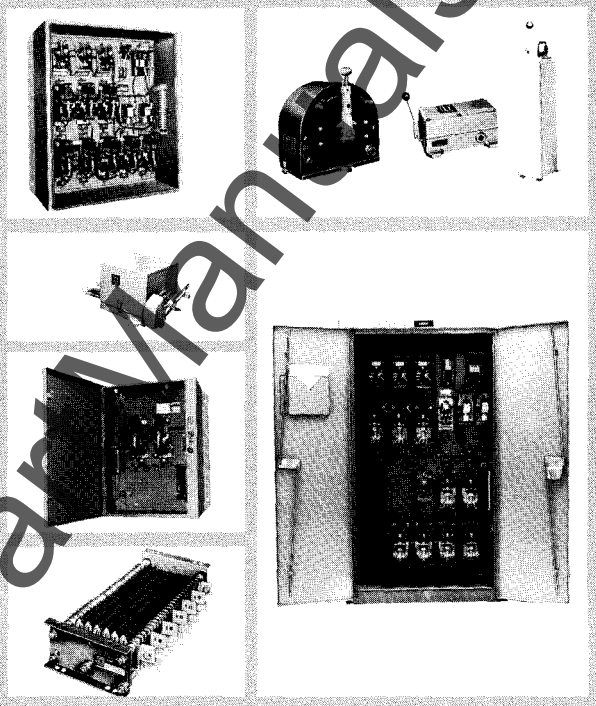
Class 6121
6131,6140
6170
JANUARY, 1981



FRONTLINE®
DC Crane Control

CONTENTS

SQUARE D COMPANY

DC MOTOR DATA
AISE FRAME 600 AND 800 MOTORS

The following typical motor data is based on the information published in the AISE Standard No. 1, DC Mill Motor Standards.

This information should be used to select the proper crane controllers and crane accessories:

1. NEMA standards require that crane controllers be selected on the intermittent motor rating (30 minute or 1 hour rating) at which the motor is applied.
2. AISE standards require that hoist controllers be selected based on the 30 minute rating of the hoist motors.
3. AISE standards require that bridge and trolley controllers be selected based on the 1 hour rating of bridge and trolley motors.

Motor Frame Size		Series Wound Totally Enclosed Motors				
		Horsepower Rating		Full Load Ratings		
600 Series	800 Series	30 Minute	1 Hour	Torque (Foot-Pounds)	Speed (RPM)	Amperes at 230V dc
	802A	6½	5	45 30	750 900	29 21
602		10	7½	80 50	675 800	44 31
	802B	10	7½	80 50	675 800	45 31
603		13½	10	115 70	620 725	57 41
	802C	13½	10	105 65	675 800	57 41
604		19	15	180 120	560 650	77 59
	803	19	15	160 110	620 725	77 59
	804	26	20	235 160	580 650	98 75
606		33	25	340 230	515 575	129 95
	806	39	30	410 275	500 575	145 112
608		45	35	500 320	470 525	175 131
610		65	50	770 525	445 500	248 184
	808	65	50	760 500	450 525	246 184
	810	90	70	1070 735	440 500	335 260
612		100	75	1225 830	430 475	375 274
614		135	100	1735 1140	400 460	500 360
	812	135	100	1690 1110	420 475	500 360
616		200	150	2630 1750	400 450	730 536
	814	200	150	2625 1710	400 460	730 533
618		265	200	3810 2560	385 410	955 712
	816	265	200	3480 2330	400 450	955 712
	818	325	250	4740 3200	360 410	1140 900
620		360	275	5570 3700	340 370	1260 970
622		500	375	8480 5790	310 340	1800 1330
624		650	500	11550 8210	300 320	2370 1800

DC CRANE CONTROL

APPLICATION DATA

CMAA CRANE SERVICE CLASSIFICATIONS

Service classifications have been established to enable the user to specify the crane operating duty and motor control requirements. The Crane Manufacturers Association of America (CMAA) has seven classes which describe crane operating duty.

CLASS A
This Class is further divided into two sub-classes due to the nature of the loads to be handled.

CLASS A1 — STAND-BY SERVICE
This service class covers cranes used in installations such as; power houses, public utilities, turbine rooms, nuclear reactor buildings, motor rooms, nuclear fuel handling and transformer stations, where precise handling of valuable machinery at slow speeds with long idle periods between lifts is required. Capacity loads may be handled for initial installation of machinery and for infrequent maintenance.

CLASS A2 — INFREQUENT USE
These cranes will be used in installations such as: small maintenance shops, pump rooms, testing laboratories, and similar operations where the loads are relatively light, the speeds are slow, and a low degree of control accuracy is required. The loads may vary anywhere from no load to full capacity with a frequency of a few lifts per day or month.

CLASS B — LIGHT SERVICE
This service covers cranes such as used in repair shops, light assembly operations, service buildings, light warehousing etc., where service requirements are light and the speed is slow. Loads may vary from no load to full rated load with an average of 50% of capacity with 2 to 5 lifts per hour, averaging 15 feet, not over 50% of the lifts at rated capacity.

CLASS C — MODERATE SERVICE
This service covers cranes such as used in machine shops, papermill machine rooms etc., where the service requirements are medium.
In this type of service, the crane will handle loads which average 50% of the rated capacity with 5 to 10 lifts per hour, averaging 15 feet, not over 50% of the lift at rated capacity.

CLASS D — HEAVY DUTY
This service covers cranes, usually cab operated, such as are used in heavy machine shops, foundries, fabricating plants, steel warehouses, lumber mills etc., and standard duty bucket and magnet operation where heavy duty production is required but with no specific cycle of operation. Loads approaching 50% of the rated capacity will be handled constantly during the working period. High speeds are desirable for this type of service with 10 to 20 lifts per hour, averaging 15 feet, not over 65% of the lifts at rated capacity.

CLASS E — SEVERE DUTY CYCLE SERVICE
This type of service requires a heavy duty crane capable of handling the rated load continuously at high speed, in repetition throughout a stated period per day, in a predetermined cycle of operation. Applications include magnet, bucket, magnet-bucket combinations of cranes for scrap yards, cement mills, lumber mills, fertilizer plants etc., with 20 or more lifts per hour all at rated capacity. The complete cycle of operation should be specified.

CLASS F — STEEL MILL AISE SPECIFICATION
Cranes in this class are covered by the current issue of The Association of Iron and Steel Engineers' Standard, No. 6 for Electric Overhead Traveling Cranes for Steel Mill Service.

NEMA SERVICE CLASSIFICATIONS

Two service classifications have been established to enable the user to specify motor control requirements. The motor control service classifications refer to the CMAA Crane classifications above.

CLASS I
These motor controls are intended for use with all CMAA crane service classes except A2 and B.

CLASS II
These motor controls are intended for use with CMAA crane service classes A2 (Infrequent use) and B (light industrial service).

FRONTLINE® DC CRANE CONTROL

GENERAL INFORMATION AND PRICING

HOIST SERVICE

Class 6121 reversing dynamic lowering controllers are recommended for use with dc series motors on crane hoist drives without mechanical load brakes. These controllers are frequently used on such special mill equipment as charging machines, forging manipulators, etc. All controllers are arranged for use with series brakes.

The standard single motor reversing dynamic lowering controller consists of:

- 1 — Two pole fused control circuit knife switch (CSW)
- 1 — Two pole unfused main line knife switch with padlock clip (LSW)
- 4 — Type M single pole contactors with mechanical interlocks for hoisting and lowering circuits (H, 1L, 2L, 3L)
- 1 — Type M single pole negative line contactor (M)
- 4 or 5 — Type M single pole acceleration contactors (1A, 2A, 3A, 4A, 5A)
- 3 or 4 — Type ST-1 static acceleration timers (2AR, 3AR, 4AR, 5AR)
- 1 — Type KE voltage relay for acceleration lowering (VR)
- 1 — Type KE limit switch relay (LSR)
- 1 — Type M single pole spring-closed dynamic lowering contactor (DB)
- 1 — Undervoltage relay (UV)
- 2 — Magnetic overload relays (one instantaneous and one inverse time) (10L, 20L)

The duplex controller consists of the equipment for a single motor controller with the exception that all contactors are double pole devices and the following equipment is added:

- 1 — Two pole mainline knife switch with padlock clip (2LSW)
- 1 — Type KE limit switch relay (21LSR)
- 2 — Magnetic overload relays (one instantaneous and one inverse time) (210L, 220L)

- MILL DUTY CLASS 7004 TYPE M LINE-ARC® CONTACTORS & CLASS 7001 TYPE K RELAYS
- CLASS 7001 TYPE ST-1 STATIC ACCELERATION TIMER

Class 6121 Type EGH-3 Hoist Controller

Volts	Max. HP Crane Rating	Contactors NEMA Size	No. of Speed Points	Open Type		General Purpose Enclosure NEMA Type 1		General Purpose Enclosure NEMA Type 1 Gasketed		Outdoor Enclosure NEMA Type 3R		Industrial Enclosure NEMA Type 12△	
				Controller Type	Price	Controller Type	Price	Controller Type	Price	Controller Type	Price	Controller Type	Price
	SINGLE MOTOR CONTROL												
230	35	3	5	EOH-3	$ 7024.	EGH-3	$ 9024.	ESH-3	$ 9448.	EWH-3	$ 9928.	EAH-3	$ 11024.
	55	4	5	FOH-3	8448.	FGH-3	10448.	FSH-3	10872.	FWH-3	11352.	FAH-3	12448.
	110	5	5	GOH-3	11496.	GGH-3	13796.	GSH-3	14220.	GWH-3	14700.	GAH-3	16096.
	225	6	6	HOH-3	17416.	HGH-3	20616.	HSH-3	21040.	HWH-3	21520.	HAH-3	23816.
	275	6A†	6	HAOH-3	22640.	HAGH-3	25840.	HASH-3	26246.	HAWH-3	26744.	HAAH-3	29040.
	330	7	6	JOH-3	33984.	JGH-3	37964.	JSH-3	38388.	JWH-3	38868.	JAH-3	41944.
	500	8	6	KOH-3	42724.	KGH-3	47064.	KSH-3	47488.	KWH-3	47968.	KAH-3	51404.
	DUPLEX MOTOR CONTROL (2 MOTORS CONNECTED IN PARALLEL)												
230	70 (2-35)	3	5	EOH-4	$14048.	EGH-4	$18048.	ESH-4	$18896.	EWH-4	$19856.	EAH-4	$ 22048.
	110 (2-55)	4	5	FOH-4	16896.	FGH-4	20896.	FSH-4	21744.	FWH-4	22704.	FAH-4	24896.
	220 (2-110)	5	5	GOH-4	22984.	GGH-4	27584.	GSH-4	28432.	GWH-4	29392.	GAH-4	32184.
	450 (2-225)	6	6	HOH-4	34832.	HGH-4	41232.	HSH-4	42080.	HWH-4	43040.	HAH-4	47632.
	550 (2-275)	6A†	6	HAOH-4	45280.	HAGH-4	51680.	HASH-4	52528.	HAWH-4	53488.	HAAH-4	58080.
	660 (2-330)	7	6	JOH-4	67968.	JGH-4	75928.	JSH-4	76776.	JWH-4	77736.	JAH-4	83888.
	1000 (2-500)	8	6	KOH-4	85440.	KGH-4	94120.	KSH-4	94968.	KWH-4	95928.	KAH-4	102800.

△Non-ventilated NEMA Type 12 enclosures are not recommended for CMAA Service Classifications E and F and for applications which have frequent jogging and inching operations because a corrosive atmosphere, detrimental to the component parts, can develop. For these applications, NEMA I Gasketed enclosures are recommended.

†Not a NEMA size/rating

ORDERING INFORMATION REQUIRED:

1. Class
2. Type
3. Motor Horsepower
4. Motor Duty Rating
5. Voltage
6. Controller Panel Modifications: Specify Form Y35 and Modification Numbers
7. Resistor Service Classification
8. Master Switch Type and Form
9. Completed Crane Data Sheet

FRONTLINE® DC CRANE CONTROL

PRICING INFORMATION AND APPLICATION DATA

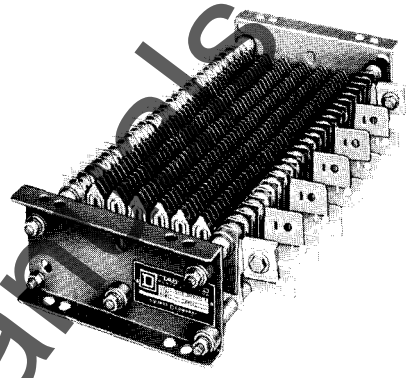
CLASS 6121

HOIST SERVICE

A complete set of motor control equipment consists of a controller and separately mounted TAB-WELD® resistors and master switch. The following tables are for selecting the resistors and master switches used with Class 6121 Hoist controllers.

TAB-WELD® RESISTORS SELECTION TABLE ⊙

Maximum HP Rating Single Motor■	PRICE NEMA Class• 152-DL	162-DL	172-DL	Price Additions Teaser Field Resistor Δ
5	$ 932.	$ 932.	$ 1304.	$1220.
7½	1340.	1340.	1420.	820.
10	1368.	1388.	1464.	820.
15	1416.	1480.	1612.	420.
20	1460.	1580.	1984.	420.
25	1508.	1680.	2352.	420.
30	1580.	1952.	2732.	420.
35	1764.	2240.	3136.	420.
40	1976.	2504.	3504.	420.
45	2176.	2788.	3904.	680.
50	2388.	3068.	4296.	680.
60	2796.	3596.	5036.	680.
65	3008.	3892.	5448.	680.
70	3220.	4156.	5820.	820.
75	3424.	4440.	6216.	820.
90	4056.	5248.	7348.	820.
100	4464.	5808.	8132.	820.
110	4880.	6356.	8900.	1340.
125	5488.	7196.	10076.	1340.
135	5912.	7728.	10820.	1340.
150	6536.	8544.	11960.	1340.
175	7572.	9956.	13940.	1340.
200	8604.	11296.	15816.	1680.
225	9640.	12672.	17740.	2340.
250	11004.	14376.	20128.	2340.
275	12028.	15740.	22036.	2660.
300	13072.	17100.	23940.	2660.
325	14108.	18508.	25912.	2920.
350	15144.	19912.	27880.	2920.
375	16176.	21252.	29756.	2920.
400	17208.	22592.	31632.	3640.
425	18244.	23968.	33556.	3640.
450	19280.	25344.	35480.	3640.
475	20644.	27048.	37868.	5080.
500	22008.	28750.	40256.	5080.



Class 6715 TAB-WELD® Resistor

RESISTOR APPLICATION DATA

⊙ For resistors mounted in racks, unwired — refer to Class 6715.

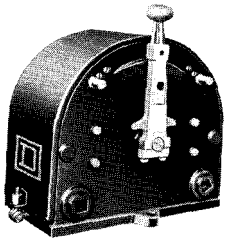
■ Duplex controllers require two sets of resistors, one set for each motor.

• Class 152 is recommended for light crane duty.
Class 162 is recommended for standard crane duty.
Class 172 is recommended for severe crane duty.
For explanation of NEMA resistor classifications — refer to Class 6715 Application Data.

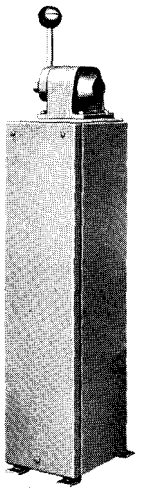
Δ Teaser field resistor limits no load hoisting speed to 250% of motor rated speed. No modification of the controller is required.

MASTER SWITCH SELECTION TABLE

CLASS 9004 VM or CM NEMA 1 ENCLOSED						
			VM		CM	
Drive	Speed Points	Form	Type	Price	Type	Price
Hoist	5	5W	VG-12	$1120..	CG-12	$1200.
	6	6W	VG-16	1744.	CG-16	1744.



