D. Price 12/3/87

Boston Gear Ratiotrol®

DC MOTOR SPEED CONTROL

INSTALLATION AND OPERATING MANUAL VE1A

VE SERIES 1/6 - 3/4 HP
Fractional Horsepower, Manual Switching

BOSTON GEAR
INCOM INTERNATIONAL INC

QUINCY, MASS. U.S.A.

Printed in U.S.A.

MANUAL VE1

STANDARD VE CONTROLS - FHP

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MANUAL VE1

INTRODUCTION

This manual covers the fractional HP Standard VE Series Ratiotrol controls in ratings from 1/6 HP through 3/4 HP.

The VE control, as a "Standard" is complete and ready to operate. In fractional HP ratings (1/6 thru 3/4 HP) the front-mounted control panel contains the line and armature fuses, speed setting dial and a manual toggle switch which performs the RUN/STOP functions.

Any VE Series control may be modified by the addition of printed circuit cards for "electronic options" or by changing the control panel for "switching options."

WARRANTY

All Ratiotrol Systems, control and motor, are covered by the standard Boston Gear 2 year warranty. See the latest Boston Gear general catalog. The warranty covers all defects in material and workmanship; external causes of failure, such as unauthorized modifications, misapplication or negligence void the warranty.

INSPECTION

Inspect the control and motor upon receipt. Any visible external damage should be reported to the carrier and noted on the carrier's form at the time of receipt. Hidden damage caused by mishandling but not visible until the material is unpacked should be reported to the carrier at once, and the material should be held for inspection by the carrier's agent. Your Boston Gear Distributor should be advised of damaged equipment, and he will be glad to assist you in filing claims with the carrier.

RATINGS AND SPECIFICATIONS

The following VE controls are intended for use with 115 VAC (±10%) single phase 60/50 Hz. power. Table I shows the AC power data and DC output specifications for these controls.

TABLE I

HP	Catalog Number Run-Stop-DB	Catalog Number For.-Rev.-DB	Electrical Specifications			
			A.C. Input 115-1-60/50		D.C. Output Amps.	
					Field	Arm.
			Max. Amps	KVA	50V	90V
1/6	63400VE16	63300VE16SR	3.3	0.38	2	2.2
1/4	63401VE25	63301VE25SR	5.0	0.58	2	3.0
1/3	63402VE33	63302VE33SR	6.0	0.69	2	3.6
1/2	63403VE50	63303VE50SR	9.0	1.04	2	5.3
3/4	63404VE75	63304VE75SR	13.0	1.50	2	7.8

PERFORMANCE SPECIFICATIONS

These specifications apply to the control and motor systems when a Boston Gear Motor is used, and all variables such as ambient temperature, motor field temperature, line voltage, line frequency, load and speed are steady-state and within specified limits:

Speed Range - Infinite, zero to base speed
Speed Range, at Rated Torque and Regulation - 30 to 1
Regulation (No load to full load) - ±1% of base speed

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DRAWING LIST

100D1001 - Main Schematic Diagram-Revised
100D1006 - Control Board Schematic Diagram-Revised
100C1001 - Wiring Diagram-Revised
100A1001 - External Connection Diagram-Revised
100C1007 - Cabinet Outline

CONTROL INSTALLATION

Before installing the control, open the cabinet and inspect for shipping damage, making sure all parts are secure and that terminal strip screws are not missing or loose.

This control is enclosed in a NEMA 12 cabinet designed for use in a clean, dry atmosphere. Ambient temperatures should not exceed 40° C (104° F). Higher temperatures and/or operation above 3300 ft. (1000 meters) altitude may cause excessive component heating; the use of a larger HP control and motor may be indicated under such conditions.

The control cabinet should be mounted in a vertical position, allowing a minimum of 4 inches clearance on all sides. Any other mounting position should be avoided since the natural flow of air will be impeded with consequent overheating and possible premature failure or reduced life of control components.

Mount the control securely on a level surface using the four (4) mounting lugs provided. See Drawing No. 100C1007 for dimensions.

The Standard VE control cabinet is NEMA 12 construction - oiltight and dusttight - but should not be used where a watertight or weatherproof cabinet is required. A kit is available to modify the operator's panel to achieve NEMA 3 and 4 enclosure. Specify Cat. No. 63463K for run-stop switch panels and Cat. No. 63464K for reversing switch panels.

WIRING - General

It is recommended that a fused disconnect switch or circuit breaker be installed ahead of the control; an existing branch disconnect switch may fulfill this requirement. Consult your local electrical code.

The use of STRANDED wire is suggested. The minimum gauge recommended is 14 AWG; again your local code should be used as a guide. Long cable runs may require the use of a larger gauge than normal to avoid excessive voltage drop.

Connections will be simplified and more secure if solderless connectors are used for all connections. Recommended catalog numbers are:

	T & B STAKON	VACO	BURNDY
16-14 AWG	RB14-6F	BA14-F6	C53386
12-10 AWG	RC10-6F	BA10F8	C53406

Avoid the use of oversize solid wire and large screwdrivers when making connections, since either may cause the terminal strip barriers to break.

Four (4) threaded conduit holes (3/4 NPT) are provided for cable entry; any or all may be used to facilitate wiring.

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AC POWER CONNECTIONS

Three (3) terminals are provided for connection of AC power, two for the line and one for the cabinet ground.

Connections should be made per Drawing No. 100A1001.

NOTE: If one of the two power leads is a "neutral wire" (ground potential), the leads must be connected according to the notation on the drawing, i.e., H = "hot wire," N = "neutral wire." The cabinet ground terminal should be connected to earth ground.

MOTOR CONNECTIONS

Check the motor nameplate to make sure that the HP, voltage and currents shown are compatible with information on the control nameplate.

Since many Boston Gear motors have dual voltage fields, make sure the motor terminal straps or leads are connected for LOW field voltage before making control connections. A connection diagram is located on the inside of the connection box cover.

The use of 4-conductor cable is recommended. Connect the motor field and armature terminals (or leads) to the control terminals per Drawing No. 100A1001. DO NOT ground any portion of the motor wiring.

OPERATION

1. Recheck all control and motor connections before applying power to the control. Make sure all connections are correct and tightly secured. Any wiring errors or accidental grounds may cause control and/or motor damage.
2. Close control cabinet cover and latch securely.
3. Set speed adjust knob to zero.
4. Set manual switch on "stop."
5. Turn on AC power at the disconnect switch box and then place the manual switch in "run" or "for." position.
6. Slowly increase the speed setting until the motor operates. If motor rotation is opposite to that desired, stop the drive with the switch; turn off AC power and interchange the two motor armature leads.
7. On "SR" reversing control, check operation with switch in "REV." position.
8. Once motor rotation is proper, advance the speed adjust knob to maximum and observe system operation.
   NOTE: The speed knob may be set at any point; it is not necessary to return to zero before restarting the drive.

NOTE: DO NOT use external line switching to start and stop the motor.

CONTROL ADJUSTMENTS

The control has been factory-tested and adjusted with the proper motor and, other than the usual speed changes, no adjustments should be required during normal operation.

CONTROL ADJUSTMENTS (Cont'd)

If necessary, certain adjustments can be made to optimize or modify the operational characteristics of the syste These adjustments are maximum and minimum speed, IR compensation (regulation) and current limit. All adjustmer should be made with the motor at operating temperature, usually achieved within 30 minutes from a cold start.

A. Maximum Speed - The maximum speed pot has been set to provide base speed (1750 RPM) with the speed adjust knob set at 100. Due to variations between motors, or high/ low line voltage, some adjustment may be necessary.

   Using a DC voltmeter across A1 and A2, or a tachometer, set the speed pot at 100 and slowly adjust the maximum speed pot until motor speed is 1750 RPM or armature voltage reads 90 VDC. If desired, maximum speed may be set as low as 1400 RPM or as high as 2000 RPM with a 10% increase in HP.

B. Minimum Speed - Set speed adjust knob at zero and slowly adjust minimum speed pot until the motor stops. If a finite minimum speed is desired, advance minimum speed pot until desired speed, between zero and 400 RPM, is reached.

C. IR Compensation - This circuit is provided with two adjustment pots in order to achieve exceptionally good speed regulation. One is labeled "LOW SPEED" and the other, "HIGH SPEED." Both are located on the small printed circuit card which plugs into the upper right hand receptacle in the larger "Control (printed circuit) Board" inside the cover.

   Normally, it should not be necessary to adjust these pots, since the control was adjusted at the factory using a loaded motor of the same HP rating. However, it may be desired to obtain even better regulation at a specific speed or within a narrow speed range. Additionally, whenever an "IR comp" board is replaced the new board should be adjusted to the actual motor being used.

