GARVAC

SOLID STATE REDUCED VOLTAGE STARTER

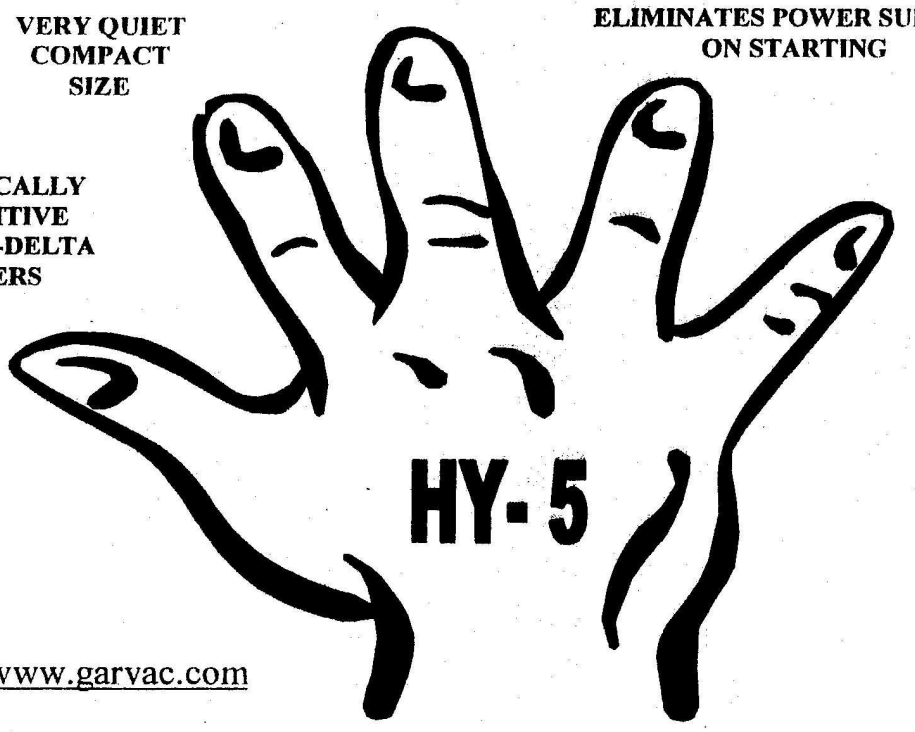
NO CONTACTS TO BURN UP OR REPLACE

VERY QUIET COMPACT SIZE

ELIMINATES POWER SURGES ON STARTING

ECONOMICALLY COMPETITIVE WITH WYE-DELTA STARTERS

SOLID STATE TECHNOLOGY



http:// www.garvac.com

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3-16-99 VAC-500 HP Selector Guide (X3 OL Rating)

Module Size	Current Rating		Max Wire	Max HP @ Voltage (Star)				Max HP @ Voltage (Delta)			
	Star	Delta	Size	208	230	460	575	208	230	460	575
1	24	42	#2	5	7.5	15	20	10	15	30	40
2	32	54	#2	10	10	20	25	15	20	40	50
3	62	104	#00	20	20	40	50	30	40	75	100
3A	69	120	#00	20	25	50	NA	40	40	75	--
4	90	156	250 MCM	30	40	60	75	60	60	125	150
5	150	260	600 MCM	50	50	100	150	75	100	200	250
5A	177	306	600 MCM	60	60	125	150	100	100	250	300

Notes:

HP is determined from NEC data. Actual HP depends upon motor nameplate FLA.

The current rating indicated is the thermal current rating -- in some cases it exceeds the NEMA current rating.

Current rating is determined for X3 OL (accelerating current) from a thermally stabilized FLA condition.

