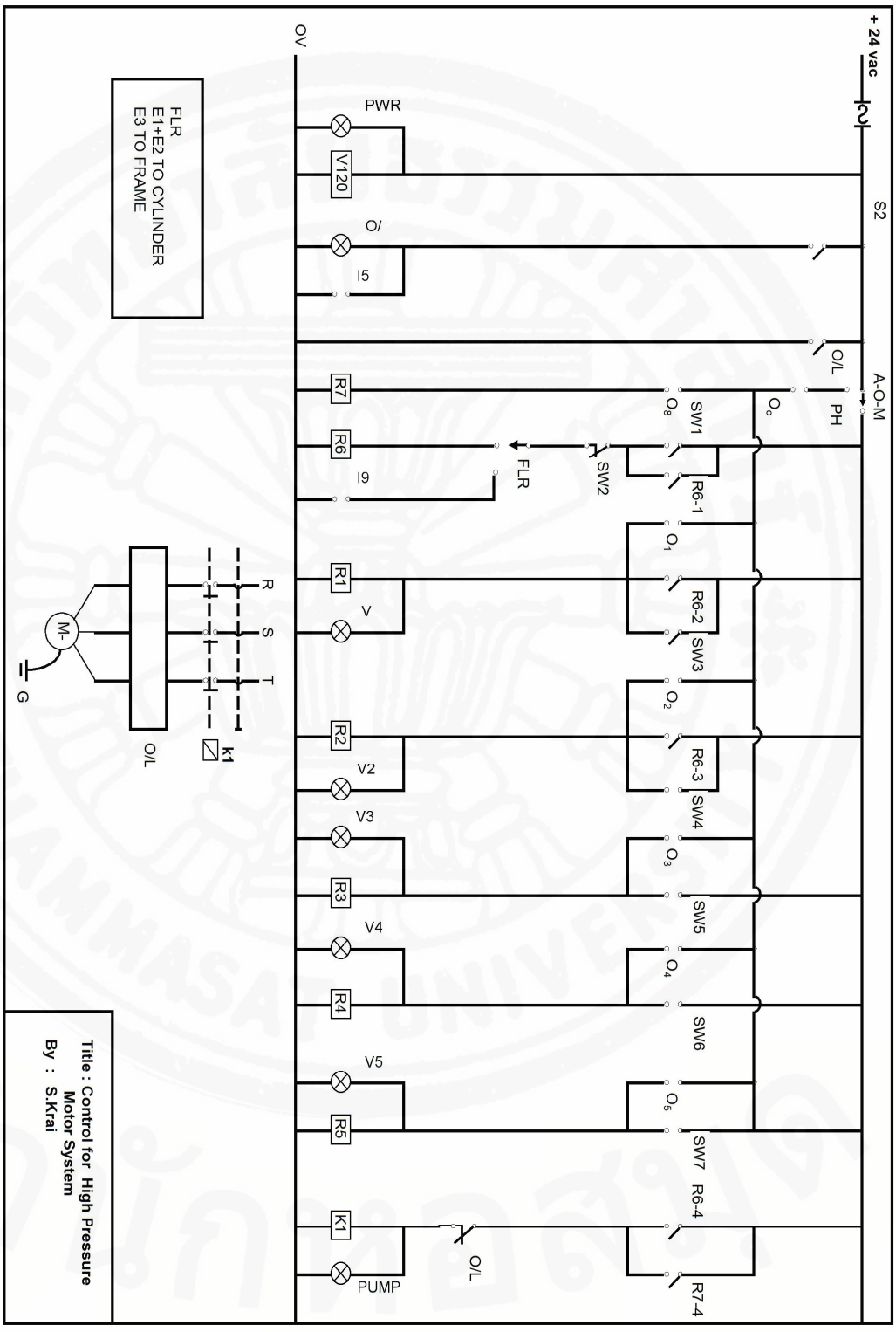
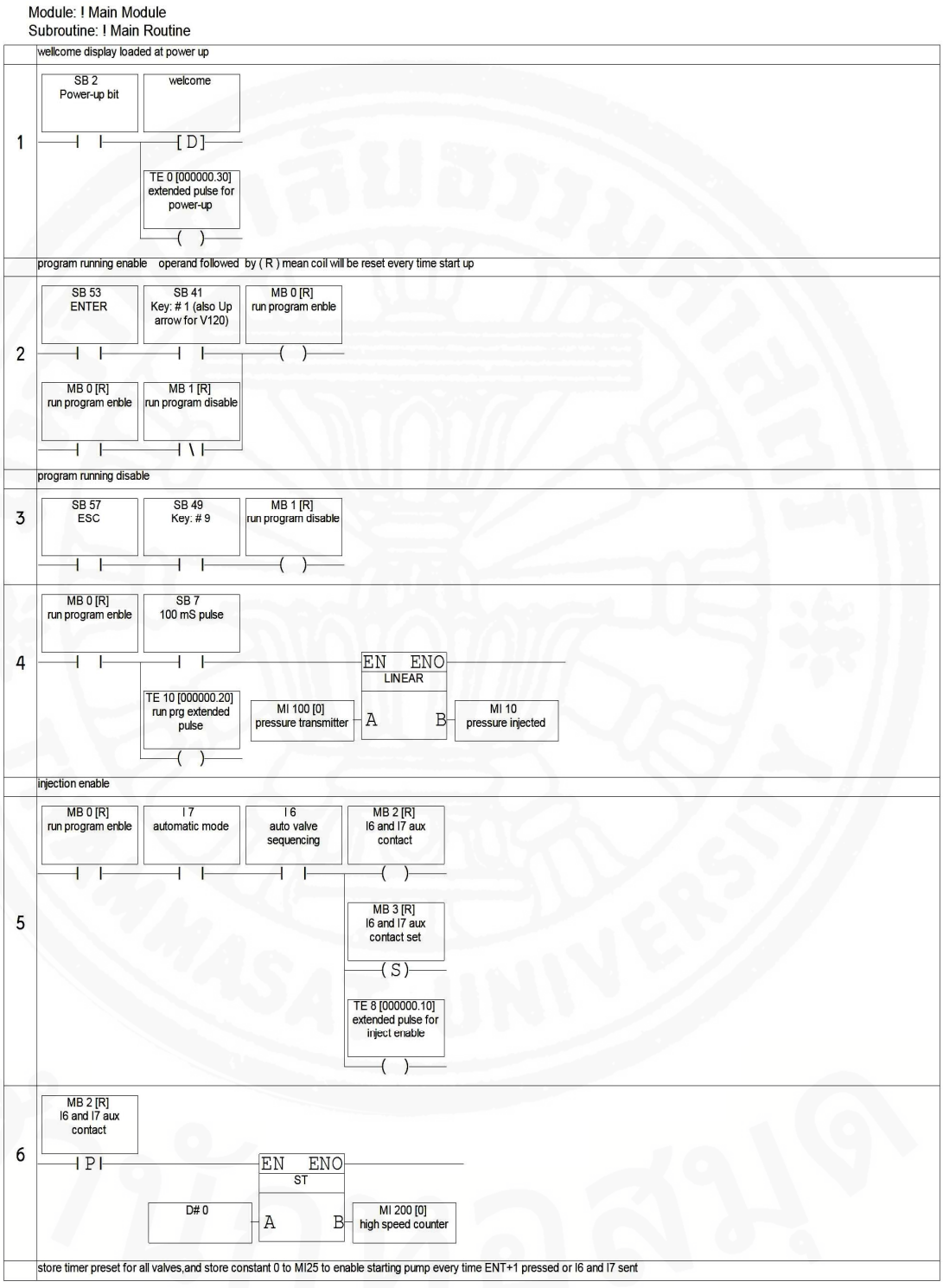
ผนวก ก
วงจรไฟฟ้า โปรแกรมควบคุม