In order to achieve satisfactory speed regulation, it will be necessary to adjust both the HIGH and LOW speed IR pots. The use of an accurate, close reading tachometer is recommended for the following adjustment:

1. Turn the LOW speed pot to its minimum position and the HIGH speed pot to mid-range.
2. Adjust the SPEED pot on the control panel to the low speed of the desired range. Note the speed for the unloaded motor.
3. Apply the load and note the speed change. (Note: For some settings of the IR pots, the speed can rise with load rather than droop.)
4. Turn the LOW speed pot slowly until the loaded speed is close to the no load speed (from step 2). Note the new speed.
5. Remove the load and note the speed – it is possible that the no-load speed has shifted from its original setting. The speed change due to load is then the difference between the speeds noted in steps 4 and 5.
6. Repeat steps 3 through 5 if closer regulation is required.
7. Next, turn the SPEED pot on the control panel up until the motor is running at the high speed of the desired range. Note the speed for the unloaded motor.
8. Apply the load and note the speed change. (See note in step 3.)
9. Turn the HIGH speed IR pot slowly until the loaded speed is close to the no load speed (from step 7). Note the new speed.
10. Remove the load and note the speed – it is possible that the no load speed has shifted from its original setting. The speed change due to load is then the difference between the speeds noted in steps 9 and 10.

CONTROL ADJUSTMENTS (Cont'd)

11. Check several other speeds within the range for satisfactory regulation. It may be necessary to reset the low speed pot in order to achieve a suitable compromise throughout the range.

12. It will be noticed that the LOW speed pot is very effective at all speeds, both low and high. However, the HIGH speed pot is effective only at high speeds (say 1000 RPM and up).

NOTE: If at any time during the adjustment procedure the motor starts to "hunt" (i.e., a noticeable oscillation in motor speed), decrease the pot setting until the hunting stops.

Hunting may be induced by certain types of load conditions such as cyclic loading and intermittent overhauling loads. The effect may be decreased or eliminated by decreasing the setting of the LOW speed pot.

D. Current Limit – This circuit is provided with two adjustment pots in order to achieve suitable matching to the HP rating of the motor. One is labeled "GAIN" and the other, "SET POINT," and both are located in the lower left hand portion of the large "Control (printed circuit) Board" inside the cover.

The current limit circuit is intended primarily as protection against high output current levels which could seriously damage both the motor and the control. It should not be necessary to adjust these pots, since the control was adjusted at the factory using a loaded motor of the same HP rating. Note that both pots have been marked to indicate these settings.

The SET POINT pot is adjusted to allow a maximum or approximately 150% of full load motor current to flow continuously. Naturally, the armature fuse would open before this high current could damage the motor.

Some applications may require a lower limit on the armature current (such as limiting torque or accelerating high inertia loads). The SET POINT pot is adjusted as follows:

1. Break one armature lead between the control and the motor. Insert a DC ammeter of adequate rating (suggest at least 2X motor full load current). Observe proper polarity when connecting the meter.

2. Turn the SET POINT pot to the full decrease position.

3. Turn the speed dial to a low setting (i.e., 20 to 40 on the dial). Actuate the start switch or pushbutton. Note that the motor probably will not run.

4. Slowly turn the SET POINT pot in the increase direction and note the current on the meter (it will be necessary to load the motor to properly adjust the pot for any current greater than no-load current). Continue turning in this direction until the desired current is flowing. Note: To obtain a particular percentage of rated output torque, set the current at a value corresponding to rated motor current X $\frac{\text{Percent}}{100}$.

CAUTION: DO NOT TURN THE POT PAST THE FACTORY-SET MARK IN THE INCREASING DIRECTION.

The GAIN pot should NOT be readjusted under any circumstances. However, if it is accidentally disturbed, merely turn the pot until the mark on the shaft aligns with the mark on the label.

NOTE: When installing a new control board, it will be necessary to adjust both pots in order to match the new board to the motor rating. Follow the instructions which accompany the new board.

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MAINTENANCE AND SERVICE

Since the Ratiotrol control is of solid-state design, maintenance is effectively eliminated except for periodic inspection and, if necessary, external cleaning.

FUSES

Fuses should be replaced only with equivalent types and identical ratings. The type and rating for both fuses is shown on the nameplate attached to the inside of the cover. Equivalent types, as noted in the parts list, are available from a variety of local sources.

The following chart shows the rating and type of fuse for the VE Series fractional HP controls:

VE SERIES FUSE CHART

Control Model	Fuse Type & Rating	
	Line	Armature
VE16,SR	BAN-30 (30 AMP)	BAN- 5 (5 AMP)
VE25,SR	BAN-30 (30 AMP)	BAN- 5 (5 AMP)
VE33,SR	BAN-30 (30 AMP)	BAN- 8 (8 AMP)
VE50,SR	BAN-30 (30 AMP)	BAN- 8 (8 AMP)
VE75,SR	BAN-30 (30 AMP)	BAN-15 (15 AMP)

BASIC TROUBLESHOOTING

Most control failures are caused by improper connections, overload or surroundings which cause the accumulation of dust or moisture. Dirt or dust deposits limit the transfer of heat away from power devices and moisture, usually caused by either "wash down" or condensation, can cause anything from intermittent or erratic operation to insulation failure and short circuits.

Always make sure the control is clean and dry inside and out before attempting to analyze and correct circuit failures.

WARNING: Make sure the AC power is disconnected before working on the control.

PARTS LIST
VE SERIES 1/6-3/4 HP

ORDER BY B. G. PART NO.

Drawing Desig.	Description	B. G. Part No.	Used In	Quant.	Typical Equivalents			
					Mfr.	Part No.	Mfr.	Part No.
- - -	Control Board	62293	VE16-VE75	1	None			
- - -	IR Board	62287	VE16-VE75	1	None			
C1	Capacitor 0.1MFD 600WVDC	63699	VE16-VE75	1	Sprague	6TM-P10	Mallory	PVC601
R2	IR Resistor 0.1 Ohm 25 Watts	63650	VE16-VE75	1	Dale	PH25		
SU1	Suppressor	63752	VE16-VE75	1	General Electric	6RS21SA5D5	Int'l. Rect.	KSA5DAF
D1-D3	Diode 12 Amp 400 PRV	63722	VE16-VE75	3	Int'l. Rect.	12F40	General Electric	IN1204A
SCR1, 2	SCR 16 Amp 400 PRV	63728	VE16-VE33	2	Westinghouse	202H	General Electric	2N1849
SCR1, 2	SCR 25 Amp 400 PRV	63729	VE50, VE75	2	Westinghouse	201H	General Electric	2N688
FU1	Line Fuse 30 Amp	63772	VE16-VE75	1	Bussmann	BAN30,		
FU2	Arm. Fuse 5 Amp	63767	VE16, VE25	1	Bussmann	BAN5	Bussmann	BAF5
FU2	Arm. Fuse 8 Amp	63768	VE33, VE50	1	Bussmann	BAN8	Bussmann	BAF8
FU2	Arm. Fuse 15 Amp	63769	VE75	1	Bussmann	BAN15	Bussmann	BAF15
T1	Transformer	61537	VE16-VE75	1	None			
- - -	Operator's Control Panel	63443CP	VE16-VE75	1	None			
	Including:							
R1	Speed Pot 1K 2 Watts	63665	63448, 63445	1	Ohmite	CMU1021	Clarostat	53C3
S1	Motor Switch	63761	63443	1	Arrow-Hart	82611		
S1	Motor Switch	63762	63445	1	Arrow Hart	81796		
- - -	Knob, Speed Pot	63819	63443, 63445	1	Raytheon	70-3-2G		
- - -	Fuseholder	63773	63443, 63445	2	Bussmann	HPC		
- - -	Fuseholder Cap	63766	63443, 63445	2	Bussmann	9789 1/2		
- - -	Terminal Board - 15 Tie	63802	63443, 63445	1	Kulka	699-15		
- - -	DB Resistor - 5 ohm 25 Watts	63705	63443, 63445	1	IRC	2D		

