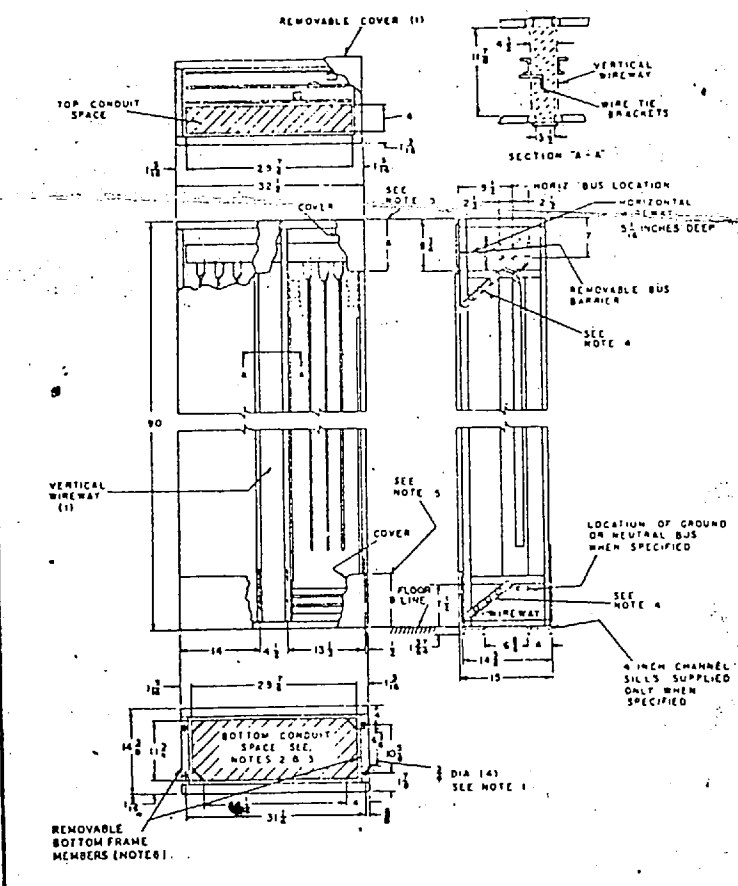
Type W Control Centers Outline and Floor Plans



Notes:

1. Min. length of anchor bolt 2 inches (1/4-13 recommended).
2. Recommended max. conduit height above floor line 3 1/2 inches.
3. Max. conduit space with channel sills 2 3/4 x 6 3/4 inches.
4. Master terminal block assembly furnished for Type C wiring only. When location not specified MTB supplied at the bottom.
5. Standard structure arrangement—Master terminal block at bottom. "A & B" dim. - 9 inches. Alternate arrangement—Master terminal block at top. "A" dim. - 15 inches, "B" dim. - 3 inches.
6. Vertical wire trough may be on right or left; for special sections wire trough may be omitted.
7. For multiple structure assemblies, either one or both of these members may be removed to provide maximum un-restricted conduit space at bottom.

STANDARD 1 VERTICAL SECTION. 15 INCHES DEEP.



Notes:

1. Min. length of anchor bolt 2 inches (1/4-13 recommended).
2. Recommended max. conduit height above floor line 3 1/2 inches.
3. Max. conduit space with channel sills 2 3/4 x 6 3/4 inches.
4. Master terminal block assembly furnished for Type C wiring only. When location not specified MTB supplied at the bottom.
5. Standard structure arrangement—Master terminal block at bottom. "A & B" dim. - 9 inches. Alternate arrangement—Master terminal block at top. "A" dim. - 15 inches, "B" dim. - 3 inches.
6. For multiple structure assemblies, either one or both of these members may be removed to provide maximum un-restricted conduit space at bottom.

STANDARD 2 VERTICAL SECTION. 15 INCHES DEEP.

TITLE: DIMENSIONS AND ARRANGEMENT NEMA 12 ENCLOSURE MCC FOR SURGE BASIN EFFLUENT STN. SHOP ORDER ITEM "B"

SHOP ORDER: 15726 JOB NAME: JACKSONVILLE, N.C.

CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD ST. PAUL, MINN. 55107

PAGE 2 OF 2

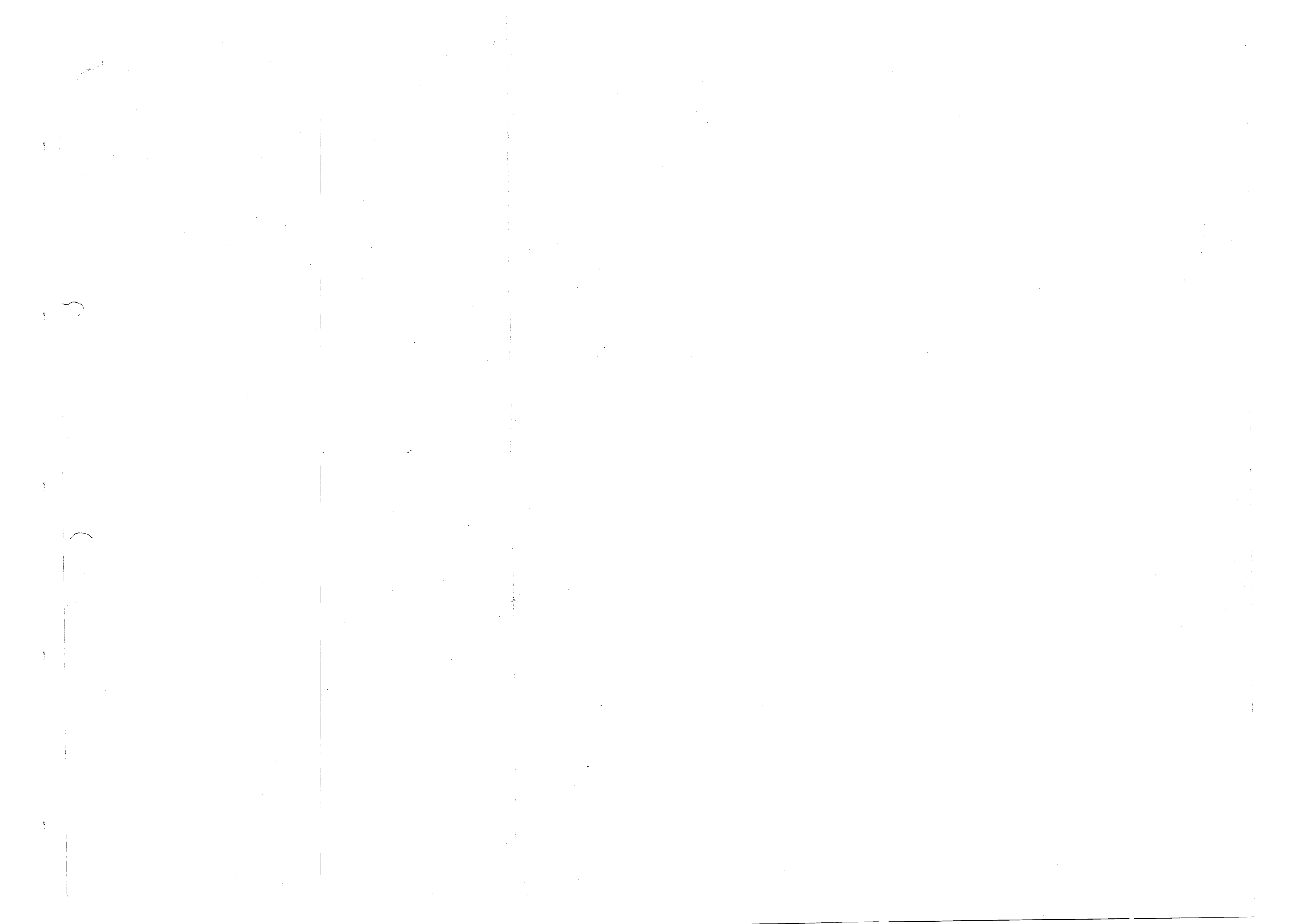
TOLERANCES UNLESS OTHERWISE SPECIFIED: TWO PLACE DEC. 1. 010. THREE PLACE DEC. 1. 005. FRACTIONS 1/64. ANGULAR.