และสมบัติของวัสดุและอุปกรณ์



ภาพที่ 1ก. แสดงวงจรไฟฟ้าและโปรแกรมควบคุม



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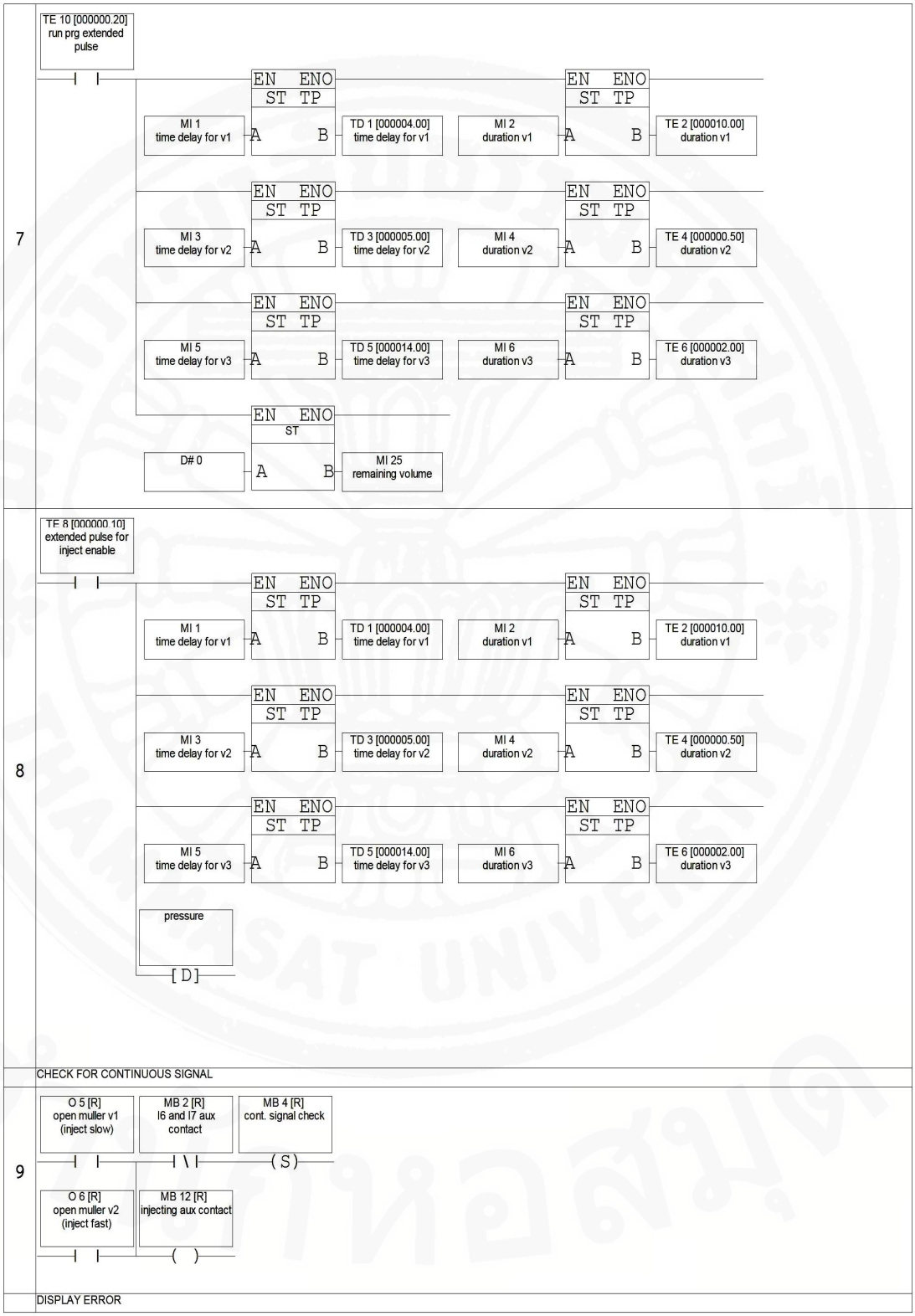

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