Class 9004 Type CG-12
Master Switch



Class 9004 Type VG-12
Master Switch

ACCESSORIES

Brakes ..... see Class 5010
YOUNGSTOWN®.. Power Limit Switch..... see Class 6170
Manual-Magnetic Disconnect Switch..... see Class 6140

FRONTLINE® DC CRANE CONTROL

GENERAL INFORMATION AND PRICING

BRIDGE OR TROLLEY SERVICE

Class 6121 reversing plugging controllers are recommended for use with dc series motors on crane travel drives. These controllers are frequently used on such special mill equipment as charging machines, forging manipulators, etc. All controllers are arranged for use with series brakes. Shunt brakes can be used when a brake relay is added to the controller.

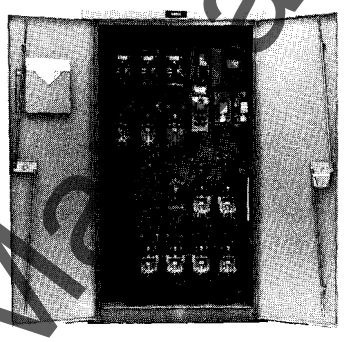
The standard single motor reversing dynamic lowering controller consists of:

1 — Two pole fused control circuit knife switch (CSW)
1 — Two pole unfused main line knife switch with padlock clip (LSW)
4 — Type M single pole directional contactors with mechanical interlocks (1F, 2F, 1R, 2R)
1 — Type M single pole negative line contactor (M)
4 or 5 — Type M single pole acceleration contactors (including one for plugging) (1A, 2A, 3A, P)
3 or 4 — Type ST-1 static acceleration timers (1AR, 2AR, 3AR, 4AR)
1 — Type KP rectifier-plugging relay (PR)
1 — Undervoltage relay (UV)
2 — Magnetic overload relays (one instantaneous and one inverse time) (10L, 20L)

The duplex controller consists of the equipment for a single motor controller with the exception that all contactors are double pole devices and the following equipment is added:

1 — Two pole mainline knife switch with padlock clip (2LSW)
1 — Type KP rectifier-plugging relay (2PR)
2 — Magnetic overload relays (one instantaneous and one inverse time) (210L, 220L)

- MILL DUTY CLASS 7004 TYPE M LINE-ARC® CONTACTORS & CLASS 7001 TYPE K RELAYS
- CLASS 7001 TYPE ST-1 STATIC ACCELERATION TIMER



Class 6121 Type EGR-3 Bridge Controller

Volts	Max. HP Crane Rating	Contactors NEMA Size	No. of Speed Points	Open Type		General Purpose Enclosure NEMA Type 1		General Purpose Enclosure NEMA Type 1 Gasketed		Rainproof and Sleet-Resistant Enclosure NEMA Type 3R		Industrial Enclosure NEMA Type 12Δ	
				Controller Type	Price	Controller Type	Price	Controller Type	Price	Controller Type	Price	Controller Type	Price
	SINGLE MOTOR CONTROL •												
230	35	3	5	EOR-3	$ 6520.	EGR-3	$ 8520.	ESR-3	$ 8944.	EWR-3	$ 9424.	EAR-3	$10520.
	55	4	5	FOR-3	7712.	FGR-3	9712.	FSR-3	10136.	FWR-3	10616.	FAR-3	11712.
	110	5	5	GOR-3	10512.	GGR-3	12812.	GSR-3	13236.	GWR-3	13716.	GAR-3	15112.
	225	6	6	HOR-3	17280.	HGR-3	20480.	HSR-3	20904.	HWR-3	21384.	HAR-3	23680.
	275	6A+	6	HAOR-3	22452.	HAGR-3	25652.	HASR-3	26076.	HAWR-3	26556.	HAAR-3	28852.
	330	7	6	JOR-3	30864.	JGR-3	34844.	JSR-3	35268.	JWR-3	35748.	JAR-3	38824.
	500	8	6	KOR-3	39408.	KGR-3	43748.	KSR-3	44172.	KWR-3	44652.	KAR-3	48088.
	DUPLEX MOTOR CONTROL (2 MOTORS CONNECTED IN PARALLEL) •												
230	70 (2-35)	3	5	EOR-4	$13040.	EGR-4	$17040.	ESR-4	$17888.	EWR-4	$18848.	EAR-4	$21040.
	110 (2-55)	4	5	FOR-4	15424.	FGR-4	19424.	FSR-4	20272.	FWR-4	21232.	FAR-4	23424.
	220 (2-110)	5	5	GOR-4	21024.	GGR-4	25624.	GSR-4	26472.	GWR-4	27432.	GAR-4	30224.
	450 (2-225)	6	6	HOR-4	34560.	HGR-4	40960.	HSR-4	41808.	HWR-4	42768.	HAR-4	47360.
	550 (2-275)	6A+	6	HAOR-4	44904.	HAGR-4	51304.	HASR-4	52152.	HAWR-4	53112.	HAAR-4	57704.
	660 (2-330)	7	6	JOR-4	61728.	JGR-4	69688.	JSR-4	70536.	JWR-2	71496.	JAR-4	77648.
	1000 (2-500)	8	6	KOR-4	78816.	KGR-4	87496.	KGR-4	88344.	KWR-2	89304.	KAR-4	96176.

Δ Non-ventilated NEMA Type 12 enclosures are not recommended for CMAA Service Classifications E and F and for applications which have frequent jogging and inching operations because a corrosive atmosphere, detrimental to the component parts, can develop. For these applications, NEMA I Gasketed enclosures are recommended.

• For explanation and pricing of multi-motor controls refer to multi-motor drives section of application data.

†Not a NEMA size/rating

ORDERING INFORMATION REQUIRED:

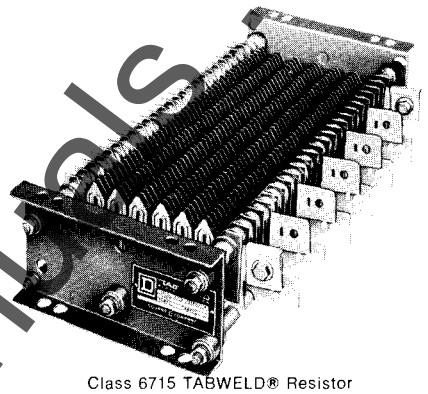
1. Class
2. Type
3. Motor Horsepower
4. Motor Duty Rating
5. Voltage
6. Controller Modifications: Specify Form Y35 and Modification Numbers
7. Resistor Service Classification
8. Master Switch Type and Form
9. Completed Crane Data Sheet

BRIDGE OR TROLLEY SERVICE

A complete set of motor control equipment consists of a controller and separately mounted TAB-WELD® resistors and master switch. The following tables are for selecting the resistors and master switches used with Class 6121 Bridge or Trolley controllers.

TAB-WELD® RESISTOR SELECTION TABLE ⊙

Maximum HP Rating Single Motor ■	Price Without Armature Shunt NEMA Class •			Price With Armature Shunt ▲ NEMA Class •			Price Additions		
	152-P	162-P	172-P	152-PAS	162-PAS	172-PAS	Service D.B. Resistor Δ	Emergency D.B. Resistor □	Continuous* Duty Slowdown Resistor
5	$ 636.	$ 636.	$ 636.	$ 804.	$ 848.	$ 1004.	$ 480.	...	$ 580.
7½	636.	636.	636.	804.	848.	1004.	480.	...	660.
10	636.	636.	720.	804.	848.	1176.	480.	...	740.
15	636.	712.	720.	936.	1012.	1176.	540.	$ 460.	900.
20	636.	712.	916.	936.	1012.	1352.	584.	460.	1280.
25	650.	752.	1092.	958.	1056.	1532.	644.	760.	1500.
30	684.	872.	1264.	992.	1184.	1716.	704.	760.	1640.
35	760.	988.	1432.	1076.	1288.	1868.	744.	760.	1780.
40	856.	1100.	1596.	1168.	1416.	2052.	810.	760.	1980.
45	956.	1228.	1780.	1264.	1620.	2348.	952.	760.	2180.
50	1048.	1320.	1916.	1356.	1764.	2556.	1040.	760.	2400.
60	1220.	1596.	2316.	1588.	1976.	2864.	1100.	760.	2620.
65	1312.	1716.	2488.	1712.	2240.	3248.	1296.	820.	3040.
70	1416.	1848.	2680.	1832.	2404.	3484.	1388.	820.	4300.
75	1484.	1952.	2832.	1936.	2548.	3696.	1476.	820.	4540.
90	1772.	2328.	3376.	2300.	3016.	4372.	1736.	820.	5140.
100	1936.	2564.	3716.	2532.	3332.	4832.	1920.	820.	5360.
110	2140.	2820.	4088.	2780.	3664.	5312.	2112.	1240.	5560.
125	2404.	3180.	4612.	3128.	4132.	5992.	2384.	1240.	...
135	2576.	3424.	4964.	3364.	4508.	6536.	2624.	1660.	...
150	2872.	3784.	5488.	3708.	4924.	7140.	2844.	1660.	...
175	3308.	4388.	6364.	4304.	5716.	8288.	3124.	1660.	...
200	3764.	5000.	7252.	4884.	6500.	9424.	3752.	1660.	...
225	4216.	5624.	8156.	5480.	7308.	10596.	4256.	2060.	...
250	4820.	6356.	9216.	6244.	8272.	11996.	...	...	...
275	5280.	6968.	10104.	6856.	9064.	13144.	...	...	...
300	5724.	7580.	10992.	7444.	9872.	14316.	...	...	...
325	6160.	8184.	11868.	8012.	10648.	15440.	...	...	...
350	6620.	8780.	12732.	8616.	11404.	16536.	...	...	...
375	7072.	9396.	13624.	9196.	12208.	17700.	...	...	...
400	7528.	10016.	14524.	9780.	13008.	18860.	...	...	...
425	7980.	10268.	14888.	10368.	13948.	19500.	...	...	...
450	8432.	11244.	16304.	10964.	14612.	21188.	...	...	...
475	9036.	11968.	17352.	11744.	15564.	22568.	...	...	...
500	9640.	12708.	18428.	12520.	16536.	23976.	...	...	...



Class 6715 TABWELD® Resistor

RESISTOR APPLICATION DATA

⊙ For resistors mounted in racks, unwired — refer to Class 6715.

■ Duplex controllers require two sets of resistors, one set to each motor.

• Class 152 is recommended for light crane duty. Class 162 is recommended for standard crane duty. Class 172 is recommended for severe crane duty.

For explanation of NEMA resistor classifications — refer to Class 6715 Application Data.

▲ Armature shunt resistors are intermittent rated for use with an armature shunt contractor, Controller Modification No. 5.

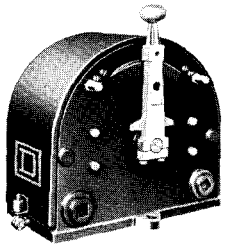
Δ Service dynamic braking resistor is used with Controller Modification No. 9.

□ Emergency dynamic braking resistor is used with Controller Modification Nos. 10 & 11. (Two motors in parallel require one set of resistors for each motor. Two motors in series require one set of resistors.)

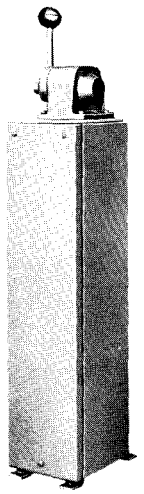
* Slowdown resistors are designed to limit Bridge drives to approximately 50% of their present free running speed. Complete motor nameplate data plus the free running current drawn by the motor must be provided to design the slowdown resistors.

MASTER SWITCH SELECTION TABLE

CLASS 9004 VM OR CM NEMA 1 ENCLOSED						
			VM		CM	
Drive	Speed Points	Form	Type	Price	Type	Price
Bridge	3	3U	VG-6	$880.	CG-6	$ 970.
or	5	5U	VG-9	960.	CG-8	1020.
Trolley	6	6U	VG-9	960.	...	...
	6	6U	...	...	CG-12	1200.



Class 9004 Type CG-8 Master Switch



Class 9004 Type VG-9 Master Switch

ACCESSORIES

Brakes ..... see Class 5010
Adjustable Torque Brakes ..... see Class 5060
Manual-Magnetic Disconnect Switch ..... see Class 6140

CONTROLLER MODIFICATIONS (FORM Y35)

Modification No.	Description		Price* Max. HP. Rating - Single Motor						
			35	55	110	225	275	330	500
1	Substitute Fused Main Line Knife Switch for unfused Main Line Knife Switch		$660.	$660.	$880.	$1780.	$1780.	Δ	Δ
2	Substitute Circuit Breakers for Main Line and control circuit Knife Switches		400.	400.	600.	600.	900.	Δ	Δ
3	Additional Acceleration Point		776.	912.	1216.	1852.	2160.	$2508.	$3624.
4	Second Plugging Step		776.	912.	1216.	1852.	2160.	2508.	3624.
5	Armature Shunt Contactor		468.	604.	908.	1544.	1898.	2200.	3316.
6	Jam Relay		368.	368.	368.	368.	368.	368.	368.
7□	Series Brake Transfer Knife Switches		1424.	2312.	3264.	6016.	6630.	7176.	6520.
8	Power Terminal Board		560.	720.	900.	1620.	1992.	2340.	3460.
9†	Service Dynamic Braking		936.	1208.	1816.	3088.	3798.	...	...
10†	Emergency Dynamic Braking, Single Point	Single Motor	4144.	4536.	6852.	11880.	14612.	16560.	11080.
		Two Motors In Parallel	4144.	5088.	6404.	9248.	11174.	12072.	16736.
		Two Motors In Series	4144.	4536.	6852.	11880.	14612.	16560.	22160.
11†	Emergency Dynamic Braking, Auto Decel.	Single Motor	5460.	5908.	8608.	14272.	17554.	19608.	26324.
		Two Motors In Parallel	6736.	7552.	9476.	10592.	16518.	17728.	24624.
		Two Motors In Series	5460.	5908.	8608.	14272.	17554.	19608.	26324.
12	Shunt Brake Relay		368.	368.	368.	368.	368.	368.	368.
13	Voltage Relay		440.	440.	440.	440.	440.	440.	440.
14	Ammeter Shunt, 50 MV		136.	184.	336.	508.	508.	508.	712.
15	Ammeter Shunt, 100 MV		208.	280.	672.	1080.	1080.	1080.	1584.
16	Miniature Ammeter Panel Mounted		200.	200.	200.	200.	200.	200.	200.
17	Arc Inhibitors (Required on all Pendant and Radio Operated Controllers		720.	720.	720.	720.	720.	720.	720.
18	Cabinet Space Heater Controlled By Interlock From M Contactor		440.	440.	440.	440.	440.	440.	440.
19	Low Headroom — See Class 6131		...	...	...	...	...	...	...
24	Substitute Type SSI Time Current Acceleration Module For Type ST Static Acceleration Timers		700.	700.	700.	700.	700.	700.	700.

*For Duplex Controllers Multiply all prices by two with the exception of modifications 7, 10, 11.
□For Duplex Controllers Using Series Brakes.
ΔContact your local Square D Field Office.
† Does not include resistor prices.

APPLICATION DATA

MULTI-MOTOR DRIVES

Two motors connected in series — The armatures and fields of each motor are connected in series and treated as a single motor. If the voltage rating of each motor is 230 vdc and the supply voltage is 230 vdc, the horsepower rating is equal to the rating of one motor. If the voltage rating of each motor is 115 vdc and the supply voltage is 230 vdc, the horsepower rating is equal to the sum of the ratings of both motors. Controller and resistor pricing is based on the horsepower rating. A single set of motor power resistors is required.

Two motors connected in parallel — One set of control equipment and power resistors is required for each motor. Controller modification prices are double those shown for a single motor scheme.

Four motors connected in parallel (quadruplex) — It is necessary to double the duplex controller price given for two motors in parallel. Four sets of motor power resistors are required.

Four motors connected in series-parallel — Two sets of series motors with their armatures and fields connected in series are connected in parallel. Controllers and modifications for this connection should be priced based on two motors in parallel. Two sets of motor power resistors are required.

SPECIAL PANEL CONSTRUCTION

Several types of factory assembled and unitized constructions are available. Consult your local Square D field office for details.