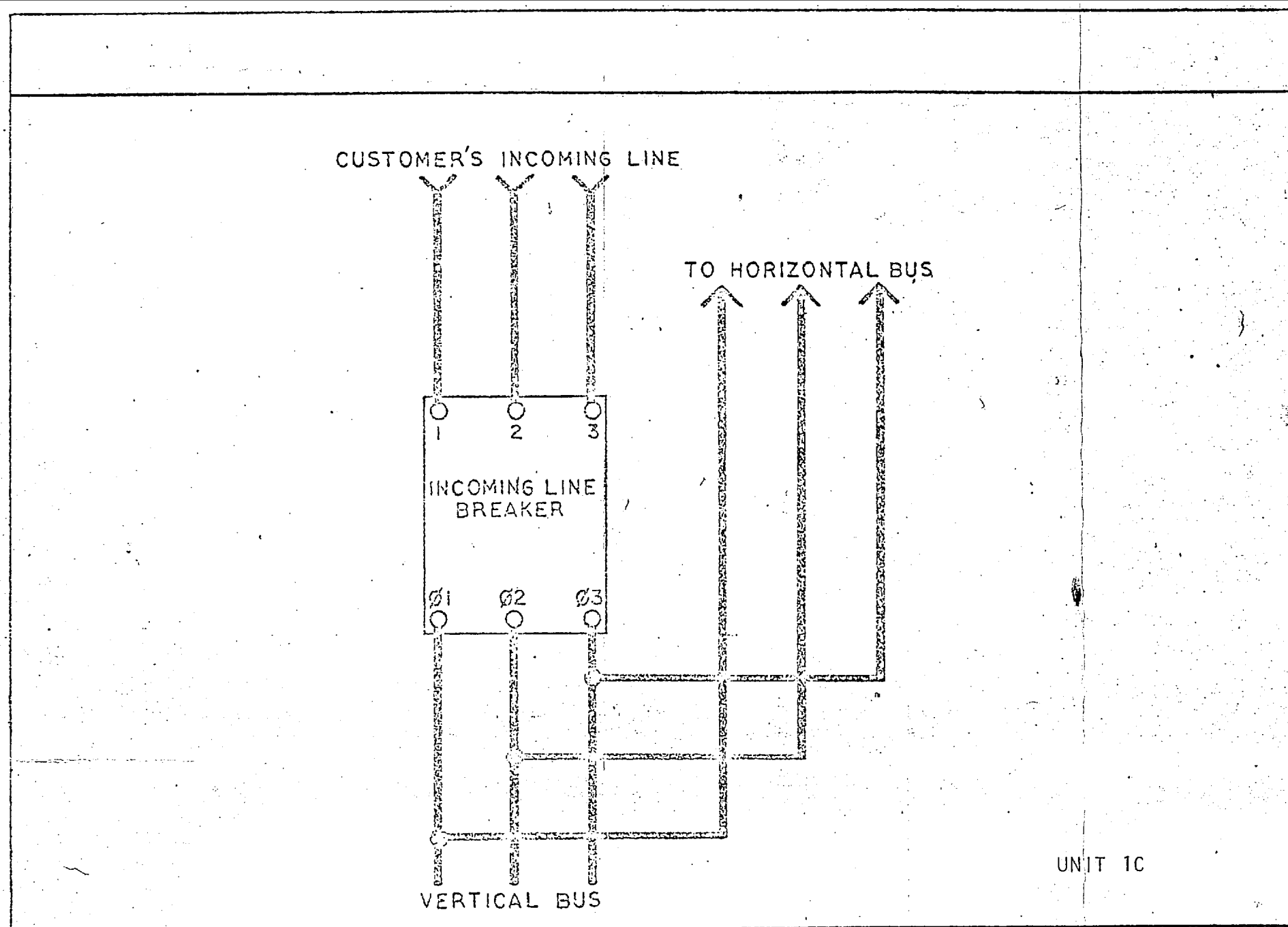
DO NOT SCALE

DESIGNED: TMM DATE: 7-25-75

DRAWN: [Signature] CHECKED: [Signature]

DRAWING NO. IM01110 B





NEMA TYPE 'A' OR 'B'

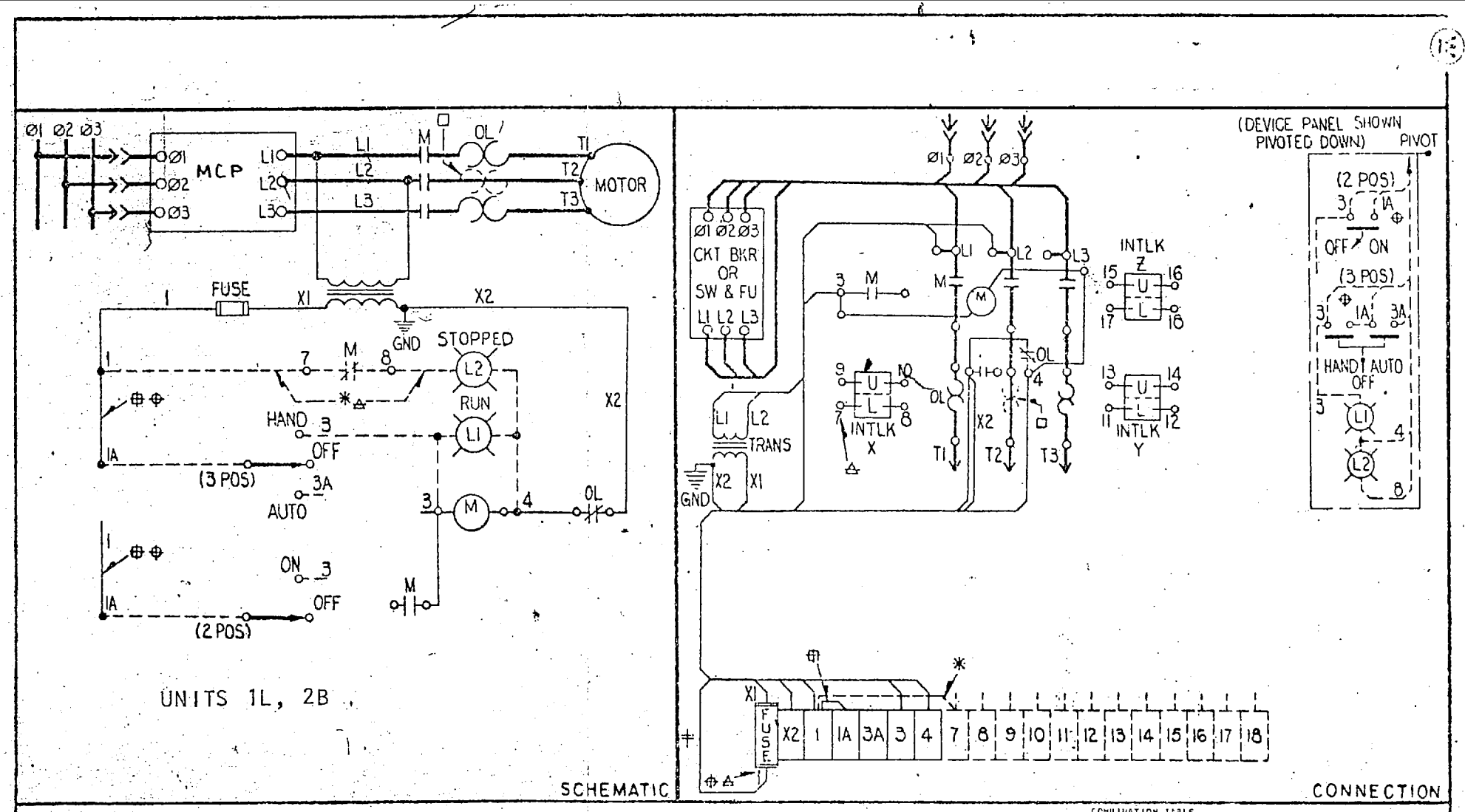
INCOMING LINE BREAKER OR SWITCH & FUSE

WESTINGHOUSE ELECTRIC CORPORATION

MOTOR CONTROL CENTER - TYPE W - STANDARD UNIT WIRING DIAGRAM

L.V.D.E. DIVISION CHICAGO, ILL. 2291A11

FORM CGM-66-131 (1A11)



NOTES FOR TYPE 'A' WIRING

NOTES FOR TYPE 'B' WIRING

GENERAL NOTES FOR BOTH TYPE 'A' AND 'B' WIRING

CONTROL DEVICES		WIRING COMBINATION		CONTACT POSITION	
L2	L1	SEL SW 3 POS	SEL SW 2 POS	INTLK	POSITION
		X			U L
	X	X			U L
X	X	X	X		N.O. N.C.
X	X	X	X		N.O. N.C.
	X	X			N.C.