Sizes 1 & 2 use natural convection, others use fan cooling

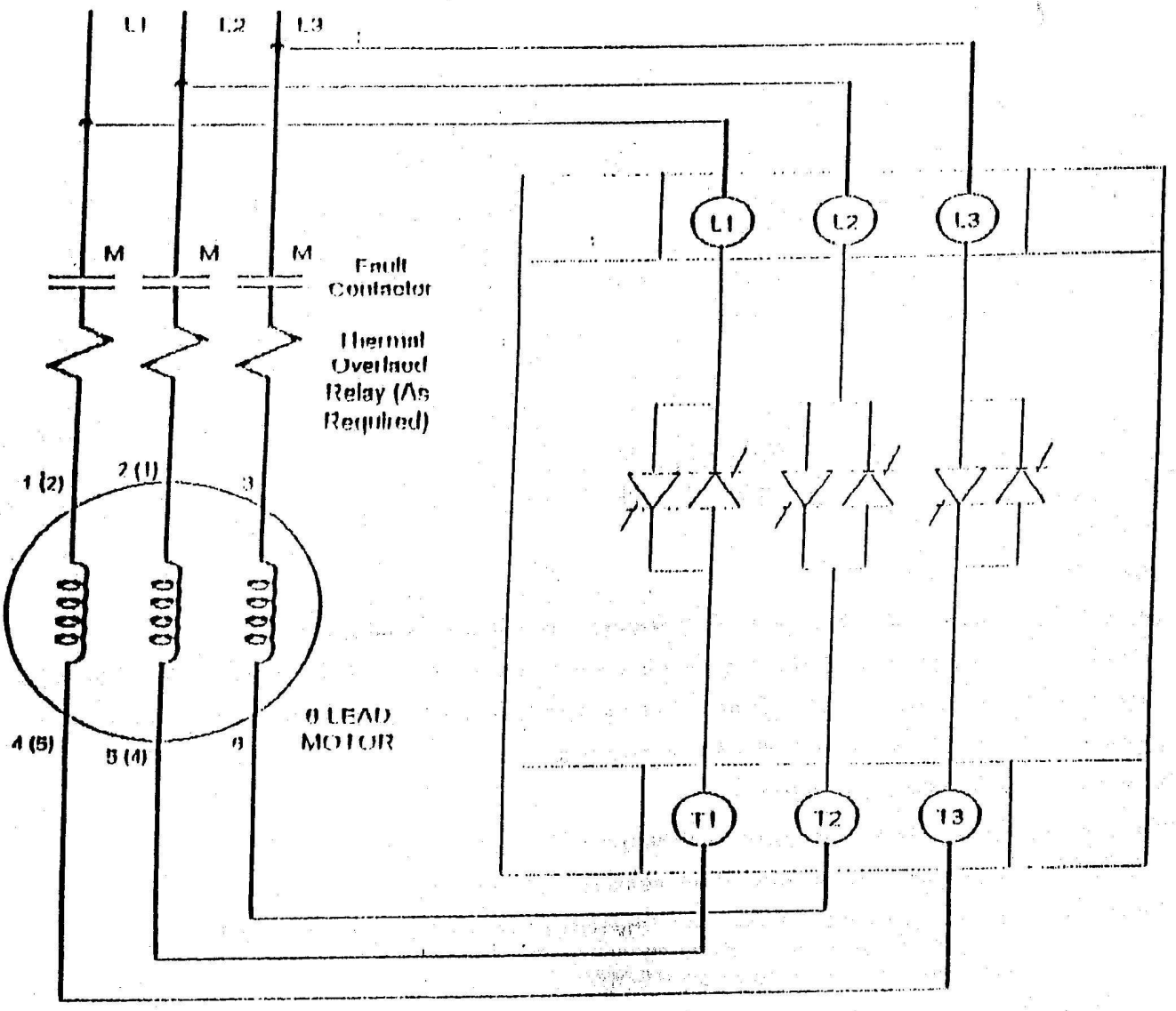
Elevation is up to 1000M above sea level

Max Ambient is 50°C (inside equipment enclosure)

All sizes use reliable pressure mounted power semiconductor devices.