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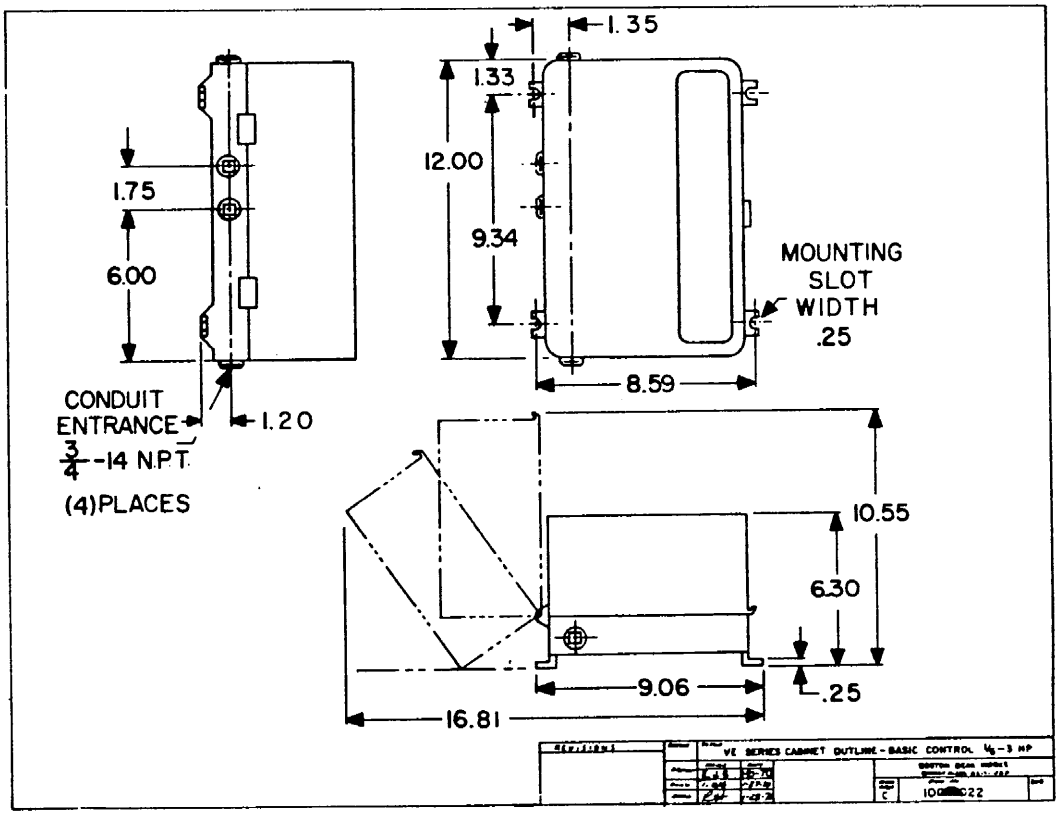
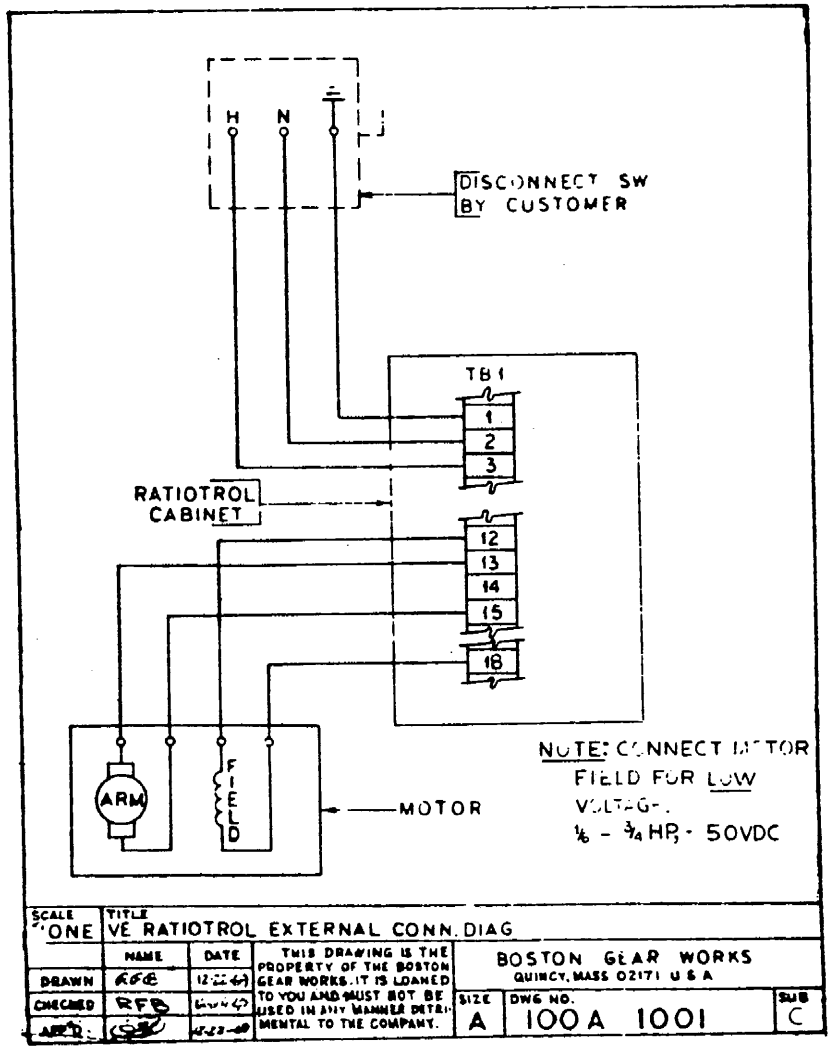
VE SERIES SERVICE PROCEDURE

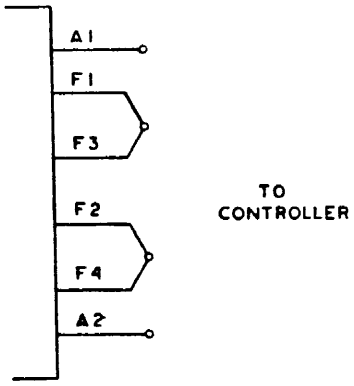
SYMPTOM	POSSIBLE CAUSE	REMEDY
1. Line Fuse Blows	Defective interconnections Shorted motor field Defective suppressor Shorted power diode Shorted SCR	Check all wiring and connections between line, control and motor. Repair or replace motor. Replace suppressor. Replace all power diodes. Replace all SCR's.
2. Armature Fuse Blows	Overload Defective control-to-motor wiring Short circuit in motor.	Remove cause of overload or resize drive HP. Check all cables and connections between control and motor. Repair or replace motor.
3. Fuses OK, Motor Does Not Run	Open AC line Improper wiring Defective motor Defective control board Defective IR board Open power diode(s) Open SCR Open IR resistor	Check branch disconnect switch and AC power source. Check all AC-to-control wiring and connections Repair or replace motor. Replace control board Replace IR board. Replace all power diodes. Replace all SCR's. Replace IR resistor.
4. Motor Runs At Top Speed Only	Defective control board Defective speed pot Defective IR Board Defective SCR's	Replace control board. Replace speed pot. Replace Replace
5. Control Cannot Be Set At Zero Speed	Minimum speed pot set too high	Adjust minimum speed pot.
6. Motor Does Not Attain Top Speed	Overload Low line voltage Max. speed pot set too low Current limit set too low Defective speed pot Defective control board	Remove cause of overload or resize drive HP. Change source or install power transformer. Adjust maximum speed pot. Adjust current limit set pot. Replace speed pot. Replace control board.
7. Unstable Speed, Hunting or Oscillations	Incorrect IR setting Oscillating load Defective motor Misfiring SCR(s)	Decrease IR pot setting until oscillations cease. Decreasing IR setting may minimize condition unless a negative motor load exists (overhauling). Check and replace motor brushes; repair or replace motor. Replace SCR(s) or control board.
8. High, Unstable Speed, Low Torque, Possible Armature Fuse Blowing	Armature and field connections interchanged	Check and correct control-to-motor connections.
9. Top Speed Approx. 50%; Motor Hums, Noisy	Half-waving; check for open power diode or SCR	Replace all power diodes and SCR's.


1.35
1.33
12.00
9.34
1.75
6.00
MOUNTING
SLOT
WIDTH
.25
8.59
CONDUIT
ENTRANCE
3/4 -14 N.P.T.
(4)PLACES
1.20
10.55
6.30
9.06
.25
16.81


H
N
DISCONNECT SW
BY CUSTOMER
TB1
1
2
3
RATIOTROL
CABINET
12
13
14
15
18
ARM
FIELD
MOTOR
NOTE: CONNECT MOTOR
FIELD FOR LOW
VOLTAGE.
1/8 - 3/4 HP - 50VDC
SCALE ONE
TITLE
VE RATIOTROL EXTERNAL CONN. DIAG
NAME
DATE
DRAWN
CHECKED
APP'D.
THIS DRAWING IS THE PROPERTY OF THE BOSTON GEAR WORKS. IT IS LOANED TO YOU AND MUST NOT BE USED IN ANY MANNER DETRIMENTAL TO THE COMPANY.
BOSTON GEAR WORKS
QUINCY, MASS 02171 U.S.A.
SIZE
A
DWG NO.
100A 1001
SUB
C

CONNECTON DIAGRAM FOR BALDOR AND CENTURY MOTORS

LOW VOLTAGE FIELD

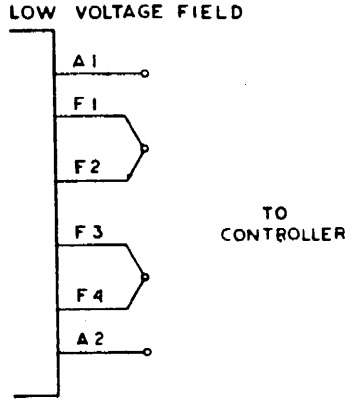


WITH A1 AND F1 POSITIVE, MOTOR WILL RUN COUNTER CLOCKWISE ROTATION WHEN VIEWED FROM COMM. END.
TO REVERSE DIRECTION OF ROTATION, INTERCHANGE LEADS A1 AND A2 AT CONTROLLER.