COMBINATION STARTER

FULL VOLTAGE NON-REVERSING

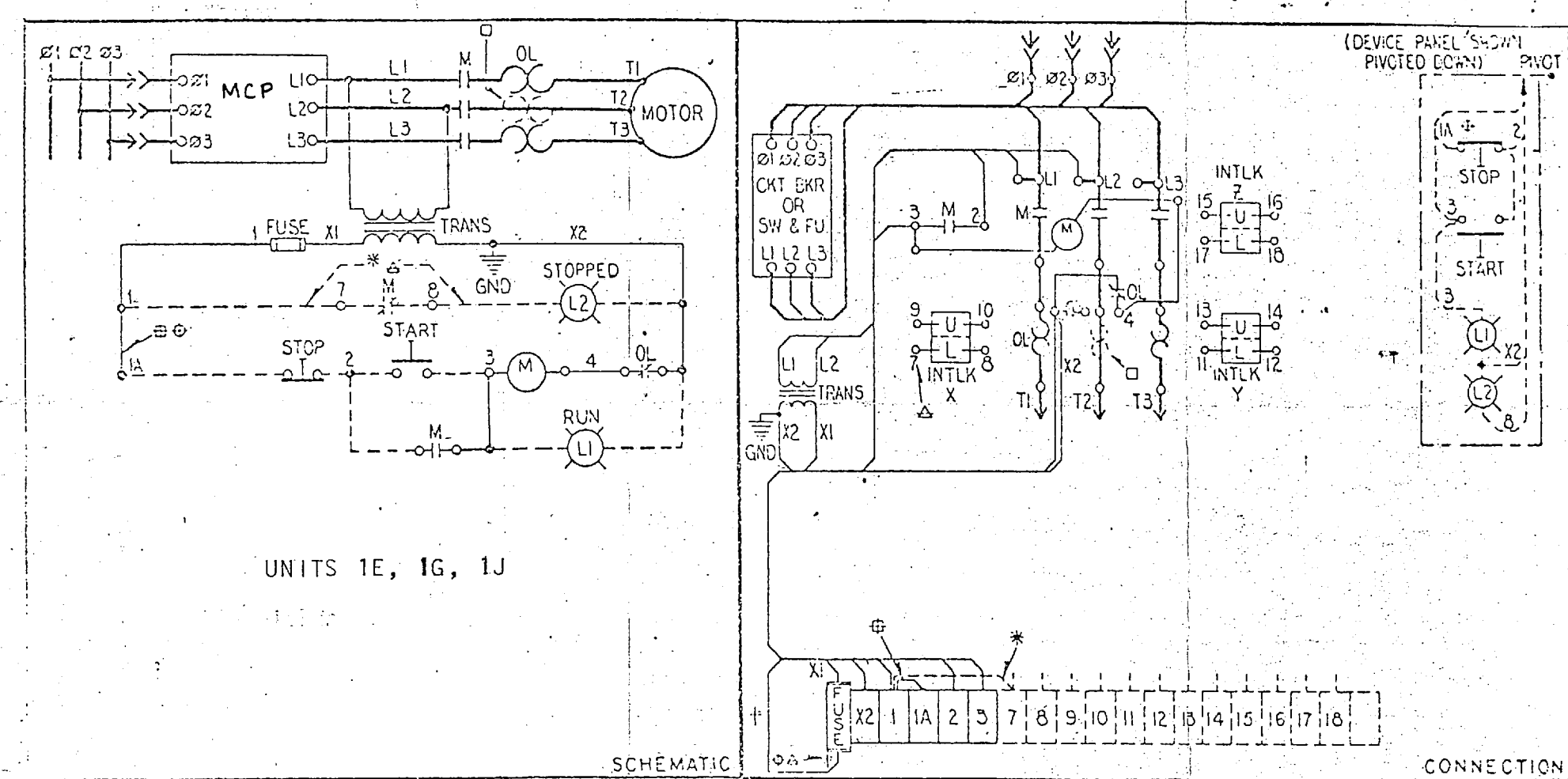
NEMA SIZE 1-2-3-4

WESTINGHOUSE ELECTRIC CORPORATION

MOTOR CONTROL CENTER - TYPE W - STANDARD UNIT WIRING DIAGRAM

L.V.D.E. DIVISION CHICAGO, ILL. 2289A131

2289A131



NOTES FOR TYPE 'A' WIRING

NOTES FOR TYPE 'B' WIRING

GENERAL NOTES FOR BOTH TYPE 'A' AND 'B' WIRING

CONTROL DEVICES		WIRING COMBINATION		CONTACT POSITION	
L2	L1	START	STOP	INTLK	POSITION
		X	X		U L
	X	X			U L
X	X	X	X		N.O. N.C.
X	X	X	X		N.O. N.C.
	X	X			N.C.

COMBINATION STARTER

FULL VOLTAGE NON-REVERSING

NEMA SIZE 1-2-3-4

WESTINGHOUSE ELECTRIC CORPORATION

MOTOR CONTROL CENTER - TYPE W - STANDARD UNIT WIRING DIAGRAM

L.V.D.E. DIVISION CHICAGO, ILL. 2289A03

2289A03

TITLE: WIRING DIAGRAM, M.C.C. FOR SURGE BASIN EFFLUENT STATION

S.O. ITEM "B"

SHOP ORDER 15726

JOB NAME JACKSONVILLE, NORTH CAROLINA

MATERIAL

FINISH

CONSOLIDATED ELECTRIC COMPANY

141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107

PAGE 1 OF 2

TOLERANCES: UNLESS OTHERWISE SPECIFIED. TWO PLACE DEC. ± .010. THREE PLACE DEC. ± .005. FRACTIONS ± 1/64. ANGULAR.

DO NOT SCALE

DESIGNED TWM

DRAWN HJG 6/30/75

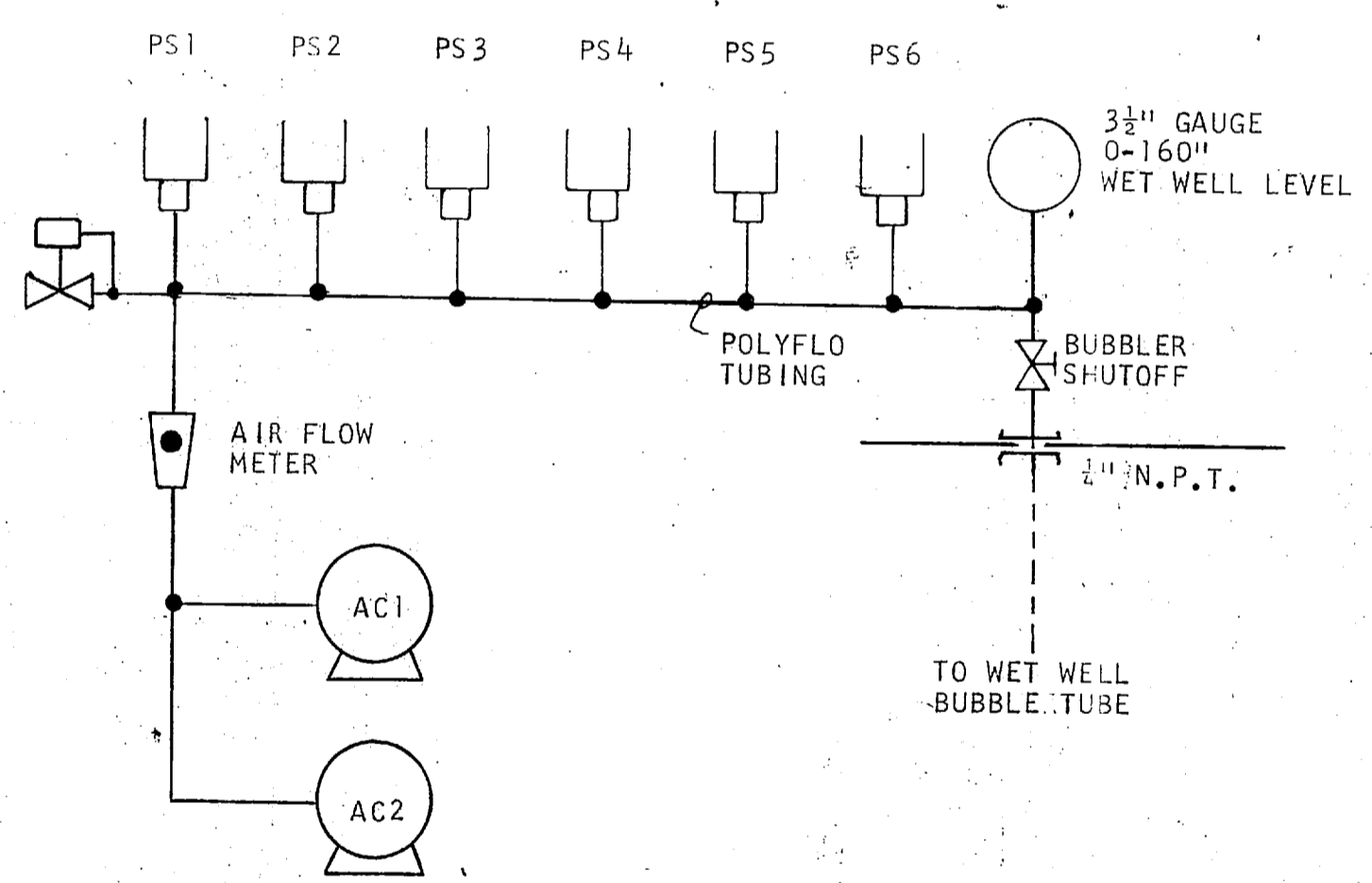
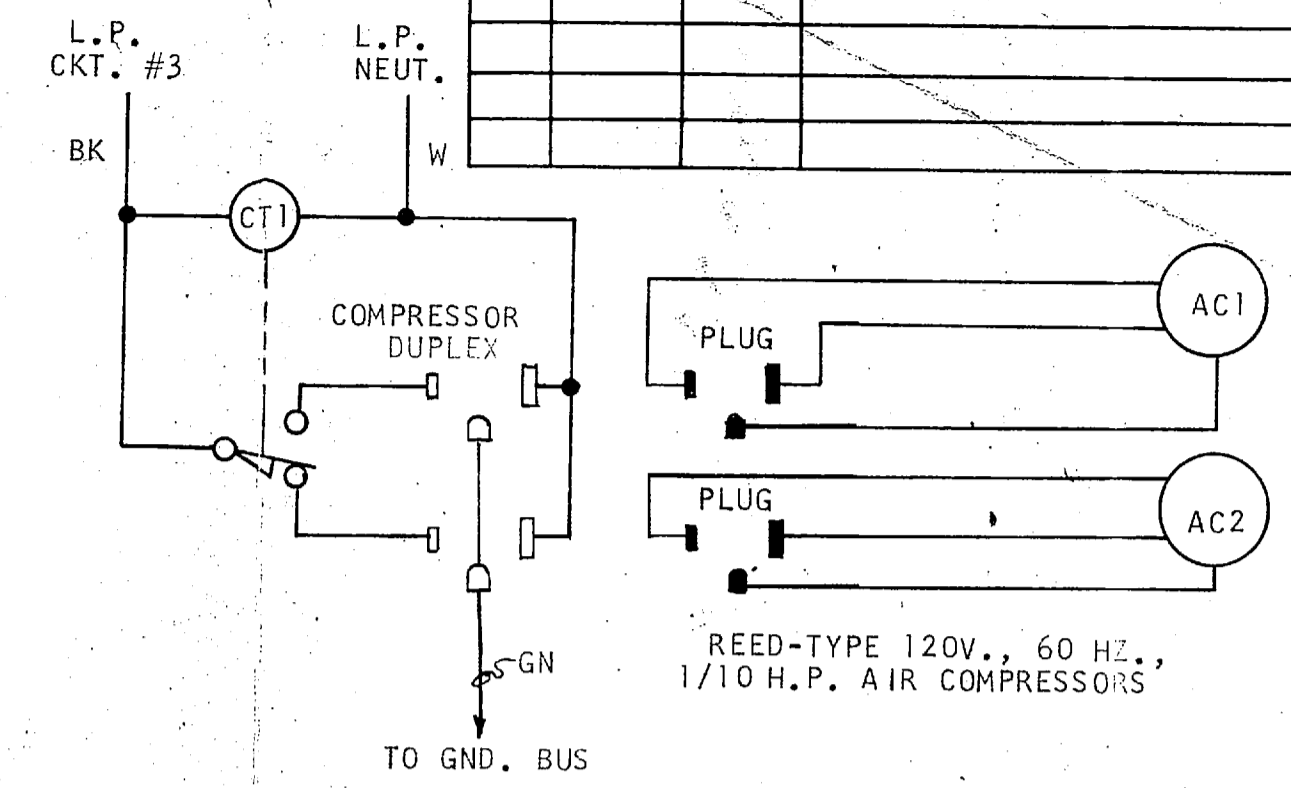
DATE 7-25-75