Size 3A differs from size 3 in that 3A uses 140° thyristors while size 3 uses 130° thyristors. While the 140° device has a higher current rating (allowing 40HP @ 208V) it does not have the voltage rating to support 575VAC.

Size 5A differs from size 5 only in that size 5A uses 140° thyristors while size 5 uses 125° thyristors.



Size wire, contactor and thermal overload for motor leg current, not total phase current. Leg current = phase current x 0.58.

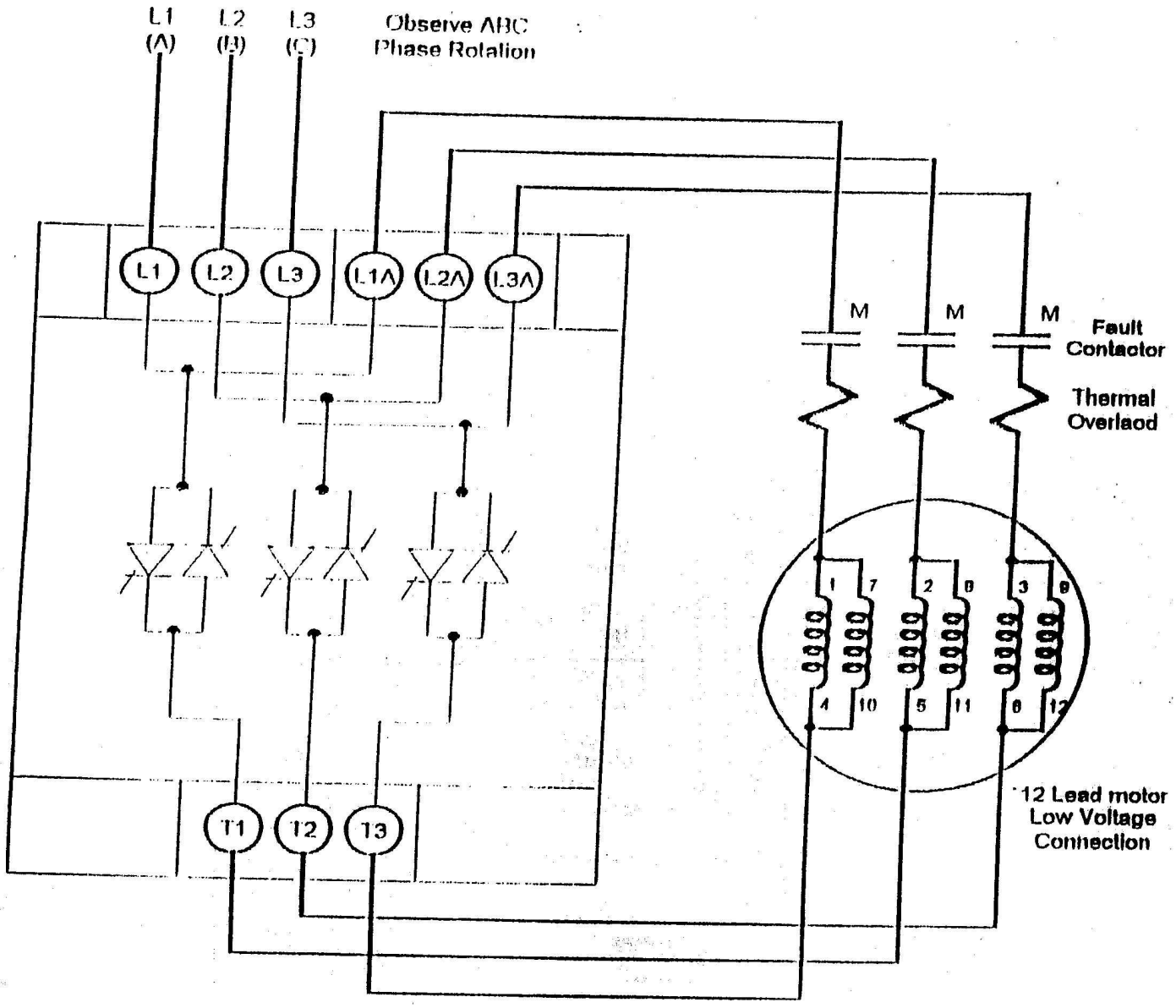
Change direction of rotation by swapping (2) motor windings. eg. Swap motor leads 1 & 2 and swap 4 & 5 as shown in parenthesis ().