SCALE	TITLE: CONNECTION DIAGRAM—BALDOR AND CENTURY MOTORS				
	NAME	DATE	THIS DRAWING IS THE PROPERTY OF THE BOSTON GEAR WORKS IT IS LOANED TO YOU AND MUST NOT BE USED IN ANY MANNER DETRIMENTAL TO THE INTERESTS OF THE COMPANY	BOSTON GEAR WORKS QUINCY, MASS. 02171 U.S.A.	
DRAWN	BGD	9-5-72			
CHECKED		9-5-72		SIZE B	DWG. NO. 100 B 1001
APPD		9-5-72			

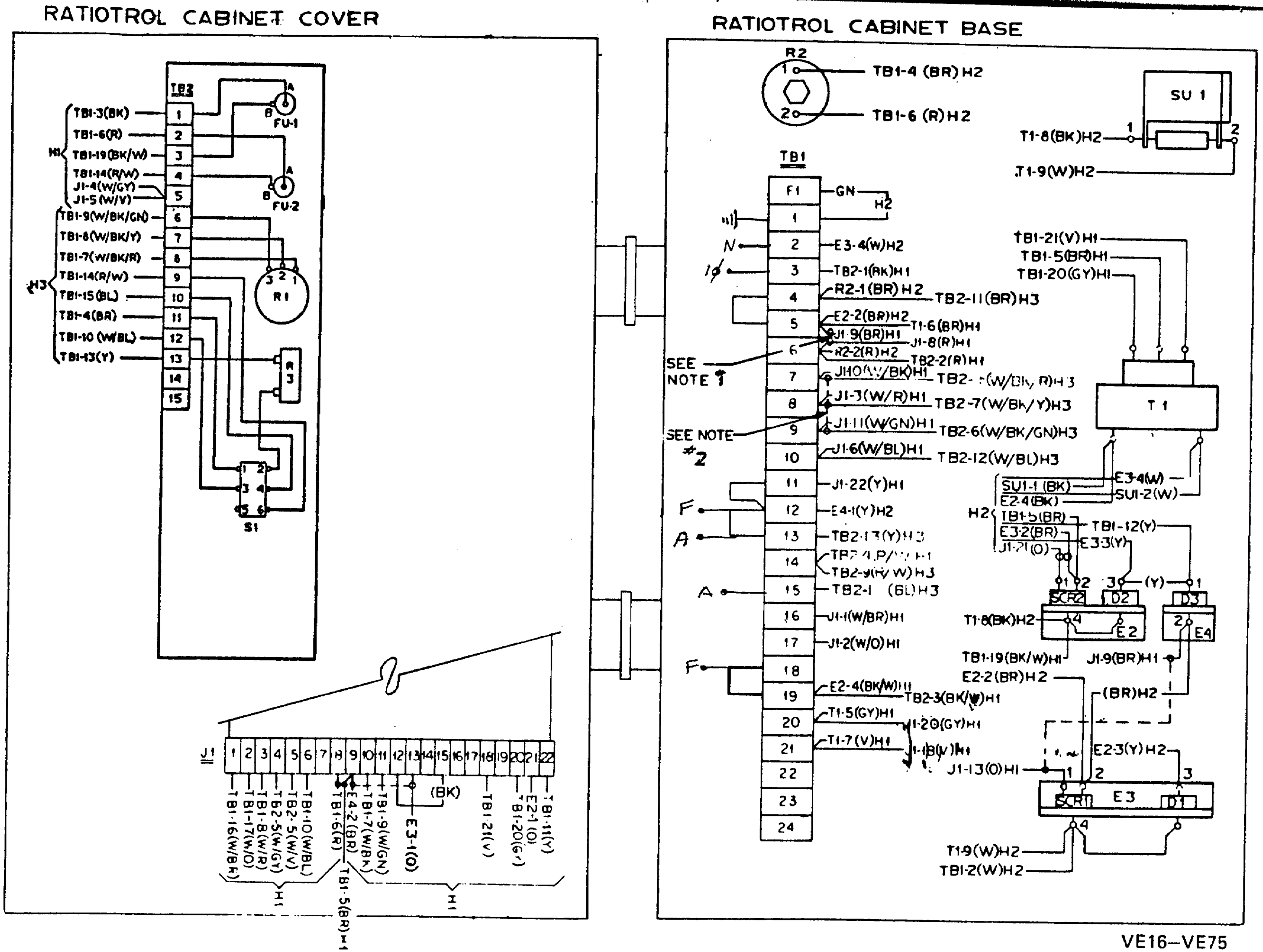
CONNECTION DIAGRAM FOR GENERAL ELECTRIC FRACTIONAL HP MOTORS

LOW VOLTAGE FIELD



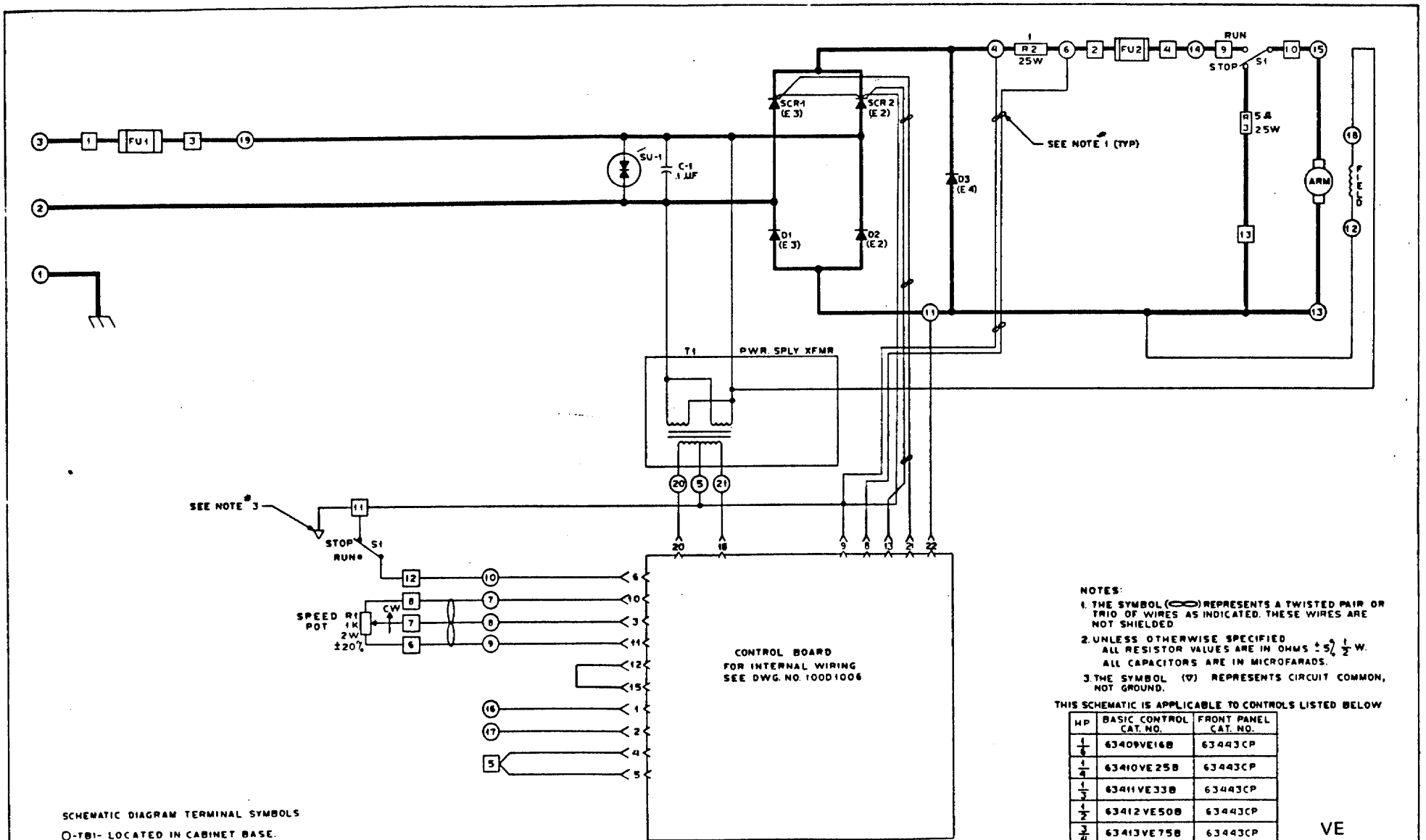
WITH A1 AND F1 POSITIVE, MOTOR WILL RUN COUNTER CLOCKWISE ROTATION WHEN VIEWED FROM COMM. END.
TO REVERSE DIRECTION OF ROTATION, INTERCHANGE LEADS A1 AND A2 AT CONTROLLER.
NOTE: CARE MUST BE EXERCISED WHEN WIRING GENERAL ELECTRIC FRACTIONAL HP MOTORS. THE LOW VOLTAGE FIELD CONNECTION IS SPECIAL. ALL MOTORS CARRYING A GEJ-4827 INSTRUCTION AND HAVING AN 'A' SUFFIX ON THE MODEL NUMBER WILL BE WIRED PER THIS SHEET. OTHER MOTORS SHOULD BE WIRED PER BGW DWG. 100 B 1001.