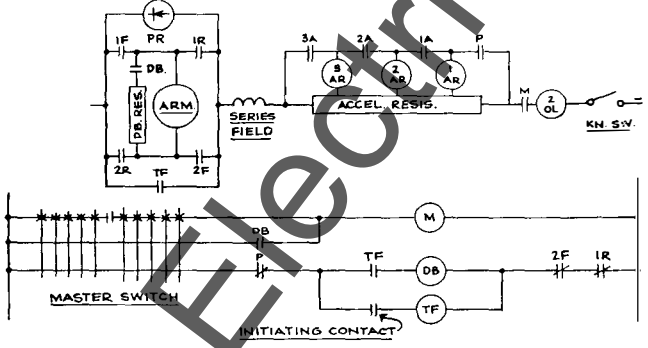
CONTROLLER MODIFICATIONS

Standard controllers come equipped with the components listed. Special features to be added to standard controllers are identified by Form Y35 and a modification number. Most of these modifications are self-explanatory. Others, however, require some additional explanation.

MODIFICATION NO. 4 lists a second plugging step. An additional plugging relay (2PR) and an additional plugging contactor (2P) are supplied. A second plugging step is recommended for heavy cranes, such as ladle crane bridge drives or high speed cranes such as ore bridge trolleys or high speed bridge drives. Two steps of plugging provide faster slowdown without spinning the wheels.

MODIFICATION NO. 7 lists series brake transfer knife switches for use on duplex controllers. For single motor operation, these knife switches connect the series brakes in series with one motor to permit operating the drive without having to manually release one brake.

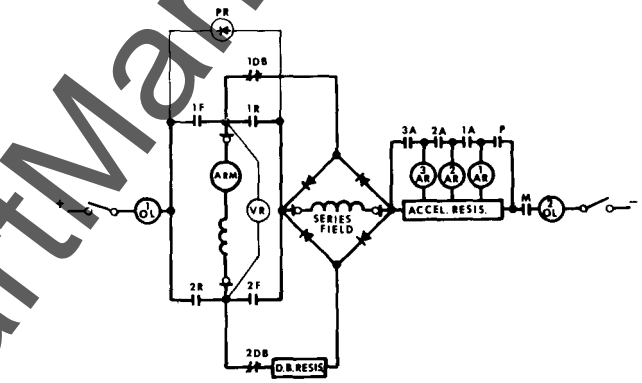
MODIFICATION NO. 9, service dynamic braking, is used for decelerating travel drives under normal operation. Service dynamic braking is occasionally used in place of plugging on a travel drive. The common arrangement is to use an initiating switch in conjunction with the electric adjustable torque or hydraulic brake pedal such that initial depression of the brake pedal provides service dynamic braking and further depression actuates the hydraulic brake. Service dynamic braking assists the hydraulic brake.



Service Dynamic Braking for single series motor.

MODIFICATION NO. 10 covers emergency dynamic braking. Emergency dynamic braking is used to decelerate crane travel drives, such as high speed bridge drives and manned trolleys and is automatically applied upon power failure or when an overload relay trips. Emergency dynamic braking provides a simple, reliable means for braking to a stop, bridge drives of cranes or manned trolleys of ore and coal bridges, etc. Emergency dynamic braking is applied in about 1/5 the time required to set a shunt brake. The motors are converted to self-excited generators to provide retardation. Braking is not dependent on an outside source of power. The circuits for single step emergency dynamic braking (Modification No. 10) are shown for the various motor connections.

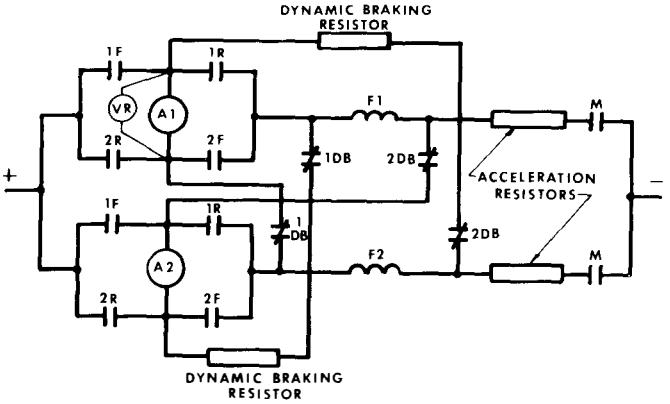
Emergency Dynamic Braking For A Single Motor — The motor is connected as a self-excited generator by using a silicon rectifier bridge around the motor series field. Braking is equally effective in each direction.



Emergency Dynamic Braking for single motor.

Emergency Dynamic Braking For Two Motors Connected In Series — The same circuit as for a single motor is used. The armatures and fields of the two motors are permanently connected in series and are treated as a single motor.

Emergency Dynamic Braking For Two Motors Connected In Parallel — The circuit shows the simple arrangement whereby the fields and the armatures of the two series motors are cross-connected to insure self-excitation for positive emergency dynamic braking from either direction of travel. Two sets of double-pole dynamic braking contactors are used.



Emergency Dynamic Braking for 2 motors in parallel.

CONTROLLER MODIFICATIONS (CONT'D)

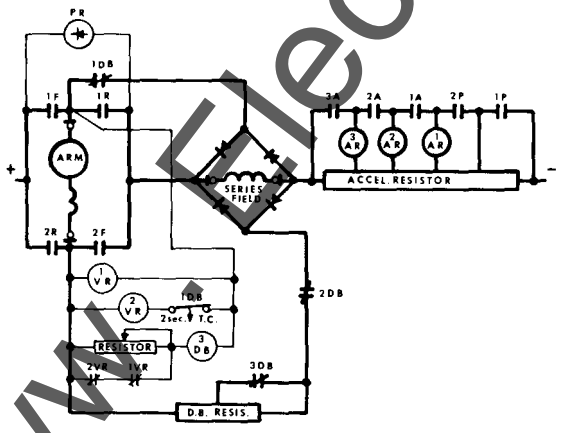
Emergency Dynamic Braking For Four Motor Drives —

For four motors connected in parallel, two sets of cross-connected motors are connected in parallel to provide dynamic braking for all four motors. For this motor connection, the controller modification is priced by doubling the price given for two motors in parallel.

When four motors are connected in series parallel, that is, when two sets of motors with their armatures and fields connected in series are connected in parallel, emergency dynamic braking should be priced based on the controller modification for two motors connected in parallel.

MODIFICATION NO. 11 covers graduated emergency dynamic braking with automatic deceleration. The automatic deceleration provides a faster stop than single step deceleration from high speed without wheel slippage.

Graduated Emergency Dynamic Braking With Automatic Deceleration For A Single Motor — An additional voltage relay (2VR) and a spring closed contactor (3DB) with its main contacts shorting out a portion of the dynamic braking resistor are added to the circuit for single step emergency dynamic braking. The two voltage relays (1VR and 2VR) are used to insure proper operation of the 3DB contactor. The generated armature voltage keeps the 3DB contactor energized until the motor speed is decreased sufficiently to provide a smooth deceleration. When the 3DB contactor closes, the value of the dynamic braking resistance is decreased, and increased braking torque is provided to stop the drive.



Graduated Emergency Dynamic Braking with Automatic deceleration for a single motor.

Graduated Emergency Dynamic Braking With Automatic Deceleration For Multi-Motor Drives — For two motors connected in series, the fields of each motor are connected in series inside the rectifier bridge and are treated as a single motor.

For two motors connected in parallel, the basic circuit for two motors in parallel with emergency dynamic braking (Modification No. 17) is used except that two voltage relays (1VR and 2VR) and two spring closed contactors (3DB and 4DB) are added. The voltage relays and the two spring closed contactors operate from the generated armature voltage of one motor and control the braking of both motors. The additional spring closed contactor (4DB) is connected with its coil in parallel with the 3DB contactor coil and its normally closed contact shorts out part of the dynamic braking resistor in the second motor power circuit.

For quadruplex connections where four motors are connected in parallel, it is necessary to double the controller modification price shown for two motors in parallel.

For four motors used in a series-parallel connection, graduated emergency dynamic braking should be priced based on the controller modification price for two motors connected in parallel.

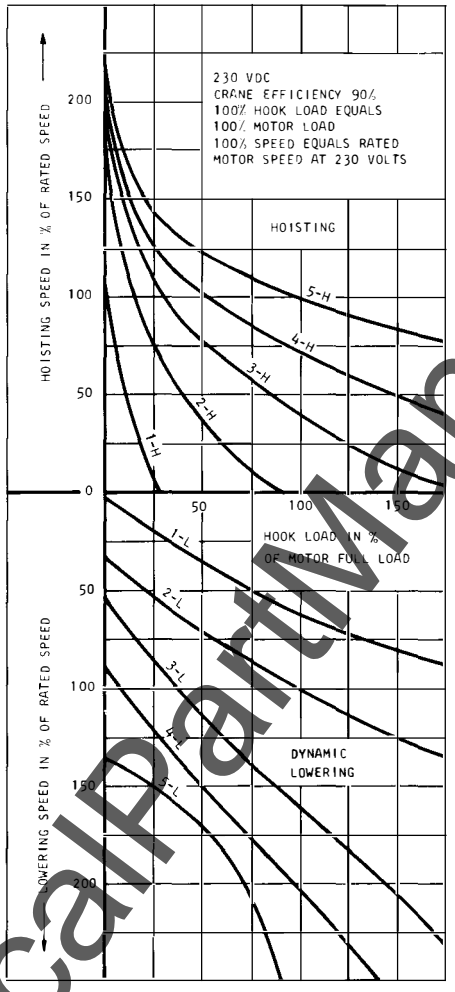
MODIFICATION NO. 12, a shunt brake relay is primarily intended for use on bridge and trolley drives using shunt brakes. The brake relay is commonly arranged for operation from a separate push button station to allow manual control of the brake.

MODIFICATION NO. 13 covers a voltage sensitive relay. An application for this addition would be the second voltage relay on a hoist drive. 2 VR protects against overspeeding and automatically returns the drive from the last point lower to the next to last point in case of overspeeding.

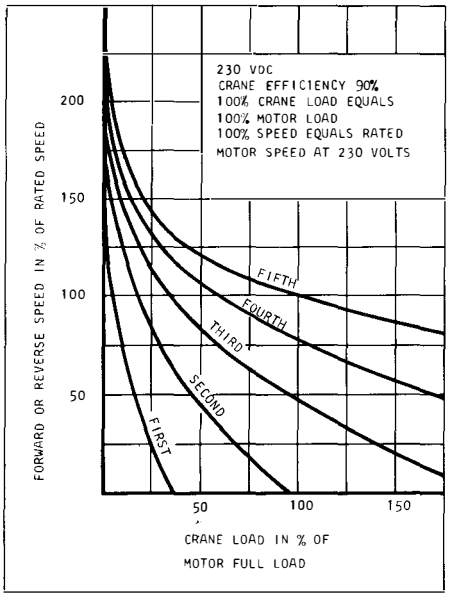
MODIFICATION NO. 19 lists low headroom panel construction. Class 6121 controllers are not available with this type construction. Class 6131 controllers with 5th speed point and negative line contactor additions should be used.

MODIFICATION NO. 24 provides time delay acceleration proportional to motor current.

CRANE HOOK SPEED VS. LOAD PERFORMANCE FOR CLASS 6121 DYNAMIC LOWERING HOIST



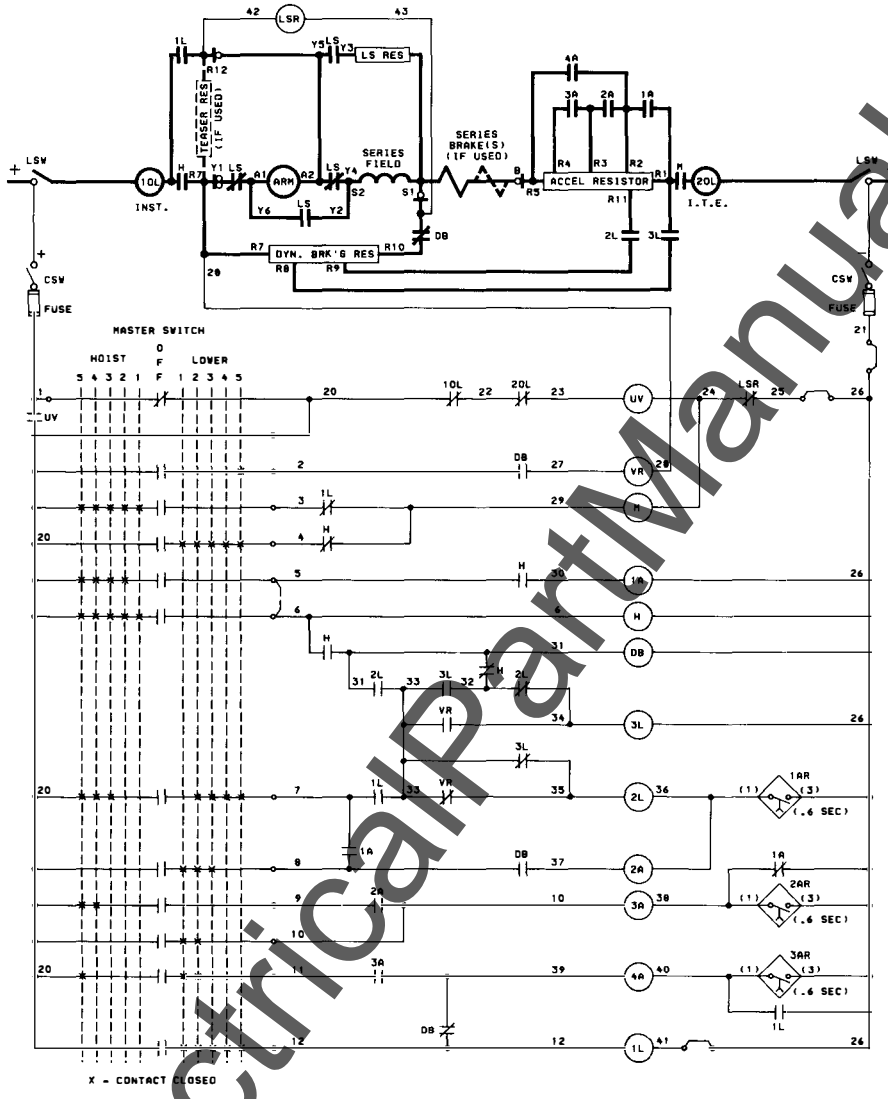
CRANE TRAVEL SPEED VS. LOAD PERFORMANCE FOR CLASS 6121 REVERSING PLUGGING



FRONTLINE® DC CRANE CONTROL

DYNAMIC LOWERING

ELEMENTARY DIAGRAM FOR HOIST CONTROL

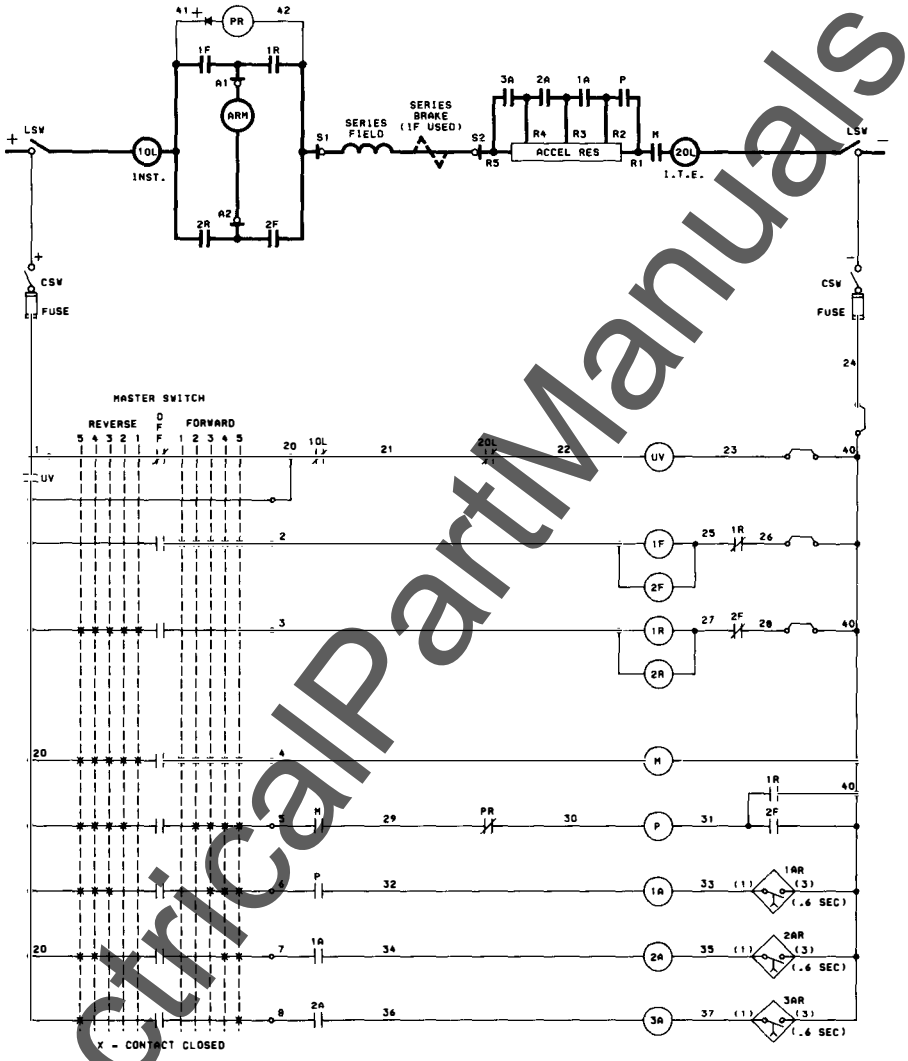


CONTACTOR SEQUENCE X - POWER TIPS CLOSED											
DEVICE	HOIST					OFF	LOWER				
	5	4	3	2	1		1	2	3	4	5
M	X	X	X	X	X		X	X	X	X	X
H	X	X	X	X	X						
DB						X					
1L							X	X	X	X	X
2L								X	X	X	
3L											X
1A	X	X	X	X							
2A	X	X	X					X	X		
3A	X	X					X	X			
4A	X						X				

CONTACTORS 1A & 1L, 3L & H, H & 2L ARE MECHANICALLY INTERLOCKED.