Module Size:	Max Wire Size:
1 to 3	AWG #4
4	AWG #2
5	Use 5/16" ID Lugs

Do not use module terminals L1, L2, & L3 as a power distribution terminal block.

GARVAC **VAC-500**
HYDRAULIC ELEVATOR SOFT START CONTROL
HEAVY WIRE CONNECTION DRAWING

10 27 98



Size wire, contactor and thermal overload for motor leg current, not total phase current. Leg current = phase current x 0.58.

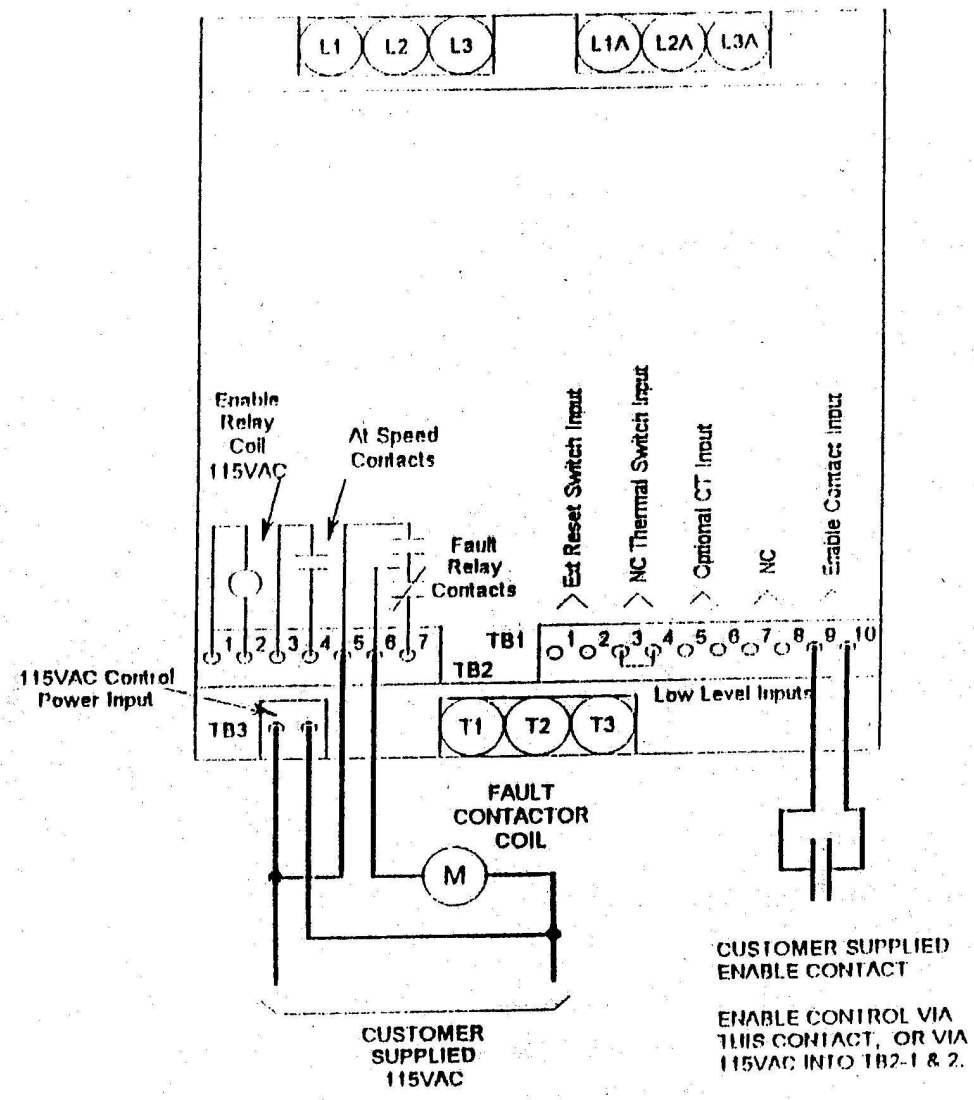
Change direction of rotation by interchanging (2) sets of motor windings. Swapping L1 & L2 at the power input will cause the control to fault from incorrect phase rotation.