SCALE	TITLE: CONNECTION DIAGRAM—G.E. FRACTIONAL HP MOTORS				
	NAME	DATE	THIS DRAWING IS THE PROPERTY OF THE BOSTON GEAR WORKS IT IS LOANED TO YOU AND MUST NOT BE USED IN ANY MANNER DETRIMENTAL TO THE INTERESTS OF THE COMPANY	BOSTON GEAR WORKS QUINCY, MASS. 02171 U.S.A.	
DRAWN	BGD	9-5-72			
CHECKED		9-5-72		SIZE B	DWG. NO. 100 B 1002
APPD		9-5-72			



NOTES:
1. TWO TWISTED WIRES (TYP).
2 THREE TWISTED WIRES (TYP).

SCALE NONE	TITLE VE RATIOTROL WIRING DIAGRAM - 1/6 - 3/4 HP RUN/STOP-SW		
DRAWN	W.E.S.	1-11-69	BOSTON GEAR WORKS
CHECKED	T.W.	1-7-69	DWG NO C 10C C 1001
APP'D		1-9-69	SUB 5



NOTES:

1. THE SYMBOL (⊂⊃) REPRESENTS A TWISTED PAIR OR TRIO OF WIRES AS INDICATED. THESE WIRES ARE NOT SHIELDED.
2. UNLESS OTHERWISE SPECIFIED
   ALL RESISTOR VALUES ARE IN OHMS ± 5% ½ W.
   ALL CAPACITORS ARE IN MICROFARADS.
3. THE SYMBOL (▽) REPRESENTS CIRCUIT COMMON, NOT GROUND.

THIS SCHEMATIC IS APPLICABLE TO CONTROLS LISTED BELOW

HP	BASIC CONTROL CAT. NO.	FRONT PANEL CAT. NO.
1/6	63409VE16B	63443CP
1/4	63410VE25B	63443CP
1/3	63411VE33B	63443CP
1/2	63412VE50B	63443CP
3/4	63413VE75B	63443CP

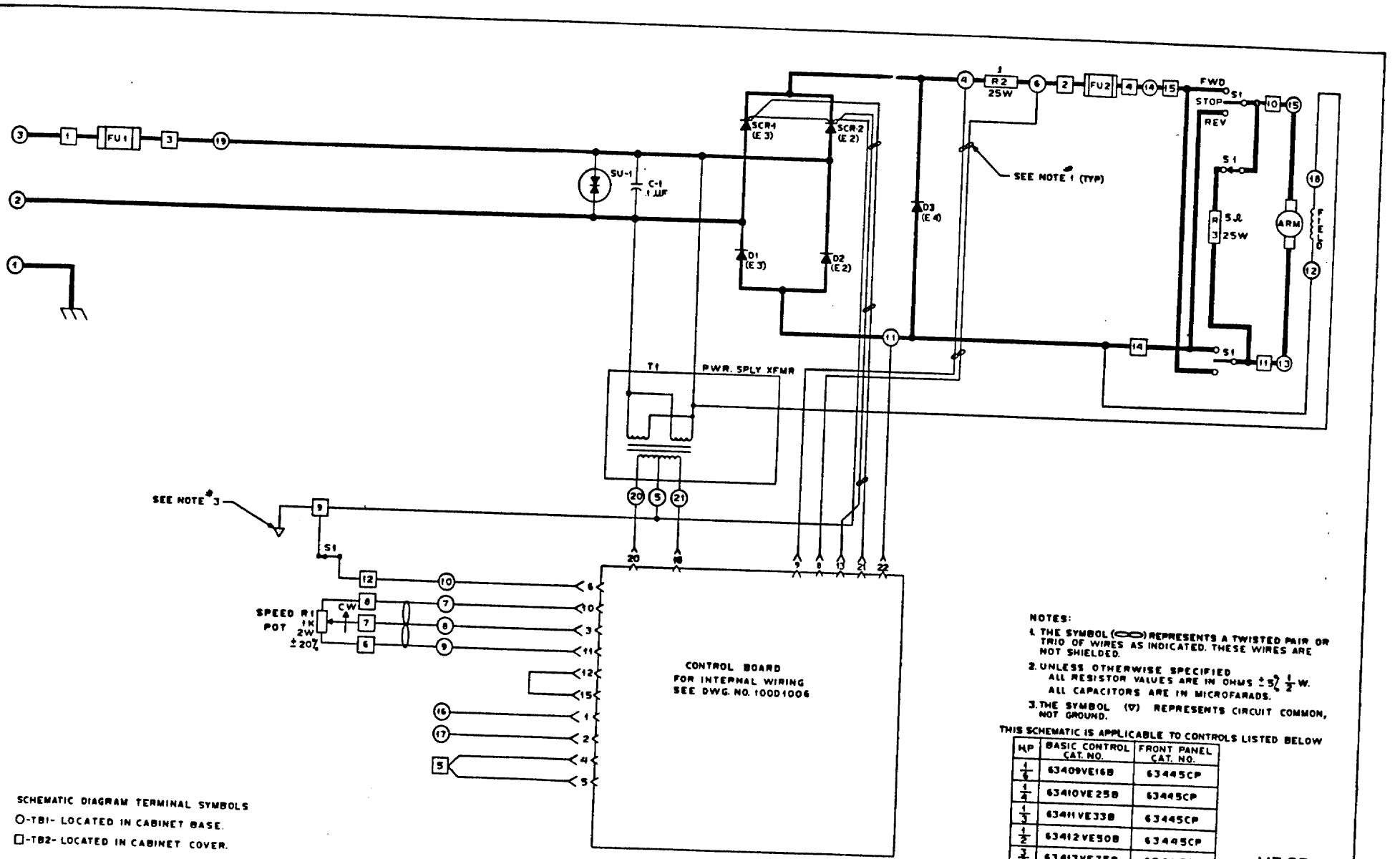
VE

SCHEMATIC DIAGRAM TERMINAL SYMBOLS

○-TB1- LOCATED IN CABINET BASE.

□-TB2- LOCATED IN CABINET COVER.

SCALE	TITLE	
NONE	VE RATIOTROL SCHEMATIC 1/6 – 3/4 HP RUN/STOP – DB SWITCH-LOCAL CONTROL	
	BOSTON GEAR WORKS	
SIZE D	DWG. NO. 100D1041	REV



SCHEMATIC DIAGRAM TERMINAL SYMBOLS

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□-TB2- LOCATED IN CABINET COVER.

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THIS SCHEMATIC IS APPLICABLE TO CONTROLS LISTED BELOW

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1/4	63410VE25B	63445CP
1/3	63411VE33B	63445CP
1/2	63412VE50B	63445CP
3/4	63413VE75B	63445CP