CHECKED

DRAWING NO. 902060-01

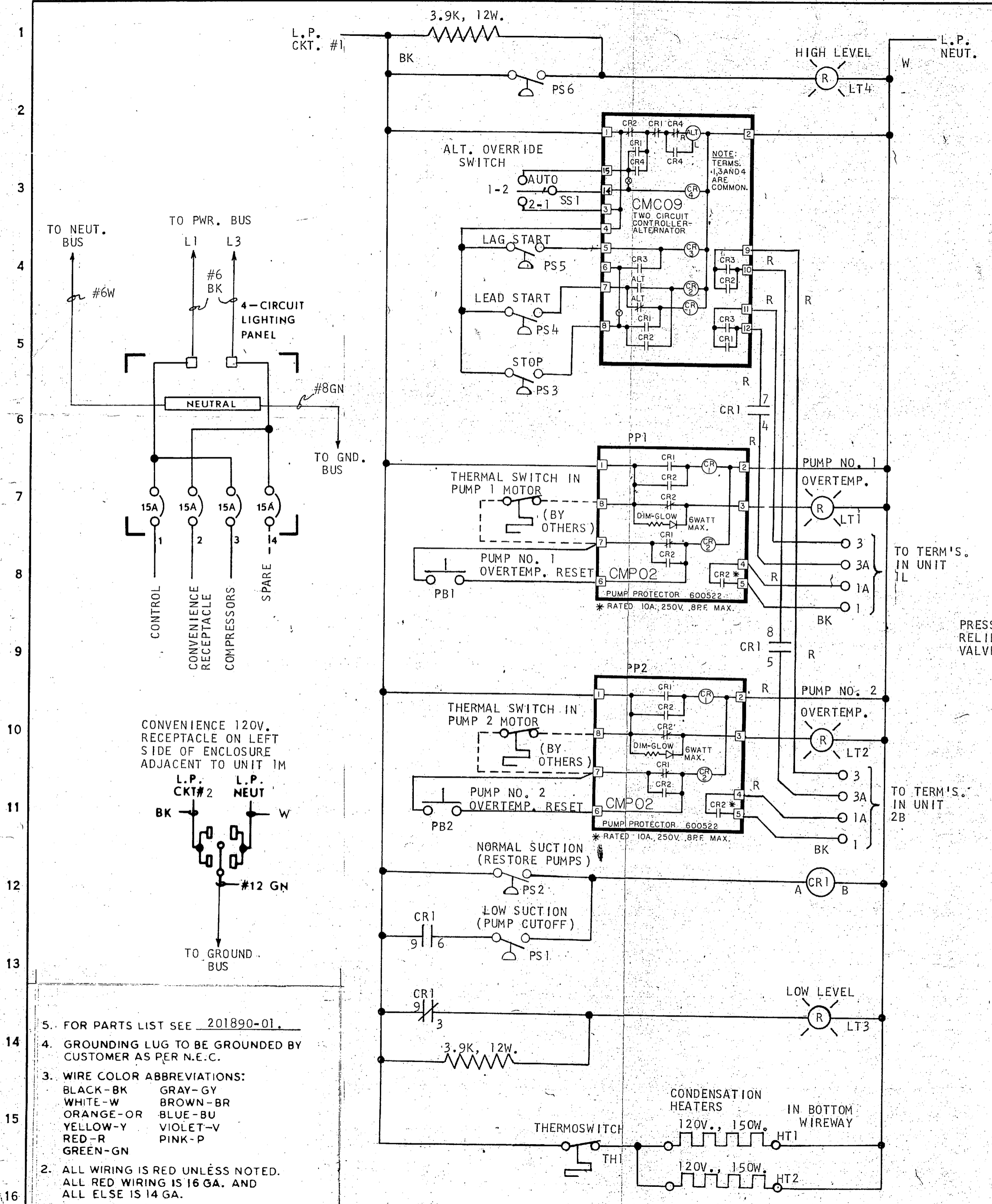
REV. B

REV	C.O. NO.	DATE	DESCRIPTION	CHK	APR
A	3723	8/7/75	RELEASED		
B	HJG	2-10-76	CUST'S. CHANGES		



HYDRAULIC DIAGRAM

TITLE: WIRING DIAGRAM, M.C.C. FOR SURGE BAS IN EFFLUENT STATION		S.O. ITEM "B"	
SHOP ORDER 15726	JOB NAME JACKSONVILLE, N.C.	DRAWING NO. 902060-01	
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		PAGE 2 OF 2	
TOLERANCES UNLESS OTHERWISE SPECIFIED: TWO PLACE DEC. 1 .010, THREE PLACE DEC. 1 .005, FRACTIONS 1/64. ANGULAR.	DO NOT SCALE	DESIGNED TWM DATE 7-30-75	DRAWN HJG 6/30/75 CHECKED CFW
			REV. B