Note: For wiring convience, size 3 module (fan cooled) may be rotated 90°

Module Size:	Max Wire Size:
1 to 2	AWG #2
3	AWG #00

GARVAC HY-5 SIZE 1 to 3 HEAVY WIRE CONNECTIONS DELTA CONNECTED LOAD A50035

6-11-99



GARVAC HY-5 LIGHT
WIRE CONNECTIONS
A50037

9-3-99

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HY-5 STARTERS
DELTA CONNECTED*

11/09/99

SIZING FAULT CONTACTOR

FOR DELTA CONFIGURATION OF MOTOR

TO SIZE FAULT CONTACTOR USE .58 X F.L. NAMEPLATE RATING OF MOTOR.

SIZE OVERLOADS FOR 10% ABOVE CONTACTOR RATING.

On existing jobs the across-the-line contactor may be used as fault contactor. Also one of the three pole contactors may be used, if replacing a Star-Delta Starter.

Wire fault contactor into elevator control panel per GarVac Drawing A50035. Size O.L.'s as indicated above.

***UNITS ARE DESIGNED FOR DELTA OR STAR CONNECTIONS.**
SEE CONNECTION DIAGRAMS FOR 3 LEAD AND 6 OR 12 LEAD MOTORS.
SEE SELECTION TABLE FOR HP AND EMPERE RATINGS.

September 3, 1999

VAC-500, INSTALLATION AND TROUBLE SHOOTING NOTES

New Installation VS Upgrade of Y-Δ Contactor: New installations will have few problems as the system will be fully engineered or is a repeat of another system. Upgrades, however, vary greatly and do not always get the same degree of engineering attention. Generally, however, an experienced technician should have little difficulty in starting up a new or upgraded system.

Contactors: In a Δ connected motor the only contactor in the system should be the fault contactor. The intended function of the fault contactor is to remove voltage from the motor in the event of a shorted SCR. A shorted SCR will cause single phase motor current even when the control is not enabled to run.

In an upgrade, part of the existing Y-Δ contactor may be utilized for the fault contactor function, but it must be rewired. It may be tempting to leave additional poles connected to minimize rewiring, but this may be troublesome.

If another contactor or disconnect (against our recommendations) is located between the control and the motor, it must <u>always</u> be picked up and <u>must not be under supervisory control</u>. The same goes with the fault contactor--it <u>must not be under supervisory control</u>. It must be wired according to our schematic.

Only the enable input should be under supervisory control.

Sequence of Events at Power Up: Power may be applied in either sequence. Either three phase power or 115VAC control power may be applied first (or simultaneously). If control power is applied first, there will be a momentary phase loss condition until three phase power is applied. This is OK. In this case, while waiting for three phase power, care must be taken not to enable the control as this will latch the "Phase Loss" fault. This will require a reset or the recycling of control power to clear the fault.

When three phase power is applied, the fault contactor is immediately picked up and stays picked up until power is removed (weeks, months or years later). This will not reduce the life of the contactor as the life is a function of the contact life. In this case, the contacts have unlimited life as they neither make nor break current--they simply conduct current.