REVERSING PLUGGING

ELEMENTARY DIAGRAM FOR BRIDGE OR TROLLEY CONTROL



CONTACTOR SEQUENCE
X - POWER TIPS CLOSED

DEVICE	REVERSE 5	4	3	2	1	OFF	FORWARD 1	2	3	4	5
1F							X	X	X	X	X
2F							X	X	X	X	X
1R	X	X	X	X	X						
2R	X	X	X	X	X						
M	X	X	X	X	X		X	X	X	X	X
P	X	X	X	X	X			X	X	X	X
1A	X	X	X	X					X	X	X
2A	X	X	X							X	X
3A	X	X									X

CONTACTORS 1F & 1R, 1R & 2F, 2F & 2R ARE MECHANICALLY INTERLOCKED.

FRONTLINE® DC CRANE CONTROL

APPLICATION DATA

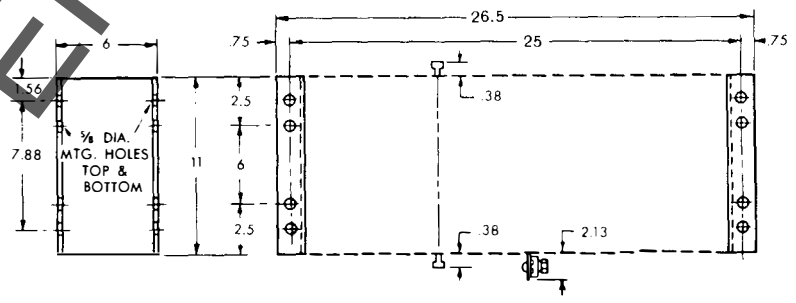
APPROXIMATE NUMBER OF SEPARATELY MOUNTED STANDARD CLASS 6715 TAB-WELD® RESISTOR SECTIONS FURNISHED WITH CLASS 6121 CONTROLLERS

This tabulation is based on Square D resistor designs for use with Class 6121 controllers only. This tabulation is for typical drive loading and may vary for a specific application. Each resistor section is 26.5 inches long and weighs 35 pounds.

Max. H.P. Rating Single Motor (230V)	Hoist ▲				Bridge or Trolley									
					Without Arm. Shunt			With Arm. Shunt			Serv. D.B.	Emerg. D.B. *		Continuous* Duty Slowdown Resistor
	152-DL	162-DL	172-DL	Teaser Field	152-P	162-P	172-P	152-PAS	162-PAS	172-PAS		Single Point	Auto. Decel.	
5	5	5	5	3	1	1	1	2	2	2	...	...	...	1
7½	4	4	4	2	1	1	1	2	2	2	...	...	...	1
10	3	3	3	2	1	1	2	2	2	3	...	...	...	1
15	3	3	3	1	2	2	2	3	3	3	3	1	1	2
20	3	3	4	1	2	2	2	3	3	3	3	1	1	3
25	3	4	6	1	2	2	3	3	3	4	3	1	2	4
30	4	5	7	1	2	2	3	3	3	4	3	1	2	4
35	4	6	8	1	2	2	3	3	3	4	4	1	2	5
40	5	6	10	1	2	3	4	3	4	5	5	1	2	5
45	6	7	10	2	3	3	5	4	4	6	6	1	2	6
50	6	8	11	2	3	3	5	4	4	7	6	1	2	6
60	8	9	13	2	4	4	5	5	5	7	7	1	2	7
65	9	10	15	2	4	5	6	5	7	8	7	1	2	8
70	9	11	15	2	4	5	6	5	7	8	8	1	2	11
75	9	11	16	2	4	5	7	6	7	8	9	1	2	11
90	11	13	17	2	4	5	8	6	7	10	10	2	2	13
100	13	14	19	2	5	6	9	7	8	11	10	2	2	13
110	13	15	23	3	5	7	10	7	9	13	10	2	3	14
125	16	19	25	3	6	7	11	8	9	14	11	2	3	...
135	17	19	26	4	6	8	12	8	10	16	13	2	4	...
150	19	24	30	4	6	9	14	8	12	18	15	2	4	...
175	21	26	35	4	7	10	16	10	13	20	16	3	4	...
200	24	27	38	5	8	13	19	11	17	23	20	3	4	...
225	26	31	39	6	10	14	20	14	18	25	21	3	5	...
250	...	34	44	7	...	16	21	...	20	26	...	...	...	...
275	...	35	45	8	...	18	24	...	22	30	...	...	...	...
300	...	42	52	8	...	19	26	...	24	32	...	...	...	...
325	...	44	56	8	...	20	28	...	25	34	...	...	...	...
350	...	47	60	8	...	22	30	...	27	38	...	...	...	...
375	...	48	69	8	...	23	32	...	31	40	...	...	...	...
400	...	54	69	10	...	25	35	...	33	43	...	...	...	...
425	...	57	73	10	...	26	36	...	33	46	...	...	...	...
450	...	60	77	10	...	28	39	...	34	49	...	...	...	...
475	...	65	82	14	...	30	41	...	39	50	...	...	...	...
500	...	68	87	14	...	32	44	...	40	52	...	...	...	...

▲Does not include YOUNGSTOWN® power limit switch resistor . . . refer to Class 6170.
*Does not include acceleration resistor.

STANDARD CLASS 6715 TAB-WELD® RESISTOR SECTIONS



APPROXIMATE DIMENSIONS

INCREASE IN STANDARD PANEL WIDTH FOR COMMONLY USED MODIFICATIONS.

The table below may be used to determine what increase in width, if any, results when modifications are added to a standard Class 6121 controller. The dimensions apply only to individual modification or combination of modifications for which they are shown.

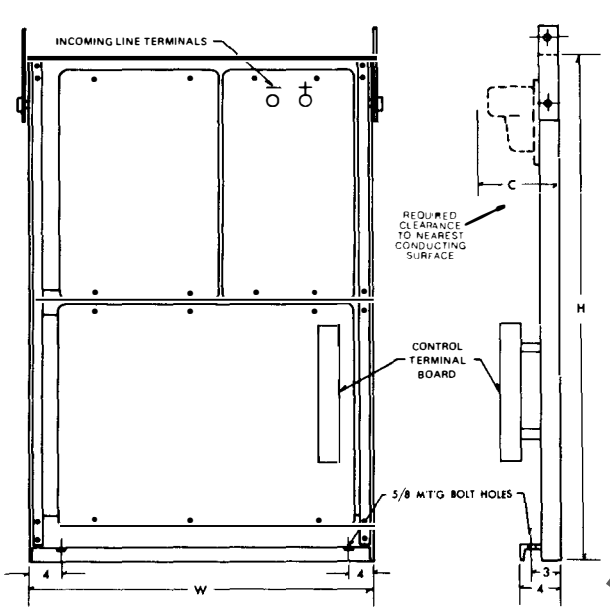
Modification No.	Description	Max. HP. Crane Rating per Motor (230V)						
		35	55	110	225	275	330	550
	HOIST CONTROLLER							
1	Circuit Breakers Instead of Control and Main Line Knife Switches	0	0	0	0	0	△	△
2	Fused Main Line Knife Switch Instead of Unfused Main Line Knife Switch	0	0	0	0	0	△	△
3	Additional Accel. Point	6	6	7	6	6	0	0
8	Power Terminal Board	6	6	7	6	6	0	0
13	Voltage Relay	0	0	0	0	0	0	0
14	Ammeter Shunt, 50 MV	0	0	0	0	0	0	0
15	Ammeter Shunt, 100 MV	0	0	0	0	0	0	0
16	Miniature Ammeter, Panel Mounted	0	0	0	0	0	0	0
17	Arc Inhibitors, Pendant or Radio Operated Controllers	0	0	0	0	0	0	0
18	Cabinet Space Heater	0	0	0	0	0	0	0
24	Type SSI Time Current Acceleration Module instead of Type ST static timers	0	0	0	0	0	0	0
	BRIDGE OR TROLLEY CONTROLLER							
1	Circuit Breaker Instead of Control and Main Line Knife Switch	0	0	0	0	0	△	△
2	Fused Main Line Knife Switch Instead of Unfused Main Line Knife Switch	0	0	0	0	0	△	△
3	Additional Accel. Point	0	0	0	0	0	0	0
4	Second Plugging Step	0	0	0	0	0	0	0
5	Armature Shunt Contactor	0	0	0	0	0	0	0
8	Power Terminal Board	6	6	7	6	6	0	0
3,8	Combination	6	6	7	6	6	0	0
4,8	Combination	6	6	7	6	6	0	0
5,8	Combination	6	6	7	6	6	0	0
9	Service Dynamic Braking	6	6	7	6	6	0	0
8,9	Combination	6	6	7	6	6	0	0
4,9	Combination	6	6	7	6	6	△	△
4,8,9	Combination	12	12	14	12	12	△	△
10	Emergency Dynamic Braking, Single Point — Single Motor	△	△	△	△	△	△	△
	Emergency Dynamic Braking, Single Point — Two Motors In Parallel							
	Emergency Dynamic Braking, Single Point — Two Motors In Series							
11	Emergency Dynamic Braking, Auto. Decel. — Single Motor	△	△	△	△	△	△	△
	Emergency Dynamic Braking, Auto. Decel. — Two Motors In Parallel							
	Emergency Dynamic Braking, Auto. Decel. — Two Motors In Series							
12	Shunt Brake Relay (& Res.)	0	0	0	0	0	0	0
8,12	Combination	6	6	7	6	6	0	0
4,8,12	Combination	6	6	7	6	6	0	0
14	Ammeter Shunt, 50 MV	0	0	0	0	0	0	0
15	Ammeter Shunt, 100 MV	0	0	0	0	0	0	0
16	Miniature Ammeter, Panel Mounted	0	0	0	0	0	0	0
17	Arc Inhibitors, Pendant or Radio Operated Controllers	0	0	0	0	0	0	0
18	Cabinet Space Heater	0	0	0	0	0	0	0
24	Type SSI Time Current Acceleration Module instead of Type ST static timers	0	0	0	0	0	0	0

△ Contact your local Square D Sales Office.

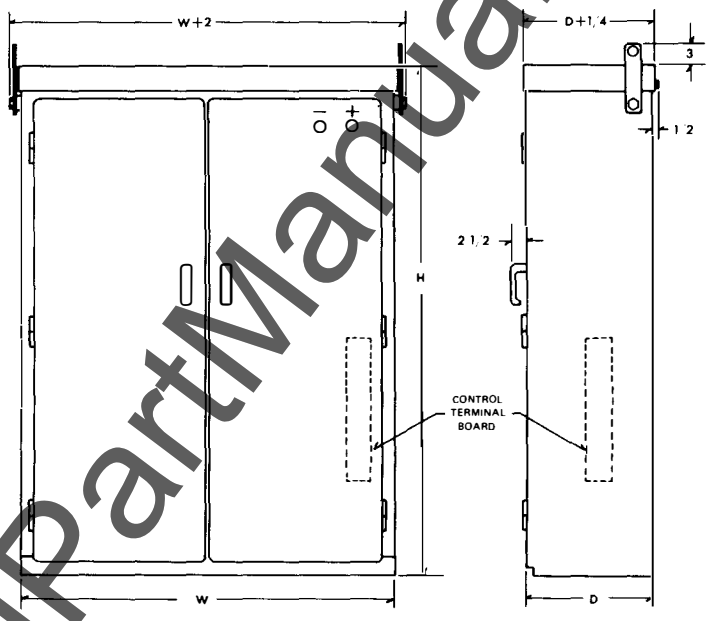
APPROXIMATE DIMENSIONS AND WEIGHTS

SINGLE MOTOR CONTROL
STANDARD CONTROLLERS

OPEN TYPE



ENCLOSED TYPE



Drive	Maximum HP (230V)	Open Type				Enclosed Type			
		H	W	C	Net Weight (Lbs.)	H	W	D	Net Weight (Lbs.)
Hoist	35	68	33	12	500	68	33	15	700
	55	68	33	12	500	68	33	15	700
	110	78	38	15	700	78	38	17	900
	225	72	72	21	1300	72	72	23	1800
	275	72	72	21	1300	72	72	23	1800
	330	90	99	25	2600	90	99	27	3700
	500	90	99	25	2600	90	99	27	3700
Bridge or Trolley	35	68	33	12	500	68	33	15	700
	55	68	33	12	500	68	33	15	700
	110	78	38	15	700	78	38	17	900
	225	72	72	21	1200	72	72	23	1500
	275	72	72	21	1200	72	72	23	1500
	330	90	99	25	2400	90	99	27	3500
	500	90	99	25	2400	90	99	27	3500