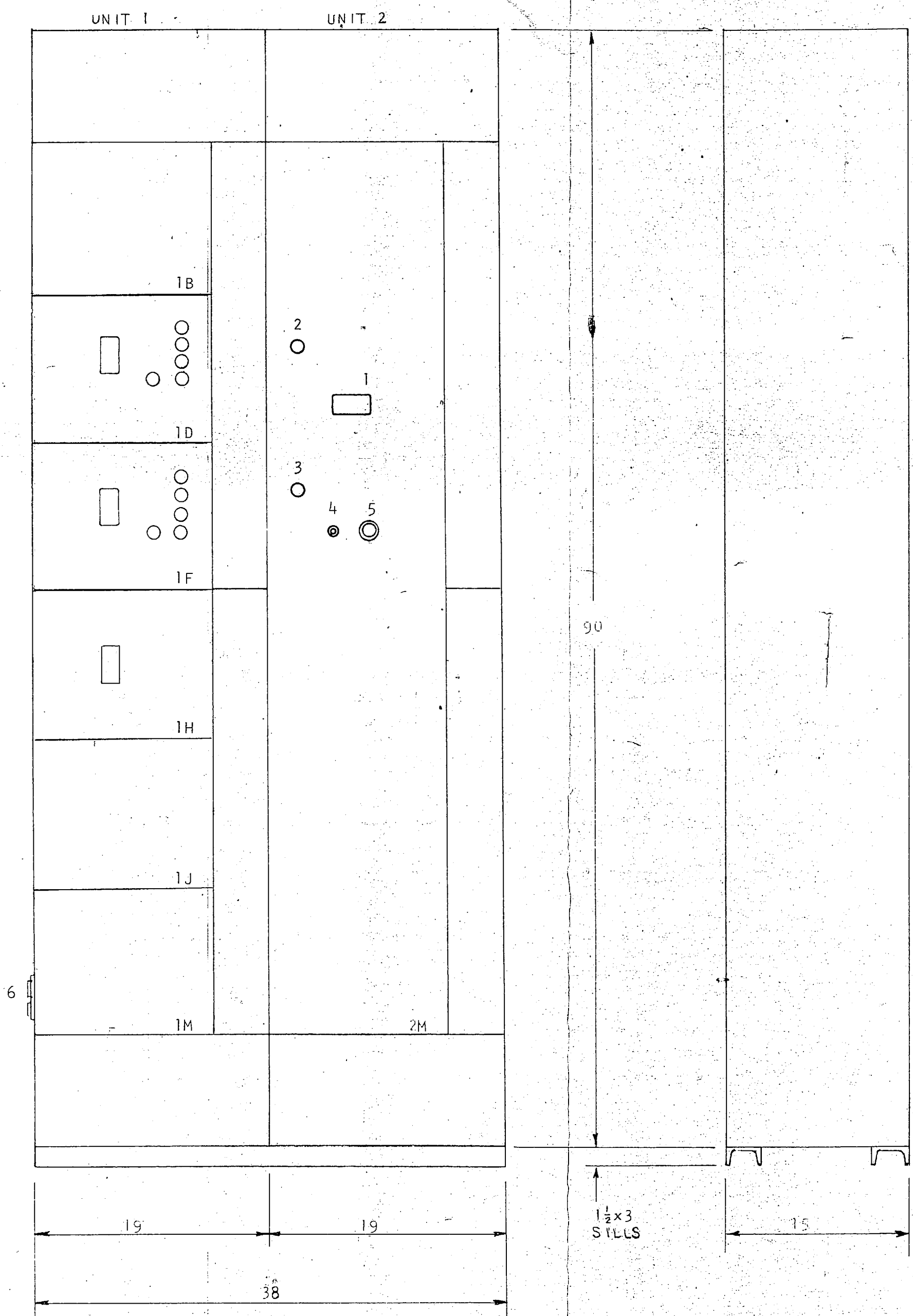


- FOR PARTS LIST SEE 201890-01.
- ALL WIRING IS RED UNLESS NOTED. ALL RED WIRING IS 16 GA. AND ALL ELSE IS 14 GA.
- ALL DASHED WIRING IS DONE BY OTHERS.
- GROUNDING LUG TO BE GROUNDED BY CUSTOMER AS PER N.E.C.
- WIRE COLOR ABBREVIATIONS:
BLACK-BK GRAY-GY
WHITE-W BROWN-BR
ORANGE-OR BLUE-BU
YELLOW-Y VIOLET-V
RED-R PINK-P
GREEN-GN

CONVENIENCE 120V. RECEPTACLE ON LEFT SIDE OF ENCLOSURE ADJACENT TO UNIT 1M



REV.	CO. NO.	DATE	DESCRIPTION	CHK.	APP.
A	3723	8-7-75	RELEASED		
B	HJG	2-10-76	CUST'S. CHANGES		



UNIT

- 1B INCOMING LINE SURGE & LIGHTNING PROTECTION
- 1D BOOSTER NO. 1 COMBINATION STARTER
- 1F BOOSTER NO. 2 COMBINATION STARTER
- 1H LIGHTING PANEL FUSED DISCONNECT SWITCH
- 1J LIGHTING PANEL TRANSFORMER - 2KVA
- 1M SPACE
- 2M CECO CONTROL

NAMEPLATE AND/OR DEVICES

- 1 - LIGHTING PANEL - 4 CIRCUIT
- 2 - BOOSTER NO. 1 LOW SUCTION - AMBER INDICATING LIGHT
- 3 - BOOSTER NO. 2 LOW SUCTION - AMBER INDICATING LIGHT
- 4 - TELEPHONE JACK
- 5 - CALL PUSHBUTTON
- 6 - DUPLEX RECEPTACLE-WEATHERPROOF (BY OTHERS)

TITLE: DIMENSIONS AND ARRANGEMENT M.C.C. FOR CURTIS RD. BOOSTER STATION		S.O. ITEM "C" PAGE 1 OF 2	
SHOP ORDER 15726	JOB NAME JACKSONVILLE, N.C.	MATERIAL 14GA. (.075) C.R.S.	
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		FINISH TWO TONE GRAY ENAMEL	
		DRAWING NO. IMO,1111	
TOLERANCES: UNLESS OTHERWISE SPECIFIED. TWO PLACE DEC. ± .010. THREE PLACE DEC. ± .005. FRACTIONS ± 1/64. ANGULAR.		DO NOT SCALE	DESIGNED TWM DRAWN HJG/EB/75 DATE 7-30-75 CHECKED
			REV. B



TYPE W M CONTROL CENTER ORDER SPECIFICATION

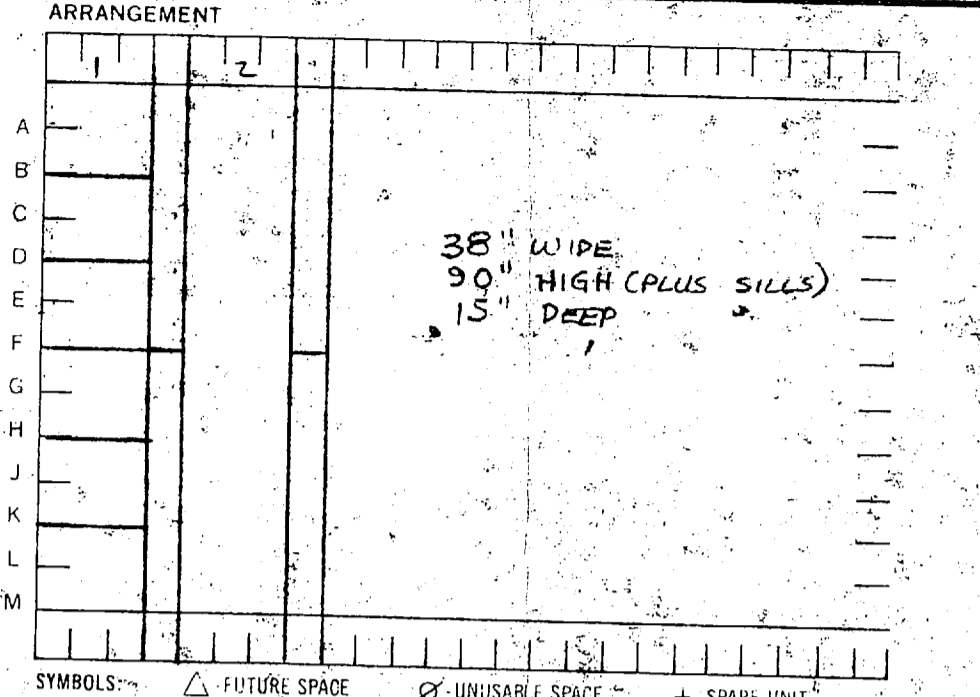
WESTINGHOUSE ELECTRIC CORPORATION GENERAL CONTROL DIVISION
CHICAGO, ILLINOIS

GENERAL INFORMATION
 MCC TITLE: JACKSONVILLE, N.C. (P.45)
 CUSTOMER: CONSOLIDATED ELECTRIC CO.
 LOCATION: ST. PAUL, MINN.
 PREPARED BY: L. HILLQUIST DATE: 5-19-75

ELECTRICAL STANDARDS
 NATIONAL CODES: NEMA (STANDARD) ANSI
 LOCAL CODES: STATE OF CALIFORNIA CITY OF CHICAGO CITY OF LOS ANGELES CITY OF PORTLAND
 DRAWINGS FOR: CONSTRUCTION CUSTOMER APPROVAL

ENCLOSURE - NEMA
 INDOOR NEMA: 1 (STANDARD) 2 DRIP PROOF 3A (GASKETED) 12 INDUSTRIAL DUST TIGHT
 OUTDOOR: 3R NON WALK IN WALK IN TUNNEL VENT WALK IN FRONT VENT WALK IN FRONT GASK WALK IN TUNNEL GASK

ADDITIONAL STRUCTURE SPECIFICATIONS
 MASTER NAMEPLATE
 CRIMP TYPE LUGS ON INCOMING LINE
 (PLANT USE):
 (PLANT USE):



STRUCTURES
 DEPTH: 15 20
 WIREWAY WIDTH: 4 9
 LOCATION: LEFT CENTER RIGHT
 MAST TERM BCK LOCATION: BOTTOM (9") TOP (15")
 UNIT MOUNTING: FRONT ONLY FRONT & REAR
 SHIPPING SPLIT

STRUCTURE MODIFICATIONS
 STRUCTURE #2 TO BE BLANK WITH BACKPAN AT REAR AND FULL HEIGHT DOOR.

MAIN HORIZONTAL BUS
 MATERIAL: ALUMINUM (STANDARD) COPPER WITH SILVER PLATE COPPER-BARE
 RATING - AMPERES: 600 1000 1400 2000 800 1200 1600 2500

SPACE HEATER YES THERMOSTAT YES
 VOLTAGE: 115 230
 SOURCE: PANEL BOARD SEPARATE

VERTICAL BUS
 MATERIAL: COPPER (STANDARD) ALUMINUM
 RATING: 300 FMO STD 600 FRONT MTG ONLY 500 BB STD

SERVICE BY REACTOR
 FEED BY: INCOMING LINE LUGS 600 1200 800 1000 1600
 OHMIC VALUE: 015 020 025

BUS BRACING
 SYMMETRICAL VALUES: 22,000 50,000 (CU ONLY) 25,000 42,000 85,000 (CU ONLY)

PULLBOX
 YES NO
 STRUCTURE LOCATION: J2 J1 J3 J4

STARTER CLASS IDENTIFICATION

EVNR	BREAKER TYPE	FUSE TYPE	BKR WITH C/L
EVNR	A-200	A-204	A-207
EVNR	A-216	A-214	A-217
EVNR	A-406	A-404	A-407
EVNR	A-606	A-604	A-607
EVNR	A-706	A-704	A-707
EVNR	A-906	A-904	A-907

INCOMING LINE
 ENTRY: TOP BOTTOM
 No. PER PHASE: 3 2
 SIZE: #6-35MCM #4-35MCM
 JIMING LINE LOCATION (STRUCTURE NO.): LUGS ONLY MAIN BREAKER OR DISCONNECT BUS DUCT