When the fault contactor picks up, the control looks for voltage drop across the SCRs. If voltage is not detected, it assumes that an SCR is shorted and the control locks out on "SCR Fault." If the motor happens to be disconnected for some reason (because another contactor or switch is not closed, it assumes the same thing (SCR Fault). When this happens, the fault contactor picks up for about 1 second and then drops out with a subsequent "SCR Fault."

For the same reason, when a control is tested on the bench a load must be connected to prevent an "SCR Fault."

Phase Loss, Power Loss and Phase Rotation: All of these conditions operate the same "Phase Loss" LED indicator.

A power loss or phase loss condition may come and go without problems provided that the control is not enabled to run. Should either occur while the control is enabled, the "Phase Loss" fault will be latched and the fault contactor will drop out.

When not enabled, a phase loss or power loss condition will cause the fault contactor to drop or not pick up. When good power is restored, it will again pick up. If a technician observes the fault

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HY-5 SOLID STATE REDUCED VOLTAGE STARTER

SET UP/START UP AND INITIAL TROUBLESHOOTING INSTRUCTIONS

Pre-Adjust Circuit Board Jumpers and Pots:
Set J401 and J402 to 50 or 60 HZ as required
Set J102, J202, J303 to or Y load configuration as required
Set Accel Rate pot to 50%
Set Dwell Time pot to 0%
Set Starting Torque pot to 0%
Set Current Limit pot to 50%
Short secondary of optional current transformer (if provided)

Terminal Block Jumper:
If a heat sink thermal switch is not provided, jumper TB1-3 to TB1-4

Start Up:
Apply 115VAC control power – Green Power and Red Phase Loss/Rotation LED lights

Apply three phase power (230/460VAC) – Red Phase Loss/Rotation Led extinguishes and Green Ready LED lights and Fault Contactor (if used) picks up.

If Phase Loss/Rotation LED does not extinguish, check incoming power for phase loss and phase rotation.

Close Enable Contact – Green Enable LED lights and motor starts and accelerates to full speed at which the Green At Speed LED lights and the At Speed contacts close.

If the fault contactor drops and the red SCR Fault led illuminates as soon as the enable contact is closed, check motor wiring.

Measure motor leg current with clamp on ammeter – All phases should be balanced within ±5%. If not, immediately turn off power and check motor wiring.

OPERATIONAL ADJUSTMENTS W/O CURRENT LIMIT OPTION

Equipment Required: Peak reading hold clamp on ammeter

Set Acceleration Rate: Adjust Acceleration rate for desired acceleration performance

contactor drop out and /or pick up unexpectedly, he should immediately check the incoming power for an intermittent condition.

Very, very seldom will phase rotation be a problem except when starting up a new or upgraded system. Electricians and the power company are careful not to change phase rotation.

Reset Input: It is not recommended that the reset input be permanently jumpered as this may introduce a dangerous condition in which the motor could start unexpectedly when a fault such as power loss or phase loss is corrected.

The supervisory control may have control of the reset input. This is recommended in unattended installations or when the control is located in an inaccessible or sealed enclosure.

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Check Acceleration Current: Start control while measuring the current of one motor leg. Maximum current during acceleration should not exceed 300% motor nameplate current.

If it exceeds 300%, reduce the Accel Rate by turning it CCW and repeat the procedure. This will indicate the maximum rate at which the motor can be accelerated. Do not set it above 300% nameplate FLA unless the control is rated for a higher current. In this case, the current during acceleration may be set to 300% of control rating.

Set Starting Torque: You may have noticed a delay before motor rotation starts. This may be reduced by increasing the Starting Torque adjustment. Simply increase the Starting Torque pot until there is no delay before motor rotation. Then turn the pot no further because it will at this point cause degradation in acceleration performance.

Set Dwell Time: Dwell Time provides a period of time at which the control remains at the starting torque level before acceleration begins. This may be useful in taking up slack before the motor is accelerated. Adjust for desired time. CCW is 0 and 100% is 4 seconds. Generally, it is set at 0%.