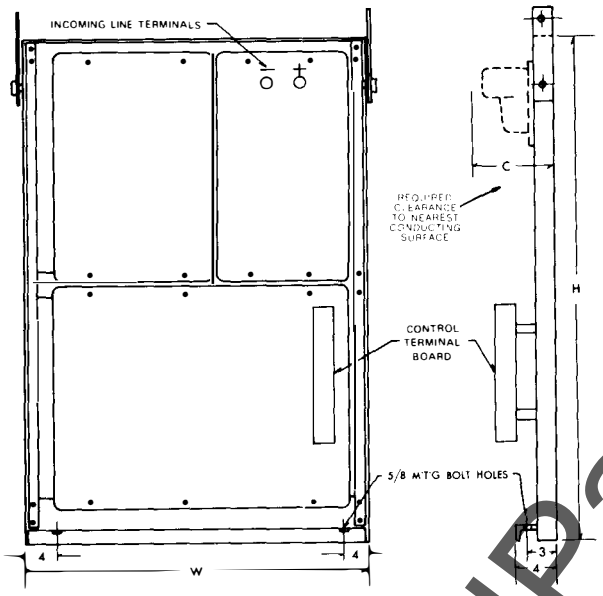
FRONTLINE® DC CRANE CONTROL

APPROXIMATE DIMENSIONS AND WEIGHTS

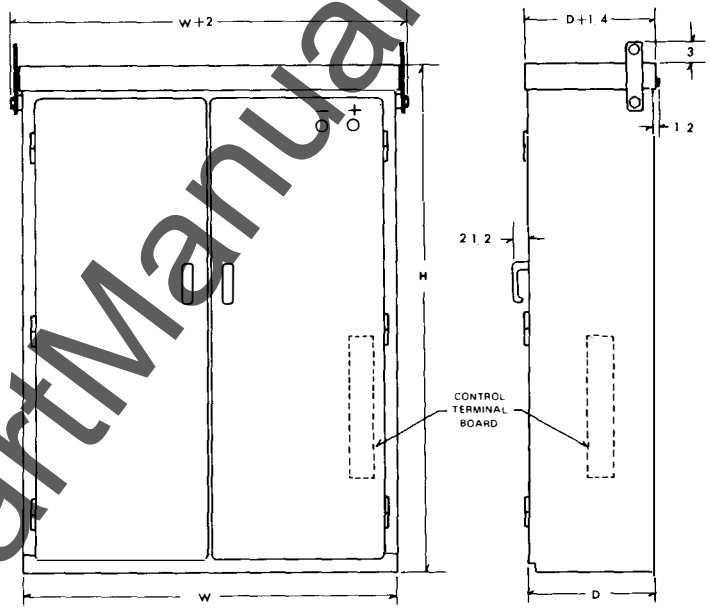
DUPLEX MOTOR CONTROL

STANDARD CONTROLLERS

OPEN TYPE



ENCLOSED TYPE



Drive	Maximum HP (230V)	Open Type				Enclosed Type			
		H	W	C	Net Weight (Lbs.)	H	W	D	Net Weight (Lbs.)
Hoist	70 (2-35)	68	66	12	1000	68	66	15	1000
	110 (2-55)	68	66	12	1000	68	66	15	1000
	220 (2-110)	78	77	15	1400	78	77	17	1800
	*450 (2-225)	72	72	21	1300	72	72	23	1800
	*550 (2-275)	72	72	21	1300	72	72	23	1800
	*660 (2-330)	90	99	25	2600	90	99	27	3700
	*1000 (2-500)	90	99	25	2600	90	99	27	3700
Bridge or Trolley	70 (2-35)	68	66	12	1000	68	66	15	1400
	110 (2-55)	68	66	12	1000	68	66	15	1400
	220 (2-110)	78	77	15	1400	78	77	17	1800
	*450 (2-225)	72	72	21	1200	72	72	23	1800
	*550 (2-275)	72	72	21	1200	72	72	23	1800
	*660 (2-330)	90	99	25	2400	90	99	27	3500
	*1000 (2-500)	90	99	25	2400	90	99	27	3500

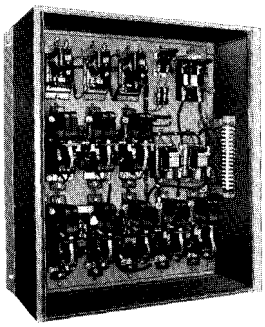
*Two controllers are required. Dimensions and weights shown are for each.

FRONTLINE® DC CRANE CONTROL

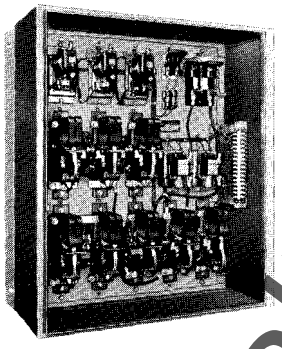
GENERAL INFORMATION AND PRICING

Class 6131 Controllers are recommended for use with dc series motors on hoist, bridge and trolley drives of general purpose overhead cranes. The hoist controllers are of the reversing dynamic lowering type and are designed for use on cranes without mechanical load brakes. The bridge and trolley controllers are of the reversing-plugging type and can also be used to control hoists with mechanical load brakes. Both the hoist and the bridge and trolley controllers are designed for use with series wound magnetic brakes. The bridge and trolley controllers can also be used with shunt wound brakes when an optional shunt brake relay is supplied.

- MILL DUTY CLASS 7004 TYPE M LINE-ARC® CONTACTORS & CLASS 7001 TYPE K RELAYS
- CLASS 7001 TYPE ST-1 STATIC ACCELERATION TIMERS



Class 6131
Type EGH-8
Hoist Controller



Class 6131
Type EGR-8
Bridge or Trolley Controller

HOIST SERVICE

The standard single motor reversing dynamic lowering controller consists of:

1 — Two pole fused control circuit knife switch with padlock clip (CSW)
1 — Two pole unfused main line knife switch with padlock clip (LSW)
4 — Type M single pole contactors with mechanical interlocks for hoisting and lowering circuits (H, 1L, 2L, 3L)
3 — Type M single pole acceleration contactors (1A, 2A, 3A)
2 — Type ST-1 static acceleration timers (1AR, 2AR)
1 — Type KE voltage relay for acceleration lowering (VR)
1 — Type KE limit switch relay (LSR)
1 — Type M single pole spring-closed dynamic lowering contactor (DB)
1 — Undervoltage relay (UV)
2 — Magnetic overload relays (one instantaneous and one inverse time) (10L, 20L)

BRIDGE OR TROLLEY SERVICE

The standard single motor reversing plugging controller consists of:

1 — Two pole fused control circuit knife switch with padlock clip (CSW)
1 — Two pole unfused main line knife switch with padlock clip (LSW)
4 — Type M single pole directional contactors with mechanical interlocks (1F, 2F, 1R, 2R)
3 — Type M single pole acceleration contactors (including one for plugging) (1A, 2A, P)
2 — Type ST-1 static acceleration timers (1AR, 2AR)
1 — Type KP rectifier-plugging relay (PR)
1 — Undervoltage relay (UV)
2 — Magnetic overload relays (one instantaneous and one inverse time) (10L, 20L)

Volts	Max. HP Crane Rating	Contactors NEMA Size	No. of Speed Points	Open Type		General Purpose Enclosure NEMA Type 1		General Purpose Enclosure NEMA Type 1 Gasketed		Outdoor Enclosure NEMA Type 3R	
				Controller Type	Price	Controller Type	Price	Controller Type	Price	Controller Type	Price
SINGLE MOTOR REVERSING DYNAMIC LOWERING HOIST CONTROL											
230	7½	1	4	COH-8	**$4088.**	CGH-8	**$4512.**	CSH-8	**$4672.**	CWH-8	**$4856.**
	15	2	4	DOH-8	**5092.**	DGH-8	**5596.**	DSH-8	**5732.**	DWH-8	**6048.**
	35	3	4	EOH-8	**5620.**	EGH-8	**6100.**	ESH-8	**6236.**	EWH-8	**6552.**
	55	4	4	FOH-8	**6400.**	FGH-8	**6980.**	FSH-8	**7116.**	FWH-8	**7432.**
SINGLE MOTOR REVERSING-PLUGGING BRIDGE OR TROLLEY CONTROL											
230	7½	1	4	COR-8	**$3564.**	CGR-8	**$3976.**	CSR-8	**$4136.**	CWR-8	**$4292.**
	15	2	4	DOR-8	**4036.**	DGR-8	**4480.**	DSR-8	**4616.**	DWR-8	**4932.**
	35	3	4	EOR-8	**4544.**	EGR-8	**4980.**	ESR-8	**5116.**	EWR-8	**5432.**
	55	4	4	FOR-8	**5272.**	FGR-8	**5780.**	FSR-8	**5916.**	FWR-8	**6232.**

ORDERING INFORMATION REQUIRED

1. Class
2. Type
3. Motor Horsepower
4. Motor Duty Rating
5. Voltage
6. Controller Modifications: Specify Form Y35 and Modification Numbers
7. Resistor Service Classification
8. Master Switch Type and Form
9. Completed Crane Data Sheet

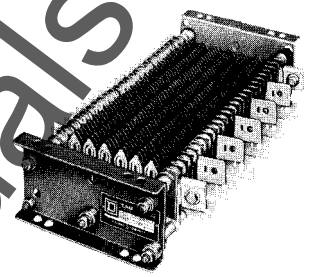
FRONTLINE® DC CRANE CONTROL

PRICING INFORMATION AND APPLICATION DATA

A complete set of motor control equipment consists of a controller and separately mounted TAB-WELD® resistors and master switch. The following tables are for selecting the resistors and master switches used with Class 6131 controllers.

TAB-WELD® RESISTOR SELECTION TABLE⊙

Maximum H.P. Rating Single Motor	HOIST NEMA Class● 152DL	HOIST NEMA Class● 162DL	BRIDGE OR TROLLEY NEMA Class● Without Armature Shunt 152P	Without Armature Shunt 162P	With Intermittent Duty Armature Shunt▲ 152PAS	With Intermittent Duty Armature Shunt▲ 162PAS	Price Addition Continuous Duty Slowdown Resistors★
5†	$ 932.	$ 932.	$ 496.	$ 540.	$ 804.	$ 848.	$ 580.
7½	1340.	1340.	496.	636.	804.	944.	660.
10	1368.	1388.	556.	636.	864.	944.	740.
15	1416.	1480.	620.	712.	936.	1012.	900.
20	1460.	1580.	620.	712.	936.	1012.	1280.
25	1508.	1680.	650.	752.	958.	1056.	1500.
30	1560.	1952.	684.	872.	992.	1184.	1642.
35	1764.	2040.	760.	988.	1076.	1288.	1780.
40	1976.	2504.	856.	1100.	1168.	1416.	1980.
45	2176.	2788.	956.	1228.	1264.	1620.	2180.
50	2388.	3068.	1048.	1320.	1356.	1764.	2400.
55	2796.	3596.	1220.	1596.	1588.	1976.	2620.



Class 6715 TAB-WELD® Resistor

RESISTOR APPLICATION DATA

⊙ For resistors mounted in racks, unwired — refer to Class 6715.

● Class 152 is recommended for light crane duty. Class 162 is recommended for standard crane duty. For explanation of NEMA resistor classifications — refer to Class 6715 Application Data.

▲ Armature shunt resistors are intermittent rated for use with an armature shunt contactor. Controller Modification No. 5.

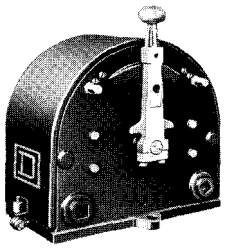
★ Slowdown resistors are designed to limit Bridge drives to approximately 50% of their present free running speed. Complete motor nameplate data plus the free running current drawn by the motor must be provided to design the slowdown resistors.

† Below 5 HP wire wound resistors are furnished.

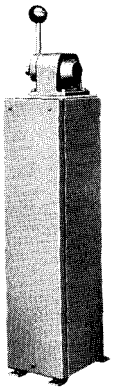
MASTER SWITCH SELECTION TABLE

CLASS 9004 VM, CM or MA				
Drive	Speed Points	Type	Form	Price
Hoist	4	AG-9	4Y	$940.
		VG-9	4Y	960.
		CG-8	4Y	1020.
Bridge or Trolley	4	AG-6	4Z	730.
		VG-6	4Z	880.
		CG-6	4Z	970.

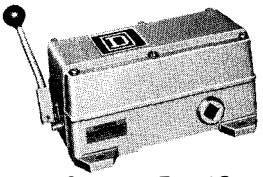
For Pendant Type Push Button Stations see Class 9004.



Class 9004 Type CG-8 Master Switch



Class 9004 Type VG-9 Master Switch



Class 9004 Type AG-9 Master Switch

ACCESSORIES

Brakes ..... see Class 5010
Adjustable Torque Brakes ..... see Class 5060
Manual-Magnetic Disconnect Switch ..... see Class 6140
YOUNGSTOWN® Power Limit Switch ..... see Class 6170

CONTROLLER MODIFICATIONS (FORM Y35)

Modification No.	Description	Max. HP Rating - Single Motor			
		7-½	15	35	55
1	Substitute Fused Main Line Knife Switch For Unfused Main Line Knife Switch	$660.	$660.	$1060.	$1060.
2	Substitute Circuit Breakers for Main Line and Control Circuit Knife Switches	400.	400.	400.	400.
3†	Additional Acceleration Point	676.	712.	776.	912.
5A*	Armature Shunt Contactor	368.	404.	468.	604.
5B*		368.	404.	468.	604.
12A*	Shunt Brake Relay	368.	368.	368.	368.
12B*		368.	368.	368.	368.
12C*		368.	368.	368.	368.
17	Arc Inhibitors (Required on all Pendant and Radio Operated Controllers)	440.	440.	440.	440.
18	Cabinet Space Heater Operated From Interlocks	440.	440.	440.	440.
25†	Negative Line Contactor	368.	404.	468.	604.

*Apply to Bridge and Trolley Controllers Only. See Application Data for explanation of modification number.

†Additional contacts are required in the master switch for these modifications. Price master switch from Class 6121 master switch selection tables.

APPLICATION DATA

Special features to be added to standard controllers are identified by Form Y35 and a modification number.

Modifications 5A and 5B are armature shunt contactors for use on Bridge and Trolley controllers only. Each modification consists of a single pole normally open contactor of equal NEMA size to the contactors in the basic controller. The operation of each is as follows:

5A: Contactor arranged to provide extra slow first speed point. This modification is to be used with a NEMA Class 152 or 162 PAS resistor filling.

5B: Contactor arranged to provide slowdown of bridge drives during floor operation of cab/floor operated cranes. This modification is to be used with NEMA Class 152 or 162P accelerating resistors plus a continuous duty bridge slowdown resistor.

Modifications 12A, 12B, and 12C cover various shunt brake relay applications. These modifications are for Bridge and Trolley controllers only and in each case a double pole 25 ampere brake relay is supplied. The three modifications differ from each other in the way the relay is wired and controlled. Each is as follows:

12A: Relay interlocked with reversing contactors through N.O. electrical interlocks. With this arrangement the shunt brake will set whenever the controllers master switch is moved to the off point.

12B: Relay controlled from external push button, foot switch, etc. This arrangement allows the shunt brake to be manually applied by the crane operator whenever necessary.

12C: Relay connected in parallel with undervoltage relay. The arrangement allows the shunt brake to set only when the main disconnect for the crane is opened or upon power failure.

NEMA SERVICE CLASSIFICATION I

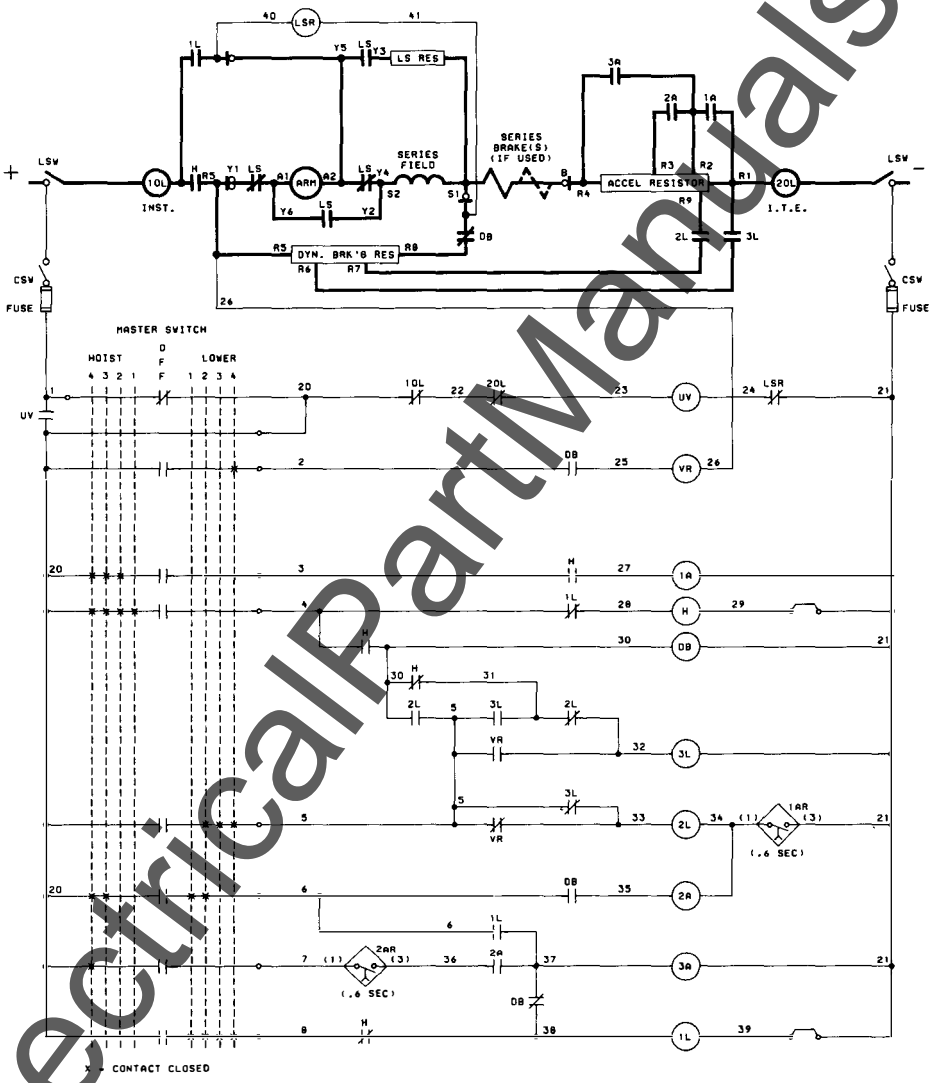
Standard controllers meet the requirements of NEMA service classification II (CMAA service classifications A2 and B). To meet the requirements of NEMA service classification I (CMAA service classification A_1, C, D, E and F), the controller must be priced with the additional acceleration point, Form Y35-3 and the negative line contactor, Form Y35-25.