MATCH UP TO EXISTING ON:
 TYPE W SPLIC LH RH
 11 300 TRANSITION G O No ITFM

OVERLOAD PROTECTION
 HEATERS NOT INCLUDED IF ORDERED AND FULL LOAD CURRENT NOT PROVIDED. OVERLOAD RELAY HEATERS WILL BE SELECTED ON THE BASIS OF AVERAGE VALUES OF CURRENT (1975 NEC) FOR 1800 RPM MOTORS HAVING A SERVICE FACTOR OF 1.0 (NEW NEMA STD) ALLOWING 115% FULL LOAD PROTECTION.
 HEATERS SUPPLIED BY: GCD CHICAGO OTHER
 POLES: 3 (STD) AMBIENT COMPENSATED (STD) NO
 SERVICE FACTOR - SF: YES NO
 TOTALLY ENCLOSED MOTOR: YES NO

FINISH
 TWO-TONE GREY (STANDARD) SPECIAL

CHANNEL SILLS YES
 BOTTOM PLATES: YES GASKETED

CONTROL DEVICE CODE

PUSH BUTTONS	IND LIGHT	SEL SWITCH
S-START	S GR (OFF)	W-2 POSITION
M-STOP	Y-RLD (ON)	1-3 POSITION
N-MAINT CONT	U-AMBER	
DEF-FAST SLOW	Q-RED (OFF)	
R-FWD-REV	Z-GN (ON)	

NAMEPLATES
 SIZE: 1 x 2 1/2 1 1/2 x 3
 COLOR: BLACK WHITE LETTERS WHITE BLACK LETTERS

NEMA CLASS
 1 2
 WIRE TYPE: A B C
 WIRING DIAGRAMS: STANDARD SPECIAL (CUSTOMER SCHEMATIC ATTACHED)

BREAKER OR SWITCH MOD CODE

A-AMB COMP	C-CURRENT LIMITER	S-SAE 1 VUE
L-ALARM SWITCH <td>F-FUNCTION PROOF <td>T-SHUNT TRIP </td></td>	F-FUNCTION PROOF <td>T-SHUNT TRIP </td>	T-SHUNT TRIP
1-AUX SW 1NO <td>M-MAGNETIC ONLY <td>R-UN VOLT TRIP </td></td>	M-MAGNETIC ONLY <td>R-UN VOLT TRIP </td>	R-UN VOLT TRIP
2-AUX SW 2NO <td>N-NON AUTO <td>V-50°C CALIBRATION </td></td>	N-NON AUTO <td>V-50°C CALIBRATION </td>	V-50°C CALIBRATION
3-AUX SW 1NO-1NC <td>P-TRI PACK <td></td> </td>	P-TRI PACK <td></td>	

INSULATED BUS
 BUS TYPE: HORIZONTAL TAPE WRAPPED VERTICAL

SERVICE VOLTAGE
 460 HZ 60 PHASE 3 50 7

FUSES

FUSE TYPE	FUSE SIZE	EXTRA
<input type="checkbox"/> 10,000 ONE TIME FUSE H1	H2	<input checked="" type="checkbox"/> K5 DUAL EI 200,000 H5
<input type="checkbox"/> K1 C-R LIMIT	H3	<input type="checkbox"/> CUR LIMIT J1
<input type="checkbox"/> K1 CUR LIMIT RE	H4	<input type="checkbox"/> CUR LIMIT TD J2
<input type="checkbox"/> K5 DUAL EI 100,000		

ISOLATED VERTICAL BUS BARRIER
 FRONT ONLY BOTTOM FRONT AND REAR PHASE TO PHASE

CONTROL VOLTAGE
 115 460
 SOURCE: TRANSFORMER LINE SEPARATE

ADDITIONAL UNIT SPECIFICATIONS

PLUG IN TERMINAL BLOCKS	SPECIAL TERMINAL BLOCKS	EXTRA VA
<input type="checkbox"/> RING TONGUE LUGS	<input type="checkbox"/> WIRE MARKERS	<input type="checkbox"/> PRIMARY USE ON CONTROL TRANSFORMER
<input type="checkbox"/> PUSH TO TEST INDICATING LIGHTS		

GROUND BUS
 MATERIAL: ALUMINUM (STANDARD) COPPER
 RATING - AMPERES: 300 500MCM

TERMINAL SIZE
 #6-35MCM 500MCM

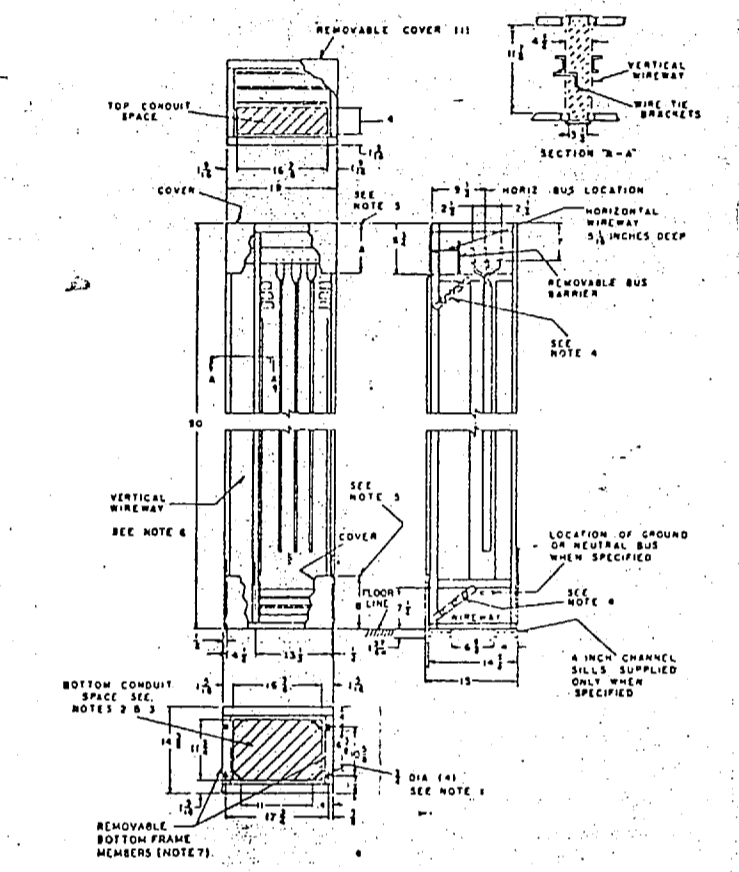
ISOLATED BUS
 MATERIAL AND RATING - AMPERES: ALUMINUM STANDARD (600) COPPER (500)
 TERMINAL SIZE: #6-35MCM 500MCM

UNIT NO.	CLASS OR DESCRIPTION	S	FLA OR HORSE POWER	FLA OR HEATER CODE	CONTROL DEVICE CODE	SIZE OR BREAKER TYPE	P	O	TRIP	BKR OR SW MOD	FUSE SIZE	INTLK TOTAL END NO.	EXTRA VA	NAMEPLATE ENGRAVING	WIRING DIAGRAM	COMBINATION TABLE	SPECIAL UNIT	SPECIAL DOOR	UNIT MOD
1B	LIGHTNING PROTECTORS & SURGE CAPACITORS																		
1D	A204 Z 25 32.5 5/4 60 7.3 60										40	1							
1F	SAME AS 1D																		
1H	FUSED SWITCH FOR TRANSFORMER - 30A										15								
1K	2 KVA TRANSFORMER																		
1M	Δ																		
2M	BLANK FOR GCO USE																		

L M N O P Q R S T U

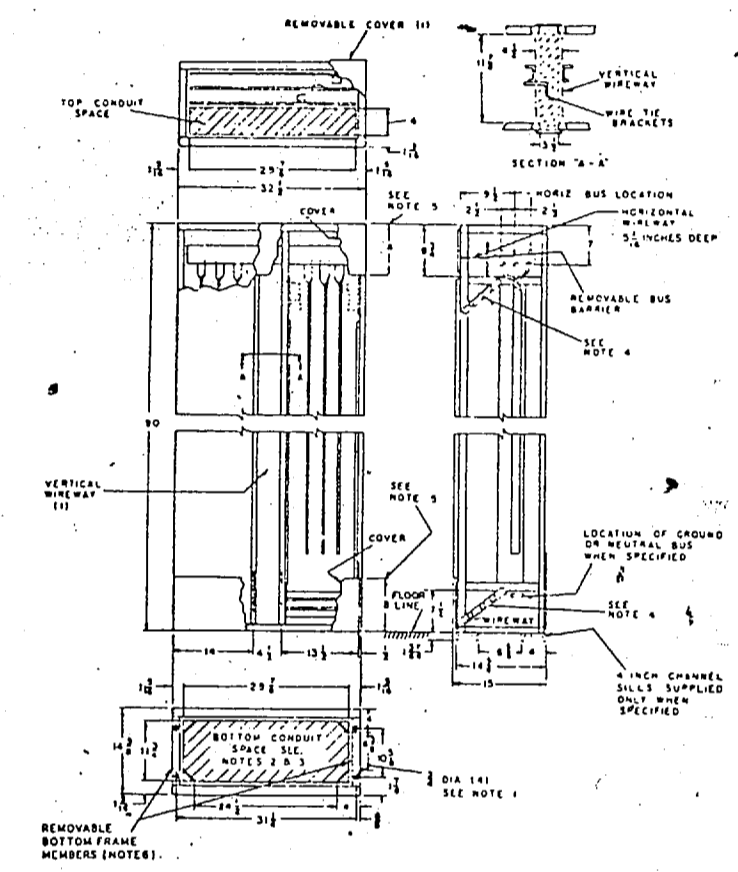
REV.	CO. NO.	DATE	DESCRIPTION	CHK.	APP.
A	3723	8/7/75	RELEASED		
B	HJG	2-10-76	CUST'S. CHANGES		

Type W Control Centers
Outline and Floor Plans



- Notes:
- Min. length of anchor bolt 2 inches (1/4-13 recommended).
 - Recommended max. conduit height above floor line 3 1/2 inches.
 - Max. conduit space with channel sils 10% x 6% inches.
 - Master terminal block assembly furnished for Type C wiring only. When location not specified, MTB supplied at the bottom.
 - Standard structure arrangement—Master terminal block at bottom. "A & B" dim. - 9 inches. Alternate arrangement—Master terminal block at top. "A" dim. - 15 inches, "B" dim. - 3 inches.
 - Vertical wire trough may be on right or left; for special sections wire trough may be omitted.
 - For multiple structure assemblies, either one or both of these members may be removed to provide maximum un-restricted conduit space at bottom.