March 1, 1999

FEATURES AND SPECIFICATIONS OF THE HY-5 HYDRAULIC SOFT START CONTROL

Introduction:

The GARVAC HY-5 is a three phase AC full control thyristor soft start motor control. It is designed for cost effective replacement of Y-Δ electro-magnetic starters. Five compact sizes are available to cover 5 to 300HP with line voltage ranging from 208 to 575VAC.

Do not confuse the GARVAC HY-5 with half-control (SCR-Diode) topology which has even harmonic output, less starting torque, higher vibration, and is not applicable to Δ loads.

While intended for elevator applications, the GARVAC HY-5 is also useful for general purpose applications[3]. It may be set up for either Y or Δ motor configurations. When used to control a delta connected load, a fault contactor is required (not included).

Phase loss /phase rotation detection is standard. Current limit acceleration is optional.

Specifications:

Current Rating:	16 to 306A in (5) sizes, see HP Selector Guide Page
Line Voltage:	208 to 575VAC ±10% (Size 5A limited to 460VAC)
Frequency:	48 to 62HZ
Efficiency:	99% (460 /545VAC), 98% (208 /230VAC)
Power Factor:	Governed by power factor of motor
Control Voltage:	115VAC ±10% @ 40VA (Contactor coil VA not included)
Max Ambient Temperature:	50°C
Max Elevation:	1000M
Transient Overload:	300% for 15 Sec. (Motor acceleration)
Ramp Period:	0.5 to 10 Sec. (Effective acceleration time = 0.25 to 5 Sec.)
Approval:	CAN/CSA-B44.1-M91 (Elevator and Escalator)

Features:

Rugged, oversize line and load compression terminals for ease of installation

May be orientated with terminals either on sides or top & bottom (Fan cooled versions only)

Conservative thermal design -- uses only rugged, reliable pressure mounted thyristors

Chassis configuration--mount on panel in your enclosure[2]

Full Wave Control provides smooth, quiet acceleration with high torque /current ratio

Incoming phase rotation & phase loss protection -- satisfies CSA requirement for phase loss protection

Fault Contact output--controls fault contactor to prevent operation with shorted power device[1]

At Speed Contact--closes when fully phased-on

Applicable for either Δ or Y load configuration

Current limit acceleration via CT (Current Transformer) option[1,4]

Flexible Enable circuit--Via customer supplied contact input or internal 115VAC relay coil

Heat sink thermal switch to guard unit against fan failure (fan cooled models)

Long life (50,000 hr) ball bearing fan

High Gate Drive Capability--Fires any SCR

Synchronized Gate Firing -- Enhances SCR latching

Line transient protection via snubbers and metal oxide varistors

Control circuit isolation

Reset push button /external contact closure for application flexibility

Two piece terminal blocks for signal wiring

Emergency operation mode -- allows temporary operation with shorted SCR

Adjustments:	Starting Torque	0 to 100%
	Acceleration	0.25 to 5 Sec
	Current Limit	200 to 400% (Optional)
	Dwell Time	0 to 5 Sec
LED Indicators:	Power	Green
	Ready	Green
	Enable	Green
	At Speed	Green
	Current Limit	Red
	Thermal Switch	Red
	SCR Fault	Red
	Phase Rotation /Loss	Red
Contact Output:	Fault output (form "C" contacts)	
	At Speed (form "A" contact)	
Enable Input	Either 115VAC signal or Normally Open relay contact	
CT Input:	Quantity (1) 1000:1 current transformer, I secondary = 50MA (Optional)[3]	
Cur Lim Scaling:	Via binary weighted DIP Switch (Accepts any load within the current range)	

Notes:

1. This control does not provide motor thermal overload protection. This is best provided via an integral contactor /thermal overload relay unit.

2. CSA requires this control to be mounted in a NEMA rated electrical enclosure.

3. Current limit not recommended for applications requiring high break away torque.