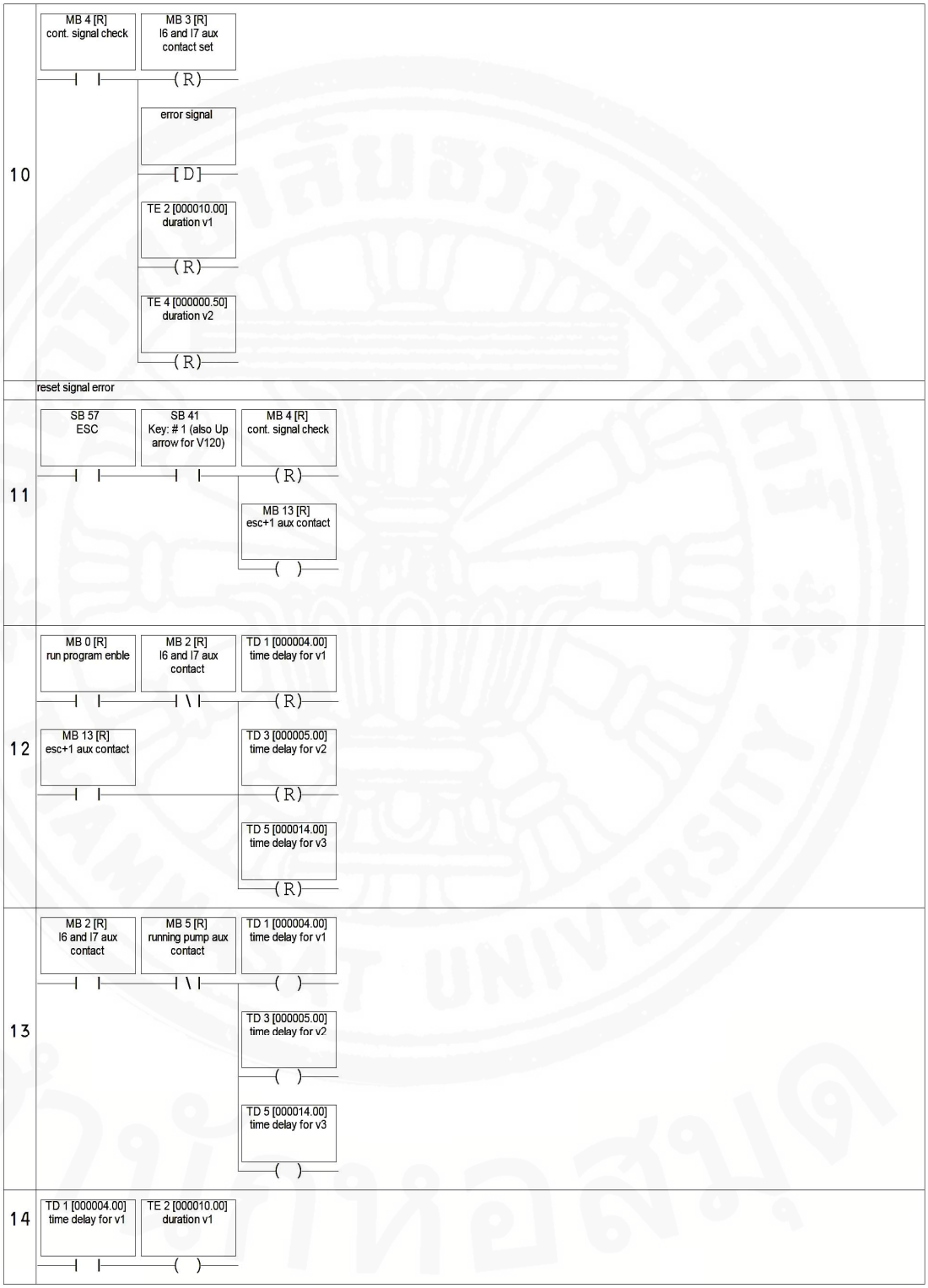

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