VE-SR

SCALE	TITLE	
NONE	VE RATIOTROL SCHEMATIC 1/6-3/4 HP FWD/STOP-DB/REV SWITCH-LOCAL CONTROL	

	NAME	DATE
DRAWN	W.E.S.	11/19/76
CHECKED		
APP'D		

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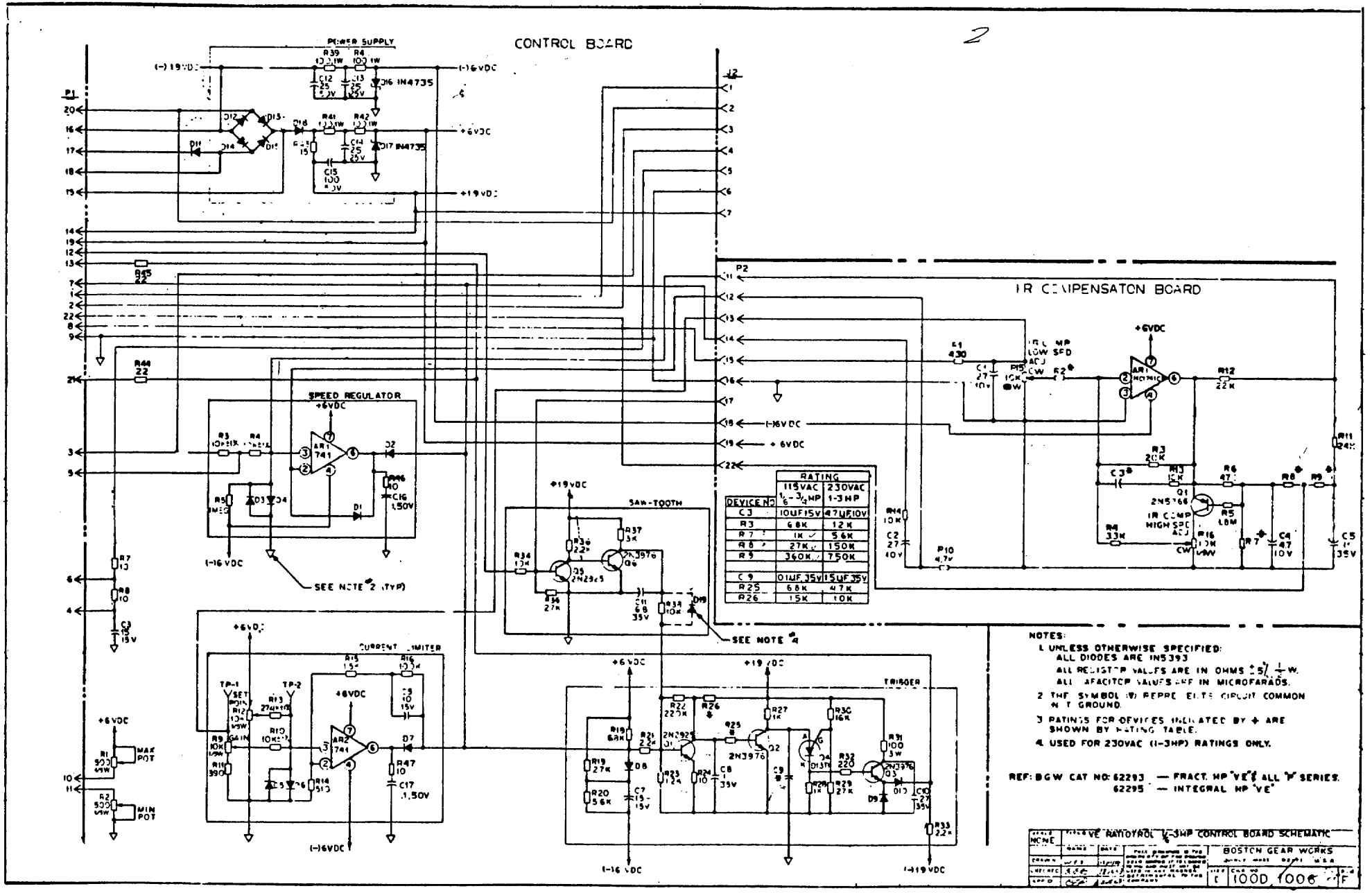
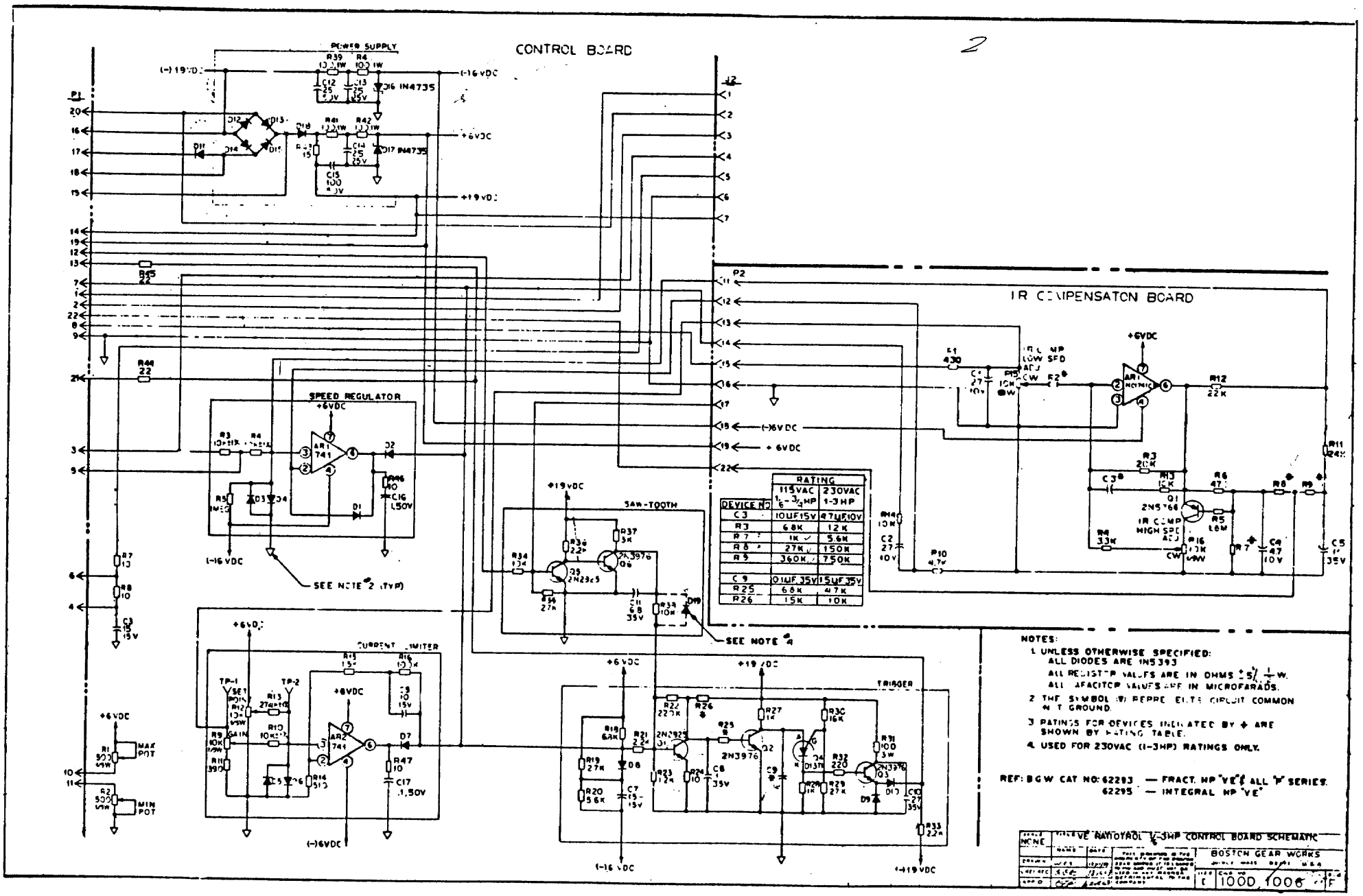
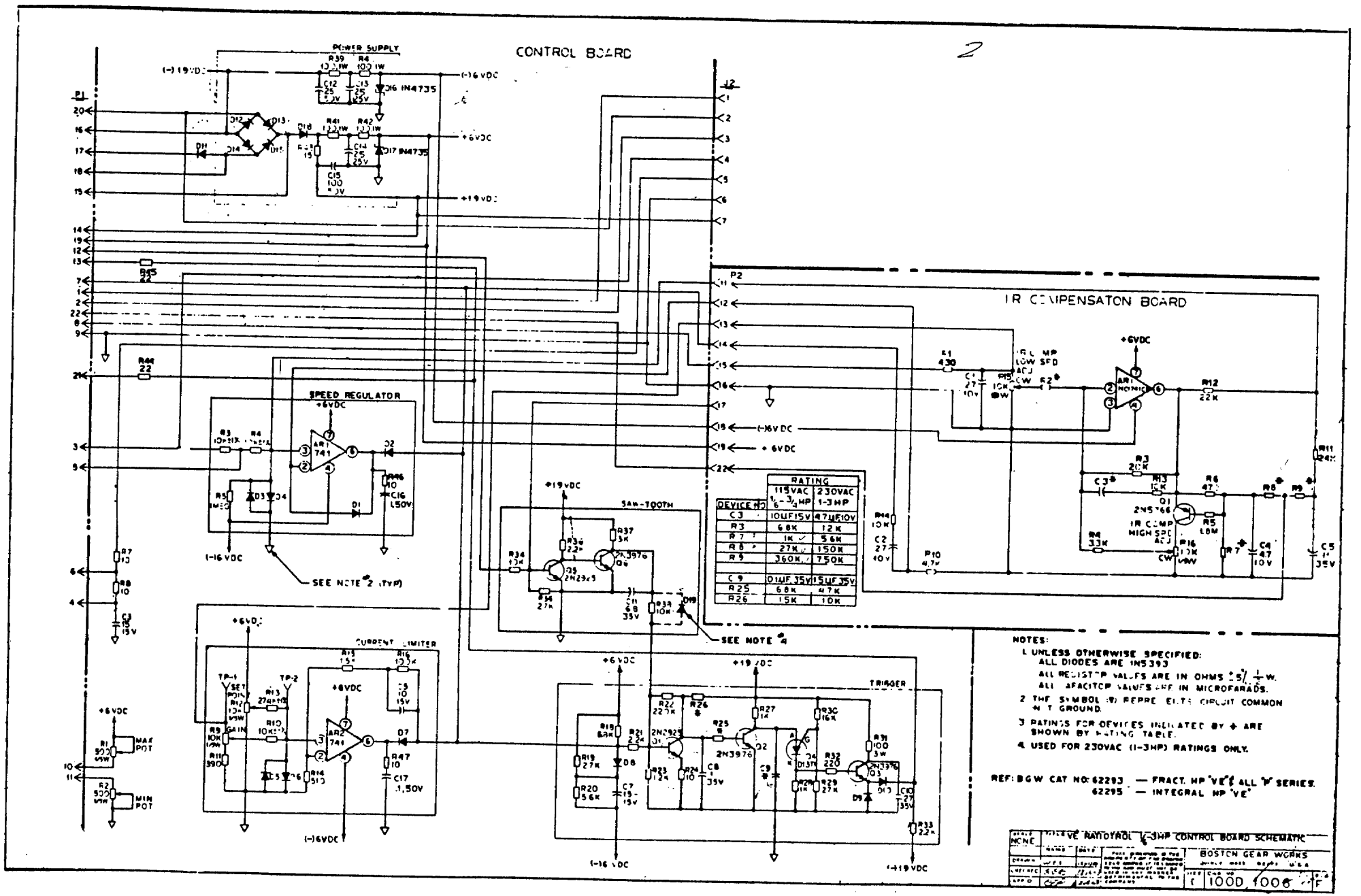
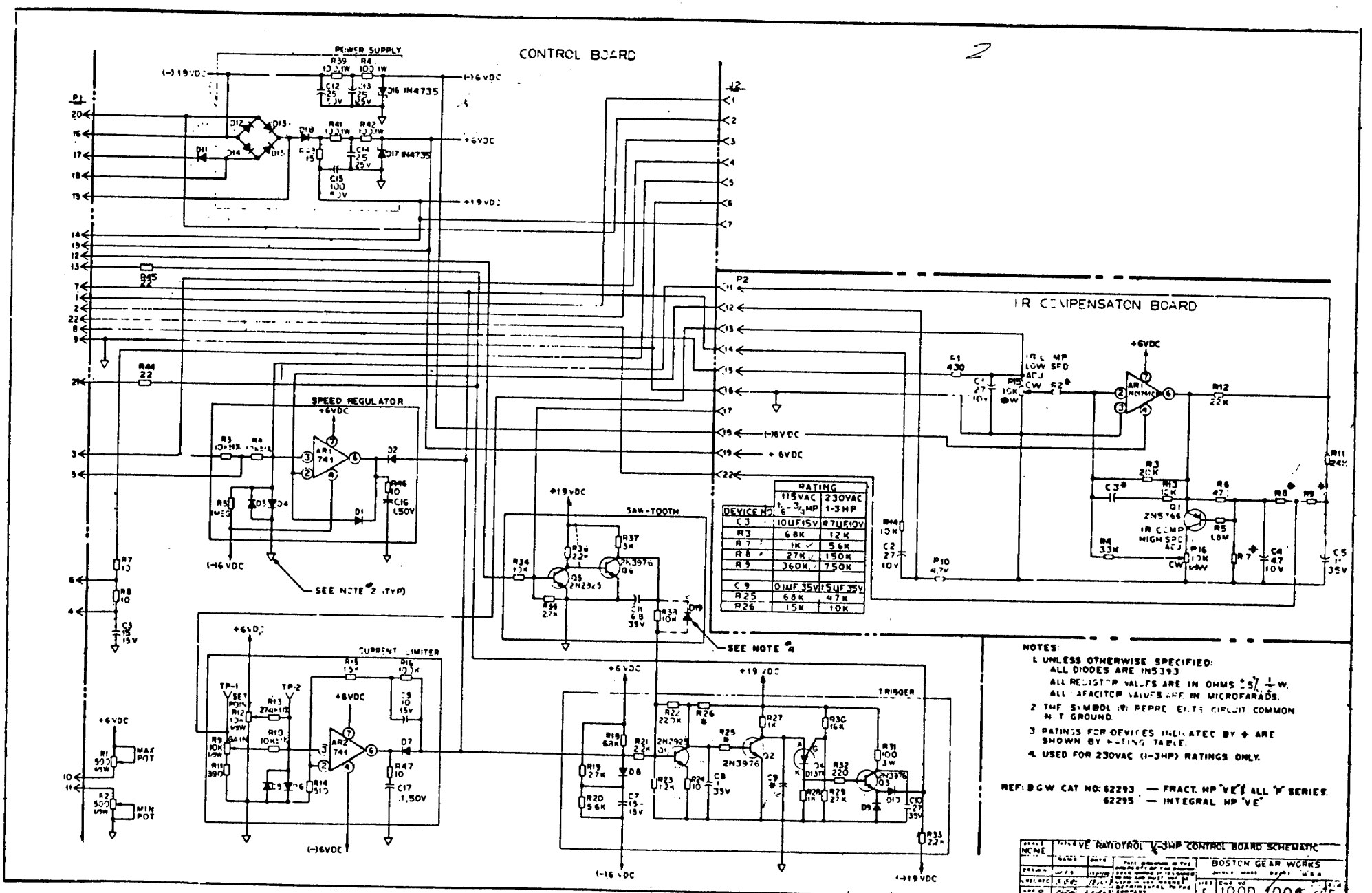
QUINCY, MASS 02171 U.S.A.