FRONTLINE® DC CRANE CONTROL

CLASS 6131

DYNAMIC LOWERING

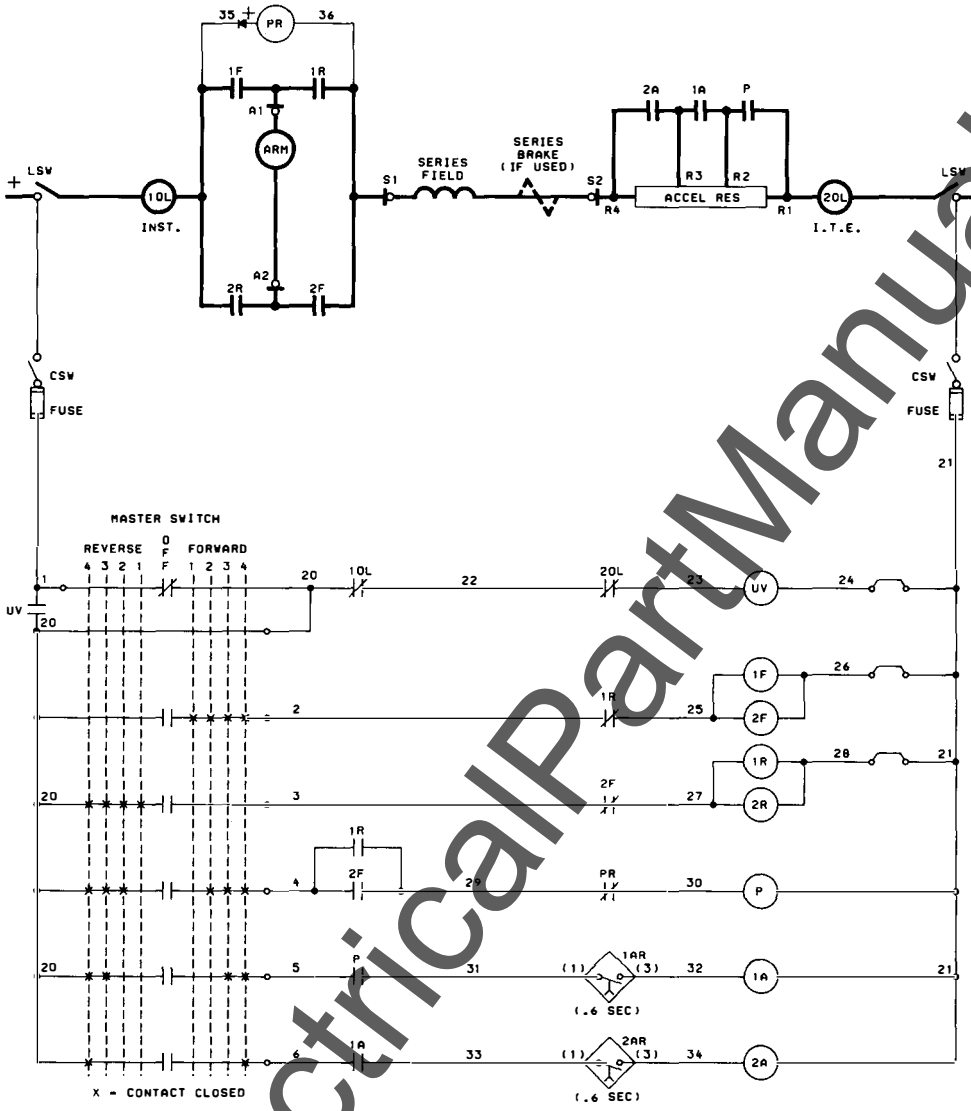
ELEMENTARY DIAGRAM FOR HOIST CONTROL



CONTACTOR SEQUENCE X = POWER TIPS CLOSED											
DEVICE	HOIST				OFF	LOWER					
	4	3	2	1		1	2	3	4		
H	X	X	X	X							
DB					X	X					
1L						X	X	X	X		
2L							X	X			
3L									X		
1A	X	X	X								
2A	X	X					X				
3A	X					X	X				

CONTACTORS 1A & 1L, 3L & H, H & 2L, ARE MECHANICALLY INTERLOCKED

ELEMENTARY DIAGRAM FOR BRIDGE OR TROLLEY CONTROL



CONTACTOR SEQUENCE X = POWER TIPS CLOSED										
DEVICE	REVERSE				0 F	FORWARD				
	4	3	2	1	F	1	2	3	4	
1F						X	X	X	X	
2F						X	X	X	X	
1R	X	X	X	X						
2R	X	X	X	X						
P	X	X	X			X	X	X		
1A	X	X					X	X		
2A	X							X		

CONTACTORS 1F & 1R, 1R & 2F, 2F & 2R, ARE MECHANICALLY INTERLOCKED

APPLICATION DATA

APPROXIMATE NUMBER OF SEPARATELY MOUNTED STANDARD CLASS 6715 TAB-WELD® RESISTOR SECTIONS FURNISHED WITH CLASS 6131 CONTROLLERS

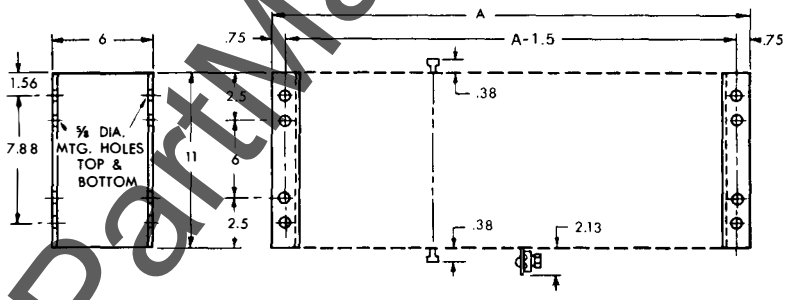
This tabulation is based on Square D resistor designs for use with Class 6131 controllers only. This tabulation is for typical drive loading and may vary for a specific application.

Max. HP. Rating Single Motor (230V)	Hoist		Bridge or Trolley				
			Without Arm. Shunt		With Arm. Shunt		Continuous Duty Slowdown Resistor
	152-DL	162-DL	152-P	162-P	152-PAS	162-PAS	
5	2E⊙	2E⊙	1E⊙	1E⊙	2D⊙	2D⊙	1D⊙
7½	3E	3E	1E	1D	2D	2D	1D
10	3E	3E	1D	1D	2D	2D	1D
15	3E	3D	1D	2D	3D	3D	3D
20	3D	3D	1D	2D	3D	3D	3D
25	3D	4D	1D	2D	3D	3D	4D
30	4D	4D	2D	2D	3D	3D	4D
35	4D	5D	2D	2D	3D	3D	5D
40	5D	6D	2D	3D	3D	4D	5D
45	5D	6D	3D	3D	4D	4D	6D
50	7D	8D	3D	3D	4D	4D	6D
55	7D	9D	3D	4D	5D	5D	7D

⊙Suffixes E & D denote type of Class 6715 Tab-Weld® sections.

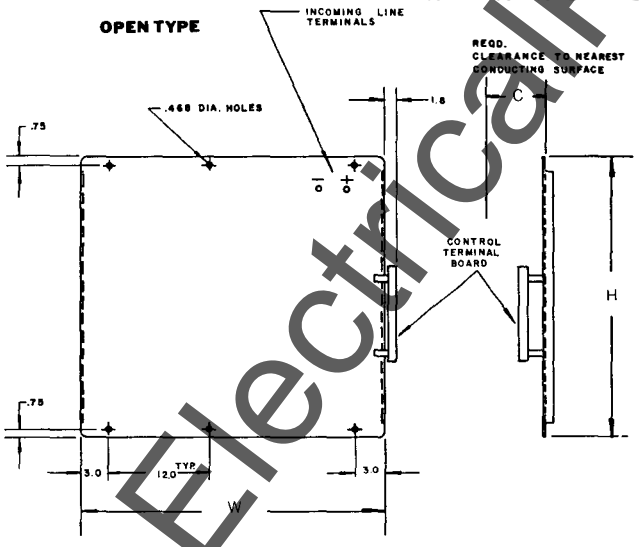
STANDARD CLASS 6715 TAB-WELD® RESISTORS SECTIONS

Type Section	A	Net Weight Per Section (Lbs.)
TW-D	26.5	35
TW-E	18	22
TW-F	12.5	18

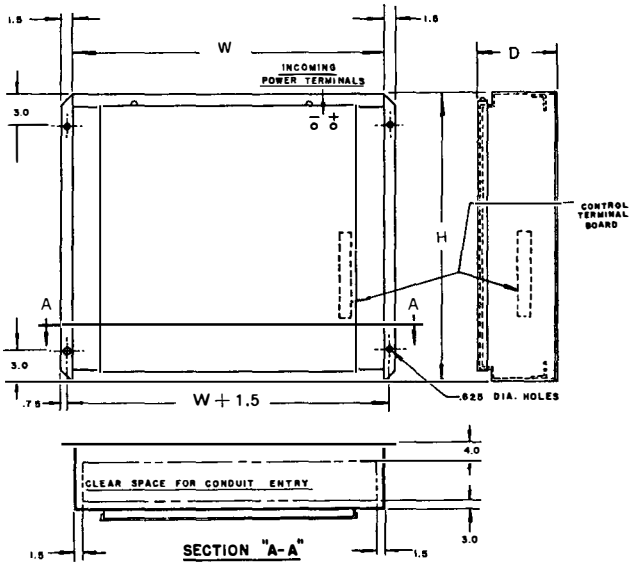


APPROXIMATE DIMENSIONS AND WEIGHTS

OPEN TYPE



ENCLOSED TYPE



Drive	Maximum HP (230V)	Open Type				Enclosed Type			
		H	W*	C	Net Weight (Lbs.)	H	W*	D	Net Weight (Lbs.)
Hoist Bridge or Trolley	7½	40.0	24.0	8.5	150	42	30.0	15.0	300
	15	40.0	24.0	8.5	150	42	30.0	15.0	300
	35	40.0	30.0	10.0	200	42	36.0	15.0	385
	55	40.0	30.0	10.0	200	42	36.0	15.0	385

*Add 6" for controllers with:
Mod. No. 1 — Fused Main Line Knife Switch and/or Mod. No. 3 — Additional Acceleration Point and/or Mod. No. 25 — Negative Line Contactor

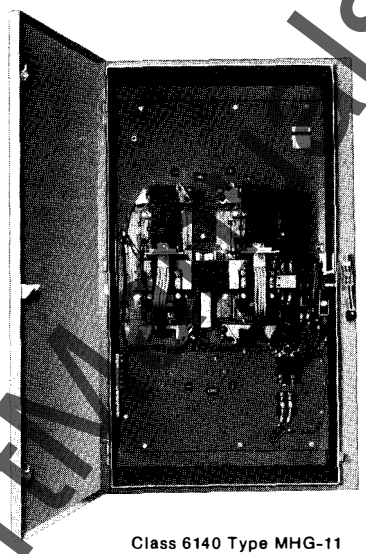
FRONTLINE®

MANUAL-MAGNETIC DISCONNECT SWITCHES

FOR DC CRANES

The manual-magnetic disconnect switch is used for protecting electrical crane circuits except lifting magnet circuits. It meets OSHA requirements for a crane disconnect switch.

- CONTACTORS OPERATED REMOTELY OR BY HANDLE ON THE ENCLOSURE
- FLANGE MOUNTED OPERATOR PERMITS OPERATION ONLY WITH DOOR CLOSED



Class 6140 Type MHG-11
Manual and Magnetic Disconnect Switch

The standard disconnect switch consists of:

2—Class 7004 Type M, Form Y78-1 (with silver faced power contact tips), SPNO contactors. The contactors are mechanically tied. One normally open and one normally closed electrical interlocks are included for indicating lights.

1—Two pole, fused, control circuit knife switch.

1—Class 9999 Type AI-1 arc inhibitors only on NEMA sizes 6, 7, 8 devices.

1—Class 8501 Type HDO-30 relay only on NEMA sizes 6, 7, 8 and on 1600 and 2700 devices.

Volts	NEMA Size	Continuous Ampere Rating	General Purpose Enclosure NEMA Type 1		General Purpose Enclosure NEMA Type 1 Gasketed		Industrial Enclosure NEMA Type 12 Outdoor Enclosure NEMA Type 3	
			Type	Price	Type	Price	Type	Price
230	4	150	MFG-11	$ 2544.	MFS-11	$ 2782.	MFA-11	$ 3104.
	5	300	MGG-11	3206.	MGS-11	3445.	MGA-11	3766.
	6	600	MHG-11	4530.	MHS-11	4770.	MHA-11	5095.
	7	900	MJG-11	7788.	MJS-11	8135.	MJA-11	8606.
	8	1350	MKG-11	9058.	MKS-11	9536.	MKA-11	10187.
	...	1600*	FG	11053.	FS	11546.	FA	12215.
	...	2700*	GG	16715.	GS	17217.	GA	17898.

*These switches use Class 7004 Type L LINE-ARC® Contactors.

CONTROLLER MODIFICATIONS (FORM Y35)

Modification No.	Description	Price — Continuous Ampere Rating						
		150	300	600	900	1350	1600	2700
1	2 - Main Line Power Fuses	$660.	$880.	$1780.	$1780.	$2180.	Δ	Δ
2	Substitute Circuit Breaker for Control Circuit Knife Switch	200.	200.	200.	200.	200.	200.	200.
3	2 - Class 9055 Instantaneous Magnetic Overload Relays	672.	672.	672.	984.	984.	1876.	2620.
4	Additional Control Circuit Interlocks, each. A maximum of 1-N.O. and 2-N.C. interlocks can be added	96.	96.	96.	96.	96.	96.	96.
5	Class 9999 Type AI-1 Arc Inhibitor	144.	144.	144.	...	...	...	...

Δ Contact your local Square D Sales Office.

PILOT DEVICES

For separately mounted pilot devices refer to Class 9001.

ORDERING INFORMATION REQUIRED:

1. Class
2. Type
3. Controller Modifications: Specify Form Y35 and Modification Numbers.

FRONTLINE

MANUAL-MAGNETIC DISCONNECT SWITCHES

FOR DC CRANES

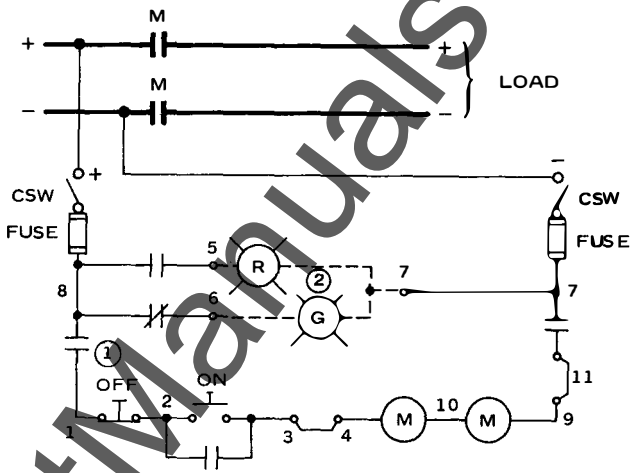
CLASS 6140

APPLICATION DATA

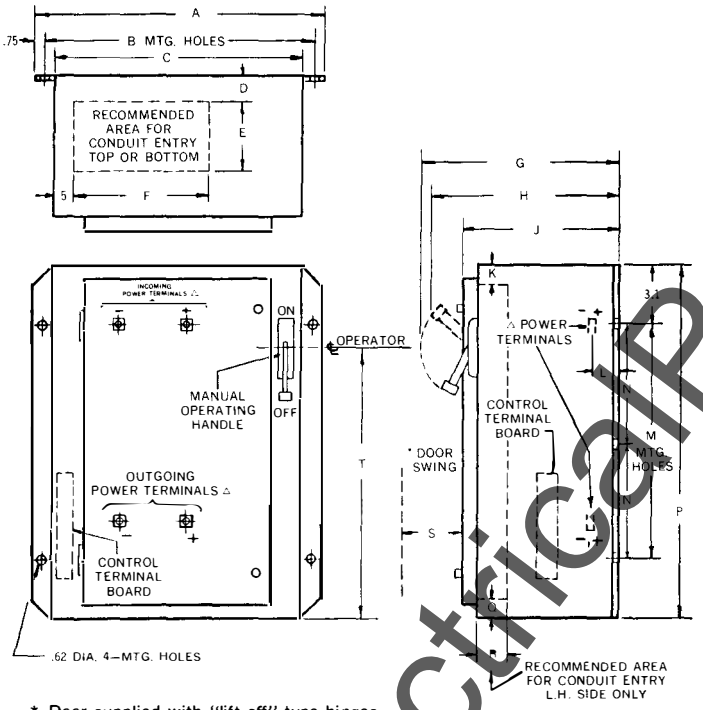
DISCONNECT SWITCH SELECTION

When applied to cranes, the continuous ampere rating of the disconnect switch shall not be less than 50 percent of the total rated current required by all motors on the crane, nor less than 75 percent of the rated motor current required by any single crane motion.

ELEMENTARY DIAGRAM



APPROXIMATE DIMENSIONS AND WEIGHTS



* Door supplied with "lift off" type hinges for door removal in limited space if necessary.
△ Solderless connectors for #8 to #1/0 cable.
□ Solderless connectors for #12 to #4 cable.

PILOT DEVICE SELECTION

The pilot device should be selected so the current rating is adequate for controlling the disconnect switch. For coil operating currents refer to Class 9998 Coil Data catalog sheet.

Contactor coils for NEMA sizes 4 and 5 disconnect switches are controlled directly by the pilot device. An arc inhibitor may be required depending upon the rating of the pilot device.

An intermediate relay is standard on NEMA sizes 6, 7 and 8 disconnect switches. An arc inhibitor may be required depending upon the rating of the pilot device.

Contactor coils on the 1600 and 2700 ampere disconnect switches are controlled by intermediate relays. An arc inhibitor may be required depending upon the rating of the pilot device.

NEMA Size	Continuous Ampere Rating	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	Net Weight (Lbs.)
4	150	27	25.5	24	3.5	4.5	10	20.8	17	15	3	4.5	26	▲	32.2	3	3.5	19	20.5	165
5	300	30	28.5	27	3.5	4.5	14	20.8	17	15	3	5.5	36	▲	42.2	3	3.5	22	26.7	235
6	600	33	31.5	30	5	8	18	25.8	22	20	14	7.2	42	▲	48.2	14	7	25	24.5	405
7	900	39	37.5	36	5	9	19	29.8	26	24	16	7.8	54	27	60.2	16	10	20	31	740
8	1350	39	37.5	36	5	9	19	29.8	26	24	16	7.8	54	27	60.2	16	10	20	31	740

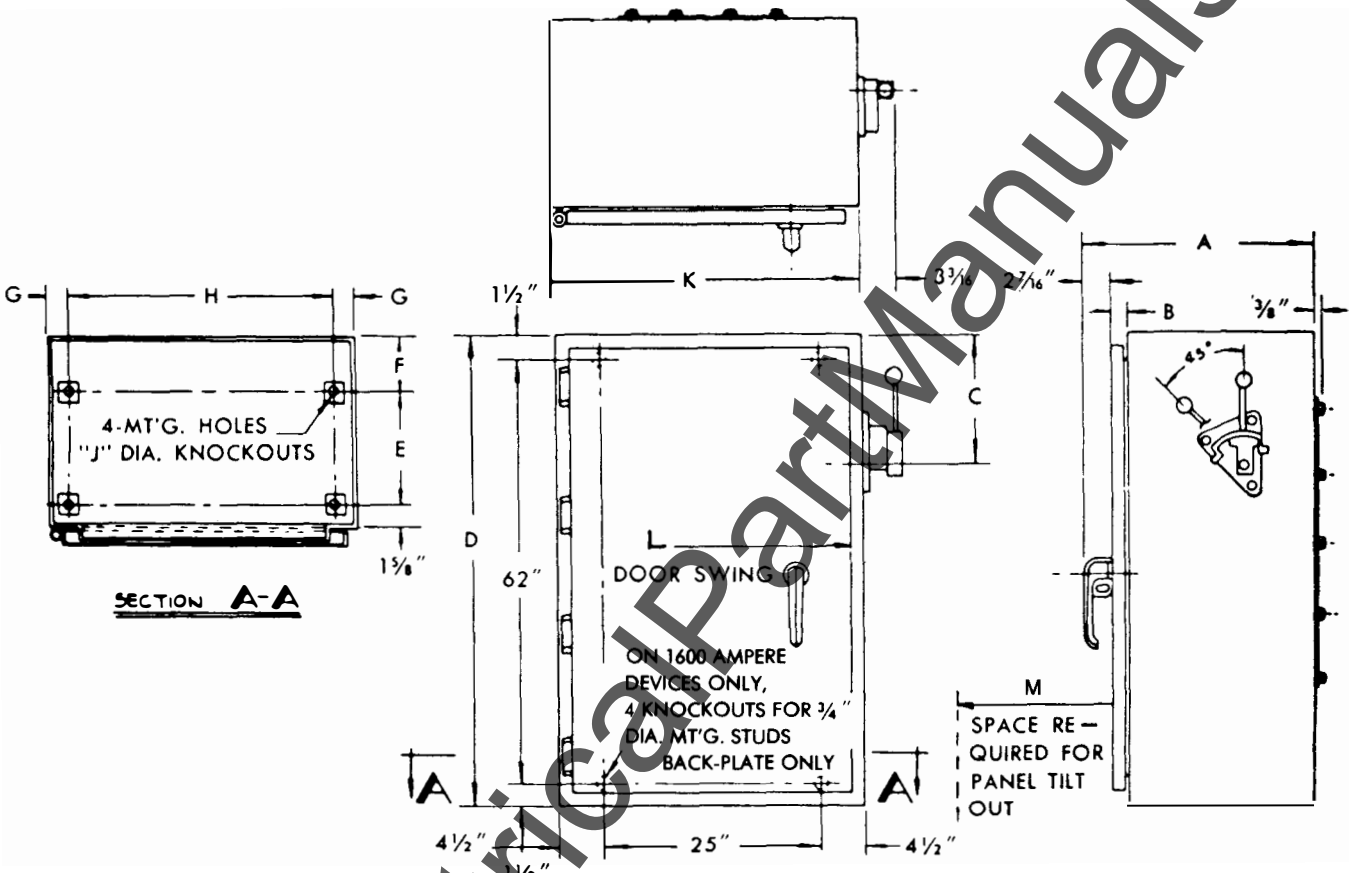
▲ Center mounting holes not supplied.

FRONTLINE

MANUAL-MAGNETIC DISCONNECT SWITCHES

FOR DC CRANES

APPROXIMATE DIMENSIONS



Continuous Ampere Rating	A	B	C	D	E	F	G	H	J	K	L△	M	Net Weight (Lbs.)
1600	27.1	1.4	16.9	83	13.5	8.1	1.5	31	.7	34	33	30	940
,2700	30.2	1.4	21.4	92	17.5	6.9	1.8	44.5	.6	48	23.1	32.2	1440

△ 2700 ampers switch has two doors.

YOUNGSTOWN® POWER LIMIT SWITCHES

CLASS 6170

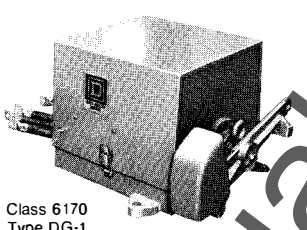
FOR AC AND DC CRANES

YOUNGSTOWN® Power Limit Switches are used on crane hoist drives to limit over travel in the hoisting direction.

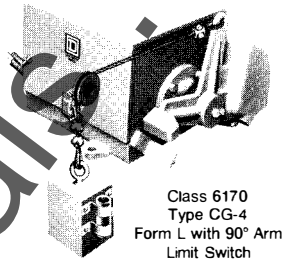
- OPERATED BY CRANE HOIST HOOK BLOCK
- INTERRUPTS HOIST MOTOR CURRENT DIRECTLY

The standard limit switch is supplied for right hand operation and consists of:

2 — Normally open and 2 — normally closed mechanically interlocked power contacts for simplex switches and 4 — normally open and 4 — normally closed contacts for duplex switches
1 — General purpose NEMA Type I enclosure
1 — Weight and cable, when specified



Class 6170
Type DG-1
Limit Switch



Class 6170
Type CG-4
Form L with 90° Arm
Limit Switch

Maximum HP — Crane Rating				Size No.	Type Without Wt. & Cable			Type With Wt. & Cable		
DC		AC			Std. Arm	90° Arm	*Price	Std. Arm	90° Arm	*Price
230 Volt	550 Volt	230 Volt	440 Volt							
SIMPLEX YOUNGSTOWNS										
26	25	25	50	5	AG-1	AG-3	**$ 1176.**	AG-2	AG-4	**$ 1254.**
50	50	50	100	10	BG-1	BG-3	**2340.**	BG-2	BG-4	**2622.**
100	100	100	200	20	CG-1	CG-3	**3938.**	CG-2	CG-4	**4308.**
200	200	200	400	30	DG-1	DG-3	**5540.**	DG-2	DG-4	**6030.**
360	660	...	...	40	EG-1	EG-3	**13238.**	EG-2	EG-4	**14142.**
500	...	...	...	50	FG-1	FG-3	**14432.**	FG-2	FG-4	**15220.**
DUPLEX YOUNGSTOWNS										
2-100	2-100	2-100	2-200	20D	CCG-1	CCG-3	**7008.**	CCG-2	CCG-4	**8060.**
2-200	2-200	2-200	2-400	30D	DDG-1	DDG-3	**10800.**	DDG-2	DDG-4	**12370.**
2-360	2-660	...	...	40D	EEG-1	EEG-3	**21392.**	EEG-2	EEG-4	**24682.**
2-500	...	...	...	50D	FFG-1	FFG-3	**29520.**	FFG-2	FFG-4	**31140.**

APPLICATION DATA

RIGHT HAND OPERATION

The limit switch is arranged for right hand operation when the reset weight and cable are on the right side (when facing the operating arm).

STANDARD OPERATING ARM

The standard operating arm is used when the weight and cable can be suspended beneath the limit switch.

When the weight and cable cannot be suspended beneath the limit switch, a 90° arm is used.

CONTROL CIRCUIT INTERLOCKS

Control circuit interlocks are provided on the power limit switch by an externally mounted control circuit limit switch which is operated by the power limit switch operating arm.

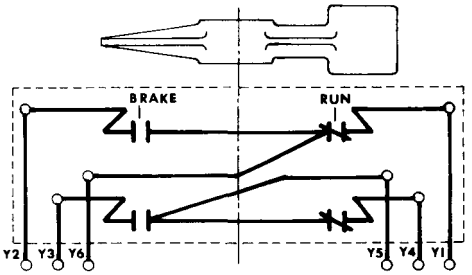
For a Type AG limit switch, a Class 9007 Type B limit switch is used.

For Types BG thru FFG limit switches, a Class 9007 Type FT limit switch is used.

ORDERING INFORMATION REQUIRED:

1. Class and type of limit switch
2. Modifications of limit switch: specify form number
3. Class and type of resistor (See page 32)

WIRING DIAGRAM



MODIFICATIONS

Form	Description	Price
L	Operating arm arranged for left hand operation	**No Charge**
C	Conduit Connection Box Type AG Type BG, CG, and DG Type EG and FG	 **$300.** **400.** **600.**
K	Control Circuit Interlock For Type AG Limit Switch: 1—N.O. and 1—N.C. Contacts	**200.**
	For Types BG thru FFG Limit Switches: 1—N.O. and 1—N.C. Contacts	**200.**

YOUNGSTOWN® POWER LIMIT SWITCHES

FOR AC AND DC CRANES

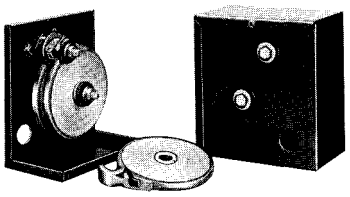
RESISTORS FOR LIMIT SWITCH APPLICATIONS ON DC DYNAMIC LOWERING HOISTS

When applied to dc dynamic lowering hoist control, a separately mounted limit switch resistor is also required.

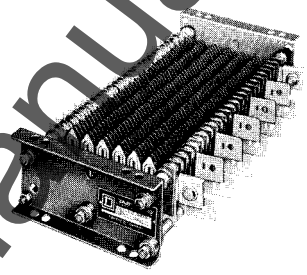
CLASS 6711 SG RESISTORS

230 VOLT DC			550 VOLT DC		
HP+	Type	Price	HP▲	Type	Price
1-2	SG-1	**$445.**	4-6½	SG-20	**$655.**
3-4	SG-2	**445.**	7-10	SG-21	**665.**
5-6½	SG-3	**445.**	11-19	SG-22	**665.**
7-10	SG-4	**445.**	20-35	SG-23	**665.**
11-13½	SG-5	**445.**	36-65	SG-24	**678.**
14-19	SG-6	**445.**	66-100	SG-25	**912.**
20-26	SG-7	**445.**			
27-33	SG-8	**445.**			
34-65	SG-9	**445.**			
66-100	SG-10	**445.**			
101-135	SG-11	**665.**			
136-200	SG-12	**912.**			

+HP rating of 230 volt dc motor.
▲HP rating 550 volt dc motor.



Class 6711
Type SG-9
Resistor



Class 6715
Type TW-120D
Resistor

CLASS 6715 TAB-WELD® RESISTORS

230 VOLT DC					300 VOLT DC					550 VOLT DC				
HP+	Open Type	Price	Enclosed Type	Price	HP+	Open Type	Price	Enclosed Type	Price	HP▲	Open Type	Price	Enclosed Type	Price
5-10	TW16F	**$240.**	TW16FG	**$400.**	5-10	TW21E	**$360.**	TW21EG	**$580.**	36-56	TW27E	**$360.**	TW27EG	**$580.**
11-13½	TW21F	**240.**	TW21FG	**400.**	11-13½	TW16F	**240.**	TW16FG	**400.**	66-110	TW42D	**460.**	TW42DG	**820.**
14-26	TW27F	**240.**	TW27FG	**400.**	14-19	TW21F	**240.**	TW21FG	**400.**	101-135	TW50D	**460.**	TW50DG	**820.**
27-33	TW32F	**220.**	TW32FG	**330.**	20-23	TW27F	**240.**	TW27FG	**400.**	136-265	TW62D	**460.**	TW62DG	**820.**
34-45	TW37F	**240.**	TW37FG	**400.**	34-45	TW32F	**220.**	TW32FG	**380.**	266-360	TW72D	**460.**	TW72DG	**820.**
46-65	TW42F	**220.**	TW42FG	**380.**	46-65	TW42F	**220.**	TW42FG	**380.**	361-500	TW120D	**460.**	TW120DG	**820.**
66-100	TW62E	**280.**	TW62EG	**500.**	66-100	TW62E	**280.**	TW62EG	**500.**	501-660	TW150D	**460.**	TW150DG	**820.**
101-135	TW85E	**280.**	TW85EG	**500.**	101-135	TW72E	**280.**	TW72EG	**500.**					
136-200	TW120D	**460.**	TW120DG	**820.**	136-200	TW85E	**280.**	TW85EG	**500.**					
201-265	TW150D	**460.**	TW150DG	**820.**	201-265	TW120D	**460.**	TW120DG	**820.**					
266-360	2-TW120D	**920.**	2-TW120DG	**1460.**	266-360	TW150D	**460.**	TW150DG	**820.**					
361-550	2-TW150D	**920.**	2-TW150DG	**1460.**	361-500	2-TW120D	**920.**	2-TW120DG	**1460.**					

+HP rating of 230 volt dc motor.
▲HP rating of 550 volt dc motor.

ORDERING INFORMATION REQUIRED:

1. Class
2. Type

APPLICATION DATA

CLASS 6711 SG RESISTOR

Suitable for both dusty and outdoor installations

Used where space is limited

CLASS 6715 TAB-WELD RESISTOR

Recommended for applications where environmental conditions of vibration and dirt are severe

Suitable for outdoor use with general purpose enclosure

RESISTORS FOR DUPLEX LIMIT SWITCHES

One resistor required for each motor, double the prices shown

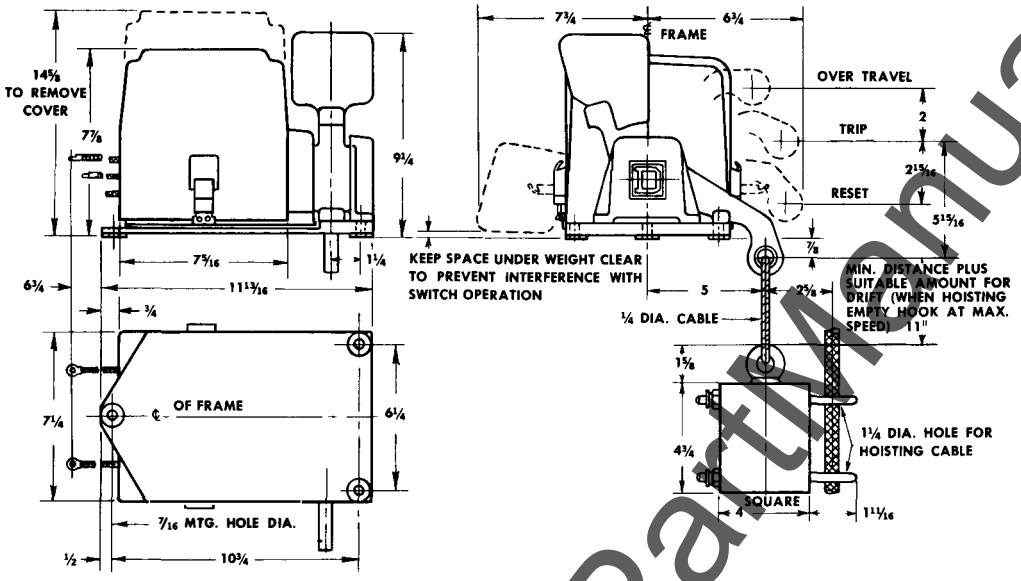
RESISTORS FOR 300 VOLTS DC

Use with Class 6424 Type HWR 300 volt dc controllers utilizing 230 volt dc motors

YOUNGSTOWN® POWER LIMIT SWITCHES

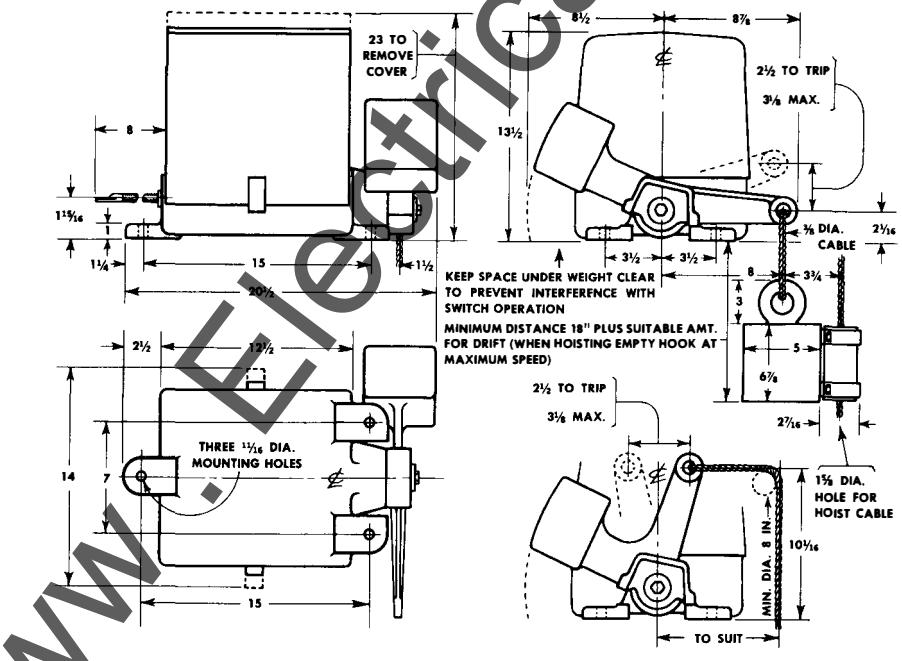
FOR AC AND DC CRANES

APPROXIMATE DIMENSIONS AND WEIGHTS



TYPE AG

Type	Size No.	Net Weight (Lbs.)	
		Limit Switch Only	Operating Weight Only
AG	5	50	22.5



TYPE BG

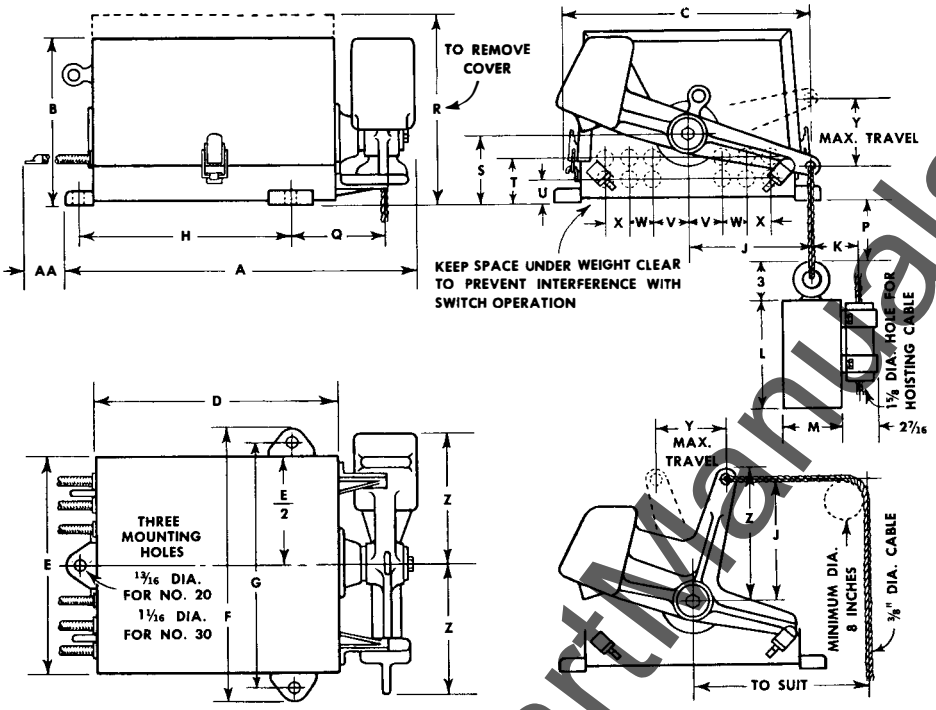
Type	Size No.	Net Weight (Lbs.)	
		Limit Switch Only	Operating Weight Only
BG	10	170	54

YOUNGSTOWN® POWER LIMIT SWITCHES

FOR AC AND DC CRANES

APPROXIMATE DIMENSIONS AND WEIGHTS

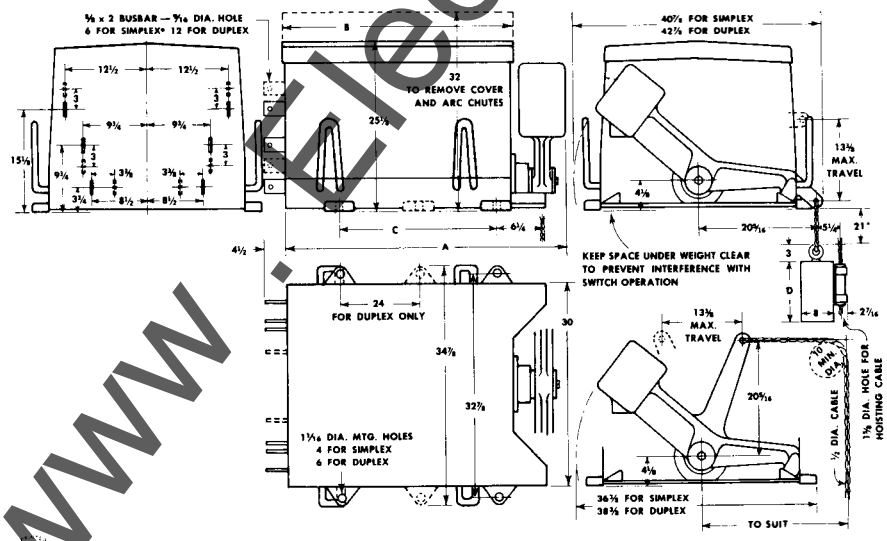
TYPES CG and DG



Type	Size No.	A	B	C	D	E	F	G	H	J	K	L	M	Net Weight (Lbs.) Limit Switch Only	Net Weight (Lbs.) Operating Weight Only
CG	20	22.5	12.2	16.3	15.4	15	18.4	16.9	13.2	8.4	3.8	9.5	5	320	67
DG	30	25.6	16.4	19.5	18	18.1	22.4	20.4	15.9	10.3	3.8	12	5	460	90
CCG	20D	34.3	12.2	16.3	25.5	15.1	18.5	16.9	23.3	8.4	4.3	11	6	540	111
DDG	30D	41.6	16.4	19.5	30.3	18.3	22.5	20.4	28.1	10.3	4.8	14.5	7	750	218

Type	Size No.	P	Q	R	S	T	U	V	W	X	Y	Z	AA	Net Weight (Lbs.) Limit Switch Only	Net Weight (Lbs.) Operating Weight Only
CG	20	9	6.8	21	4.4	2.9	—	2.8	1.4	1.6	4.4	9.3	10.4	320	67
DG	30	10	6.8	27.4	5.4	3.6	—	3.1	1.9	2	5.4	11.3	13.4	460	90
CCG	20D	9	7.3	21	4.4	2.9	1.6	2.8	1.4	1.6	4.4	9.3	10.4	540	111
DDG	30D	10	8.5	27.4	5.4	3.6	1.7	3.1	1.9	2	5.4	11.3	13.4	750	218

TYPE EG and FG



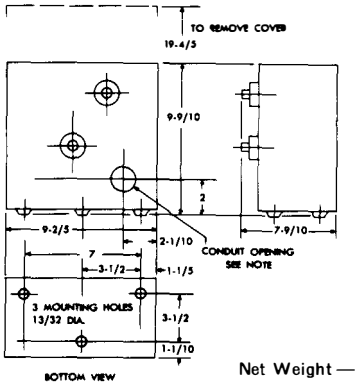
Type	Size No.	A	B	C	D	Net Weight (Lbs.) Limit Switch Only	Net Weight (Lbs.) Operating Weight Only
EG	40	42.4	36	24	14.8	1450	265
FG	50					1550	265
EEG	40D	66.4	60	48	29.5	2250	530
FFG	50D					2350	530

YOUNGSTOWN® POWER LIMIT SWITCHES

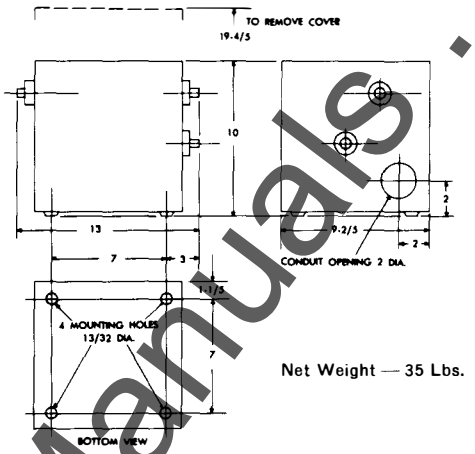
FOR AC AND DC CRANES

APPROXIMATE DIMENSIONS AND WEIGHTS

CLASS 6711 SG RESISTOR



Net Weight — 20 Lbs.



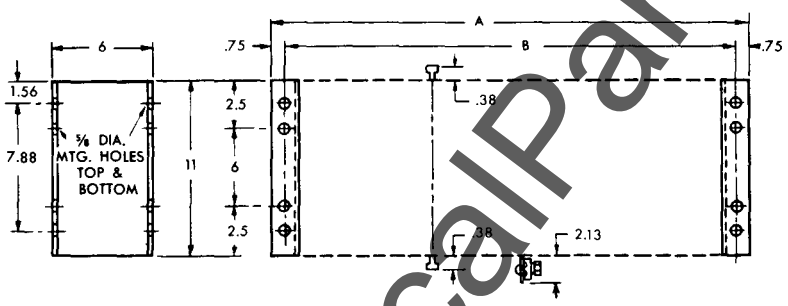
Net Weight — 35 Lbs.

SG-1 thru SG-7, SG-22 & SG-23 conduit opening 1.38″ diameter; SG-8 thru SG-10 conduit opening 2.0″ diameter

SG-11 thru SG-13, SG-20, SG-21, SG-24, and SG-25

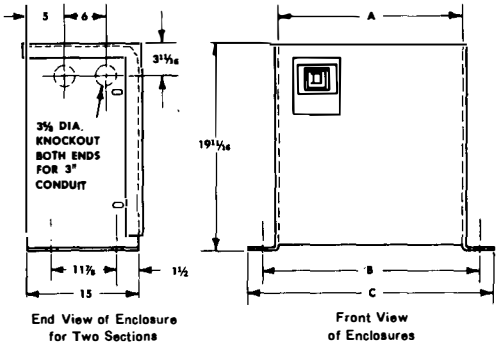
CLASS 6715 TAB-WELD® RESISTORS

OPEN TYPE



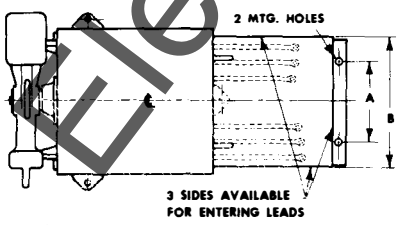
Type Section	A	Net Weight Per Section (Lbs.)
TW-D	26.5	35
TW-E	18	22
TW-F	12.5	18

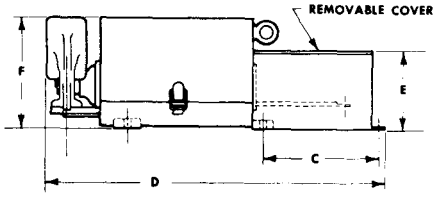
ENCLOSED TYPE

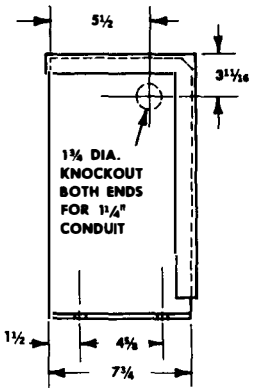


Type Section	A	B	C	Net Weight (Lbs.)
TW-DG	27	29	30.3	40
TW-EG	18.5	20.5	21.8	25
TW-FG	13	15	16.3	20

CONDUIT CONNECTION BOX—FORM C







Limit Switch Type	Limit Switch Size	A	B	C	D	E	F	Net Weight (Lbs.)
AG	5	3.5	5.1	8.3	19.8	4.6	9.3	5
BG	10	6	10.6	11.5	31.2	4.8	13.5	15
CG	20	9	13.2	14.3	36.9	8.3	12.2	25
CCG	20D	9	13.2	14.3	48.3	8.3	12.2	40
DG	30	10	16	17.3	42.5	9.1	16.4	35
DDG	30D	10	16	17.3	58.5	9.1	16.4	48

SQUARE D COMPANY

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