STANDARD 1 VERTICAL SECTION, 15 INCHES DEEP.



- Notes:
- Min. length of anchor bolt 2 inches (1/4-13 recommended).
 - Recommended max. conduit height above floor line 3 1/2 inches.
 - Max. conduit space with channel sils 29% x 6% inches.
 - Master terminal block assembly furnished for Type C wiring only. When location not specified, MTB supplied at the bottom.
 - Standard structure arrangement—Master terminal block at bottom. "A & B" dim. - 9 inches. Alternate arrangement—Master terminal block at top. "A" dim. - 15 inches, "B" dim. - 3 inches.
 - For multiple structure assemblies, either one or both of these members may be removed to provide maximum un-restricted conduit space at bottom.

STANDARD 2 VERTICAL SECTION, 15 INCHES DEEP.

TITLE: DIMENSIONS AND ARRANGEMENT
M.C.C. FOR CURTIS RD. BOOSTER STATION

S.O. ITEM "C"

SHOP ORDER 15726 JOB NAME JACKSONVILLE, N.C.

CONSOLIDATED ELECTRIC COMPANY
141 SOUTH LAFAYETTE ROAD ST. PAUL, MINN. 55107

PAGE 2 OF 2

TOLERANCES - UNLESS OTHERWISE SPECIFIED: TWO PLACE DEC. 1/10. THREE PLACE DEC. 1/100. FRACTIONS 1/64. ANGULAR

DO NOT SCALE

DESIGNED TWM
DRAWN HJG 7/28/75
DATE 7-30-75
CHECKED