SIZE D DWG NO 100D1042 REV A


CONTROL BOARD
POWER SUPPLY
SPEED REGULATOR
SAW-TOOTH
CURRENT LIMITER
TRIGGER
IR COMPENSATON BOARD
+6VDC
+19VDC
-16VDC
SEE NOTE 2 (TYP)
SEE NOTE 4
MAX POT
MIN POT
IR COMP HIGH SPD ADJ
IR COMP LOW SPD ADJ
RATING
115VAC 1/6-3/4HP
230VAC 1-3HP
DEVICE NO
C3 10UF15V 47UF10V
R3 6.8K 12K
R7 1K 5.6K
R8 27K 150K
R9 360K 750K
C9 .01UF.35V .15UF.35V
R25 6.8K 4.7K
R26 15K 10K
NOTES:
1. UNLESS OTHERWISE SPECIFIED:
ALL DIODES ARE IN5393
ALL RESISTOR VALUES ARE IN OHMS ±5% 1/4W.
ALL CAPACITOR VALUES ARE IN MICROFARADS.
2. THE SYMBOL (▽) REPRESENTS CIRCUIT COMMON NOT GROUND.
3. RATINGS FOR DEVICES INDICATED BY ✦ ARE SHOWN BY RATING TABLE.
4. USED FOR 230VAC (1-3HP) RATINGS ONLY.
REF: BGW CAT NO: 62293 — FRACT. HP "VE" & ALL "P" SERIES.
62295 — INTEGRAL HP "VE"
"VE" NATIONAL 1/6-3HP CONTROL BOARD SCHEMATIC
BOSTON GEAR WORKS
1000 1006

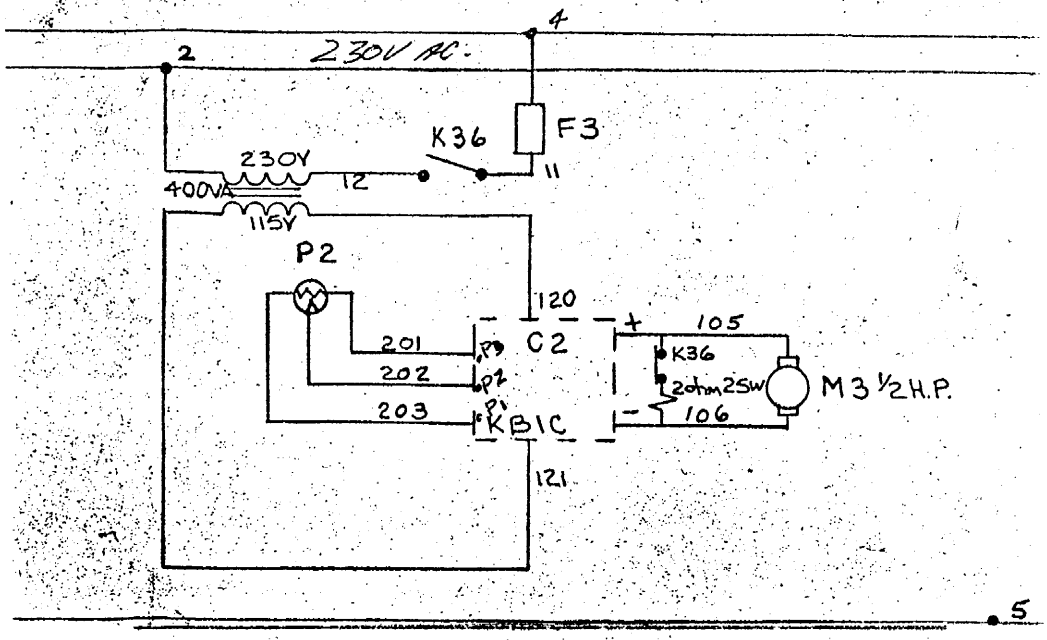

CONTROL BOARD
2
POWER SUPPLY
(-)19VDC
(-)16 VDC
+6VDC
+19VDC
D16 IN4735
D17 IN4735
P1
P2
SPEED REGULATOR
SEE NOTE 2 (TYP)
SAW-TOOTH
SEE NOTE 4
CURRENT LIMITER
TRIGGER
MAX POT
MIN POT
IR COMPENSATON BOARD
IR COMP LOW SPD ADJ
IR COMP HIGH SPD ADJ
RATING
115VAC 1/6-3/4HP
230VAC 1-3HP
C3 10UF15V 47UF10V
R3 6.8K 12K
R7 1K 5.6K
R8 27K 150K
R9 360K 750K
C9 .01UF,35V .15UF,35V
R25 6.8K 47K
R26 15K 10K
NOTES:
1. UNLESS OTHERWISE SPECIFIED:
ALL DIODES ARE IN5393
ALL RESISTOR VALUES ARE IN OHMS ±5% 1/4W.
ALL CAPACITOR VALUES ARE IN MICROFARADS.
2. THE SYMBOL ⏚ REPRESENTS CIRCUIT COMMON NOT GROUND.
3. RATINGS FOR DEVICES INDICATED BY ✦ ARE SHOWN BY RATING TABLE.
4. USED FOR 230VAC (1-3HP) RATINGS ONLY.
REF: BGW CAT NO: 62293 — FRACT. HP "VE" & ALL "F" SERIES.
62295 — INTEGRAL HP "VE"
VE NAVOYAOL 1-3HP CONTROL BOARD SCHEMATIC
BOSTON GEAR WORKS
1000 1006


CONTROL BOARD
IR COMPENSATON BOARD
POWER SUPPLY
SPEED REGULATOR
SAW-TOOTH
CURRENT LIMITER
TRIGGER
+6VDC
+19VDC
(-)16VDC
(-)19VDC
SEE NOTE 2 (TYP)
SEE NOTE 4
RATING
DEVICE NO
115VAC 1/6-3/4HP
230VAC 1-3HP
C3 10UF15V 47UF10V
R3 6.8K 12K
R7 1K 5.6K
R8 27K 150K
R9 360K 750K
C9 .01UF35V 15UF35V
R25 6.8K 47K
R26 15K 10K
NOTES:
1 UNLESS OTHERWISE SPECIFIED:
ALL DIODES ARE IN5393
ALL RESISTOR VALUES ARE IN OHMS ±5% 1/4W.
ALL CAPACITOR VALUES ARE IN MICROFARADS.
2 THE SYMBOL (@) REPRESENTS CIRCUIT COMMON NOT GROUND.
3 RATINGS FOR DEVICES INDICATED BY * ARE SHOWN BY RATING TABLE.
4 USED FOR 230VAC (1-3HP) RATINGS ONLY.
REF: BGW CAT NO: 62293 — FRACT. HP 'VE' & ALL 'W' SERIES.
62295 — INTEGRAL HP 'VE'
VE RADIOFAIL 1-3HP CONTROL BOARD SCHEMATIC
BOSTON GEAR WORKS
1000, 1006


CONTROL BOARD
POWER SUPPLY
SPEED REGULATOR
SAW-TOOTH
CURRENT LIMITER
TRIGGER
IR COMPENSATON BOARD
IR COMP HP LOW SPD ADJ
IR COMP HIGH SPD ADJ
+6VDC
+19VDC
(-)16VDC
(-)19VDC
SEE NOTE 2 (TYP)
SEE NOTE 4
MAX POT
MIN POT
RATING
DEVICE NO
115VAC 1/6-3/4 HP
230VAC 1-3 HP
C3 10UF15V 47UF10V
R3 6.8K 12K
R7 1K 5.6K
R8 27K 150K
R9 360K 750K
C9 .01UF 35V 1.5UF 35V
R25 6.8K 4.7K
R26 15K 10K
NOTES:
1. UNLESS OTHERWISE SPECIFIED:
ALL DIODES ARE IN5393
ALL RESISTOR VALUES ARE IN OHMS ±5% 1/4 W.
ALL CAPACITOR VALUES ARE IN MICROFARADS.
2. THE SYMBOL (#) REPRESENTS CIRCUIT COMMON NOT GROUND.
3. RATINGS FOR DEVICES INDICATED BY + ARE SHOWN BY RATING TABLE.
4. USED FOR 230VAC (1-3HP) RATINGS ONLY.
REF: BGW CAT NO: 62293 — FRACT. HP 'VE' & ALL 'P' SERIES.
62295 — INTEGRAL HP 'VE'
VE RATIO FRACT 1-3HP CONTROL BOARD SCHEMATIC
BOSTON GEAR WORKS
1000, 1006

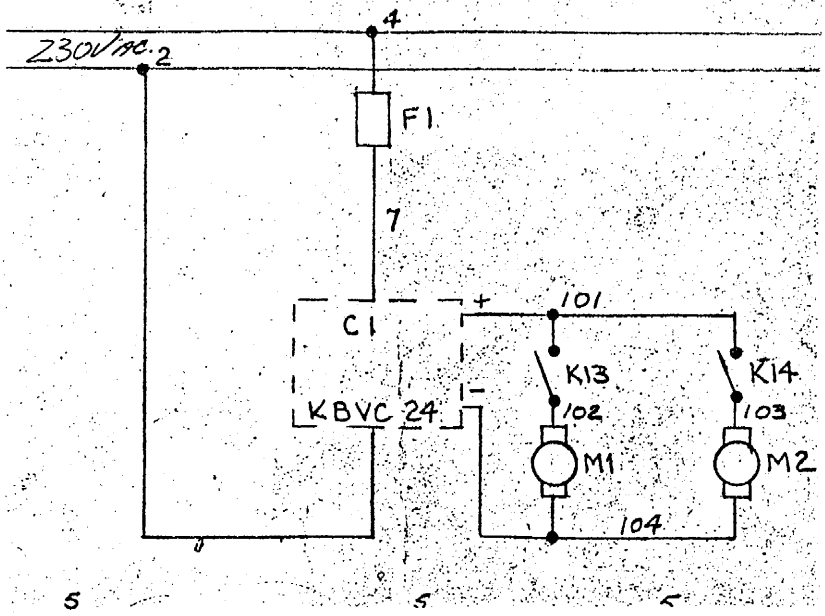
Speed Control

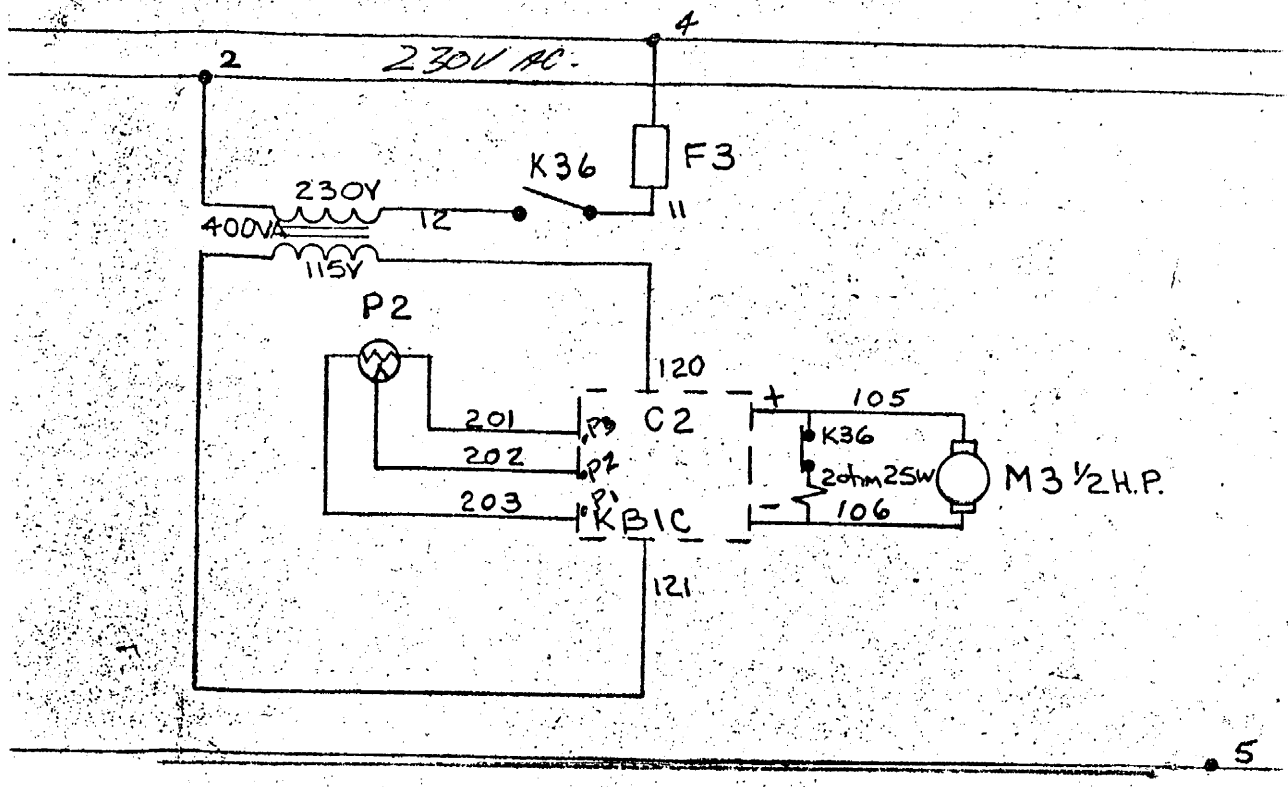
½ H.P. DC motor (115 V)



Speed Control

DC motor. 230 V.





Speed Control
DC Motor. 230 V.