DRAWING NO. IM.01111

REV. B



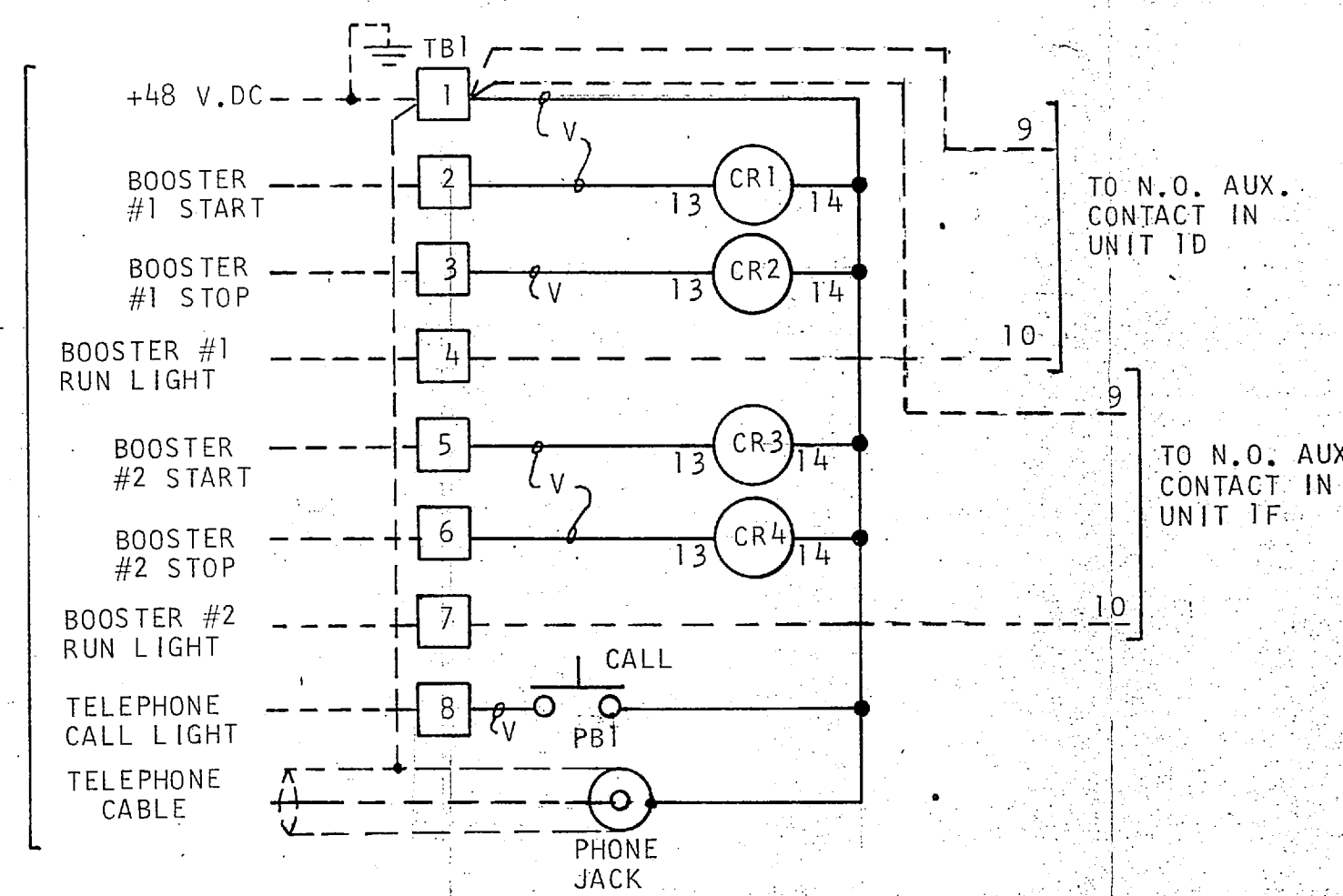
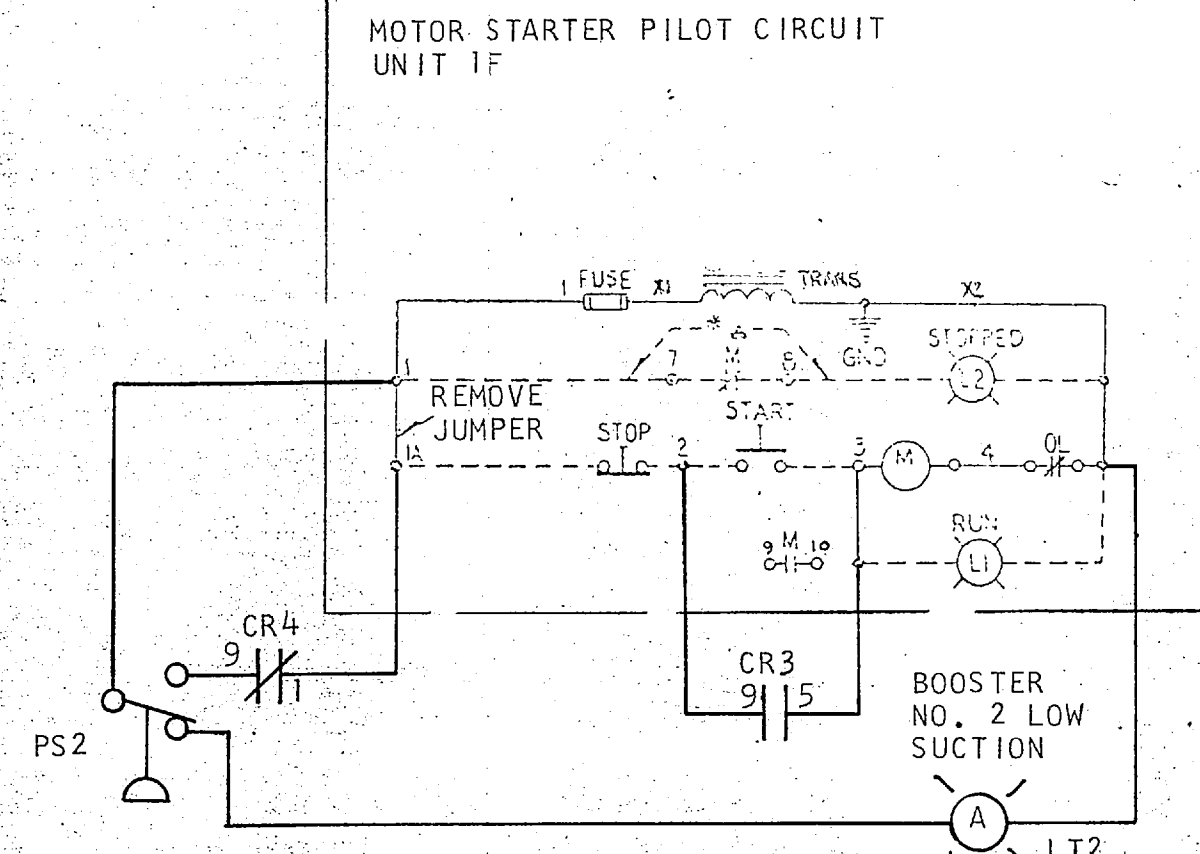
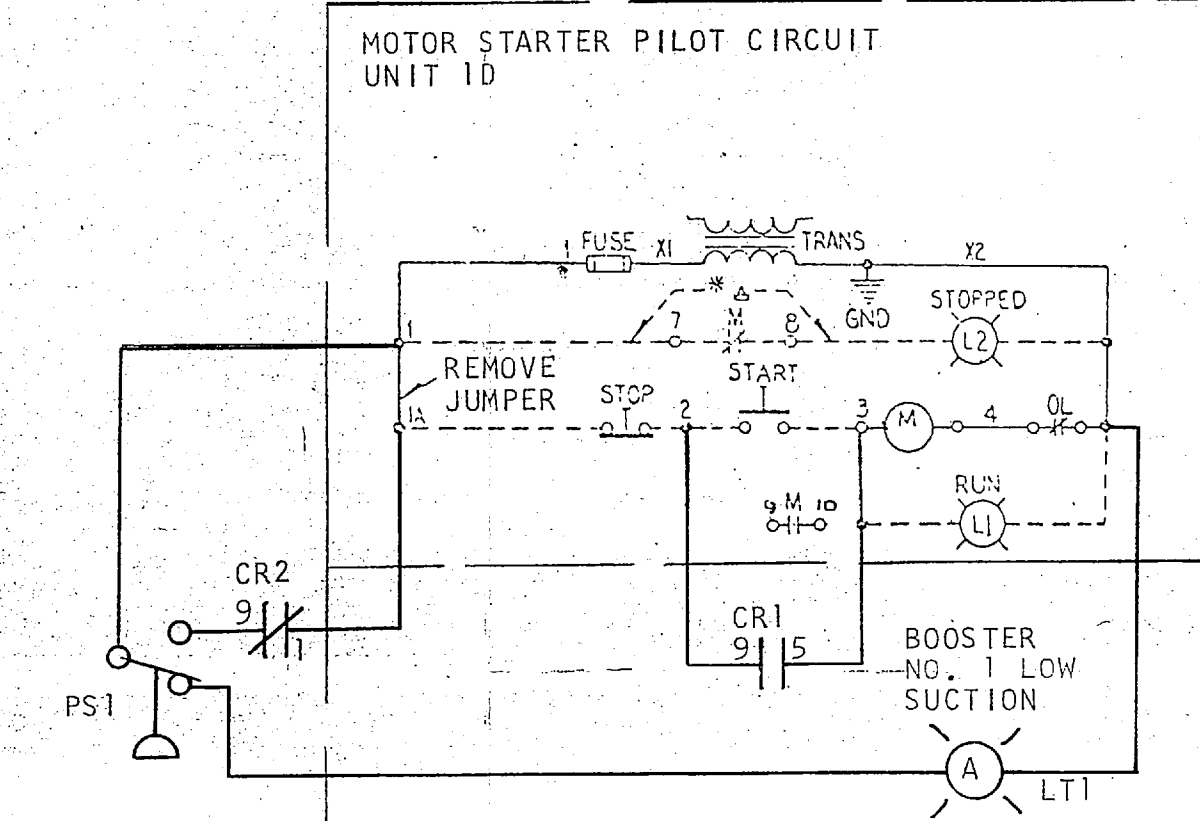
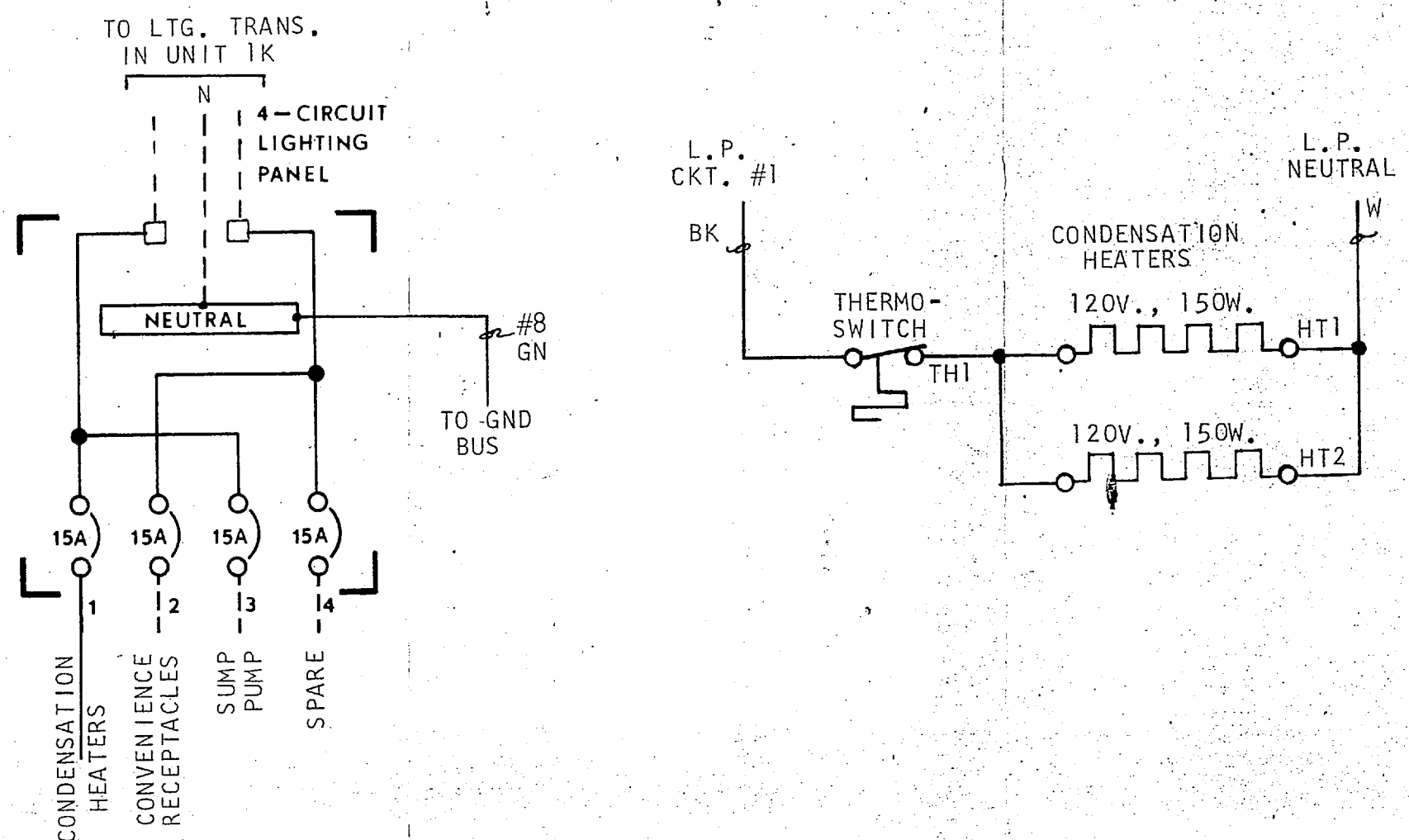
100

100

100

100

REV	C.O. NO.	DATE	DESCRIPTION	CHK	APR
A	3723	8/7/75	RELEASED		
B	HJG	2-10-76	CUST'S. CHANGES		



D.C. CONTROL LINES FROM MAIN WATER PLANT PANEL S.O. ITEM M

- FOR PARTS LIST SEE 201891-01.
- GROUNDING LUG TO BE GROUNDED BY CUSTOMER AS PER N.E.C.
- WIRE COLOR ABBREVIATIONS:
BLACK-BK GRAY-GY
WHITE-W BROWN-BR
ORANGE-OR BLUE-BU
YELLOW-Y VIOLET-V
RED-R PINK-P
GREEN-GN
- ALL WIRING IS RED UNLESS NOTED. ALL RED WIRING IS 16 GA. AND ALL ELSE IS 14 GA.
- ALL DASHED WIRING IS DONE BY OTHERS.

TITLE: WIRING DIAGRAM, M.C.C. FOR CURTIS RD. RAW WATER BOOSTER STN.		S.O. ITEM "C"	
SHOP ORDER 15726	JOB NAME JACKSONVILLE, N.C.		
CONSOLIDATED ELECTRIC COMPANY 141 SOUTH LAFAYETTE ROAD • ST. PAUL, MINN. 55107		PAGE 2 OF 2	
TOLERANCES UNLESS OTHERWISE SPECIFIED: TWO PLACE DEC. ± .010. THREE PLACE DEC. ± .005. FRACTIONS ± 1/64. ANGULAR	DO NOT SCALE	DESIGNED TWM DRAWN HJG 7/28/75 DATE 7-30-75 CHECKED	DRAWING NO. 902061-01 REV. B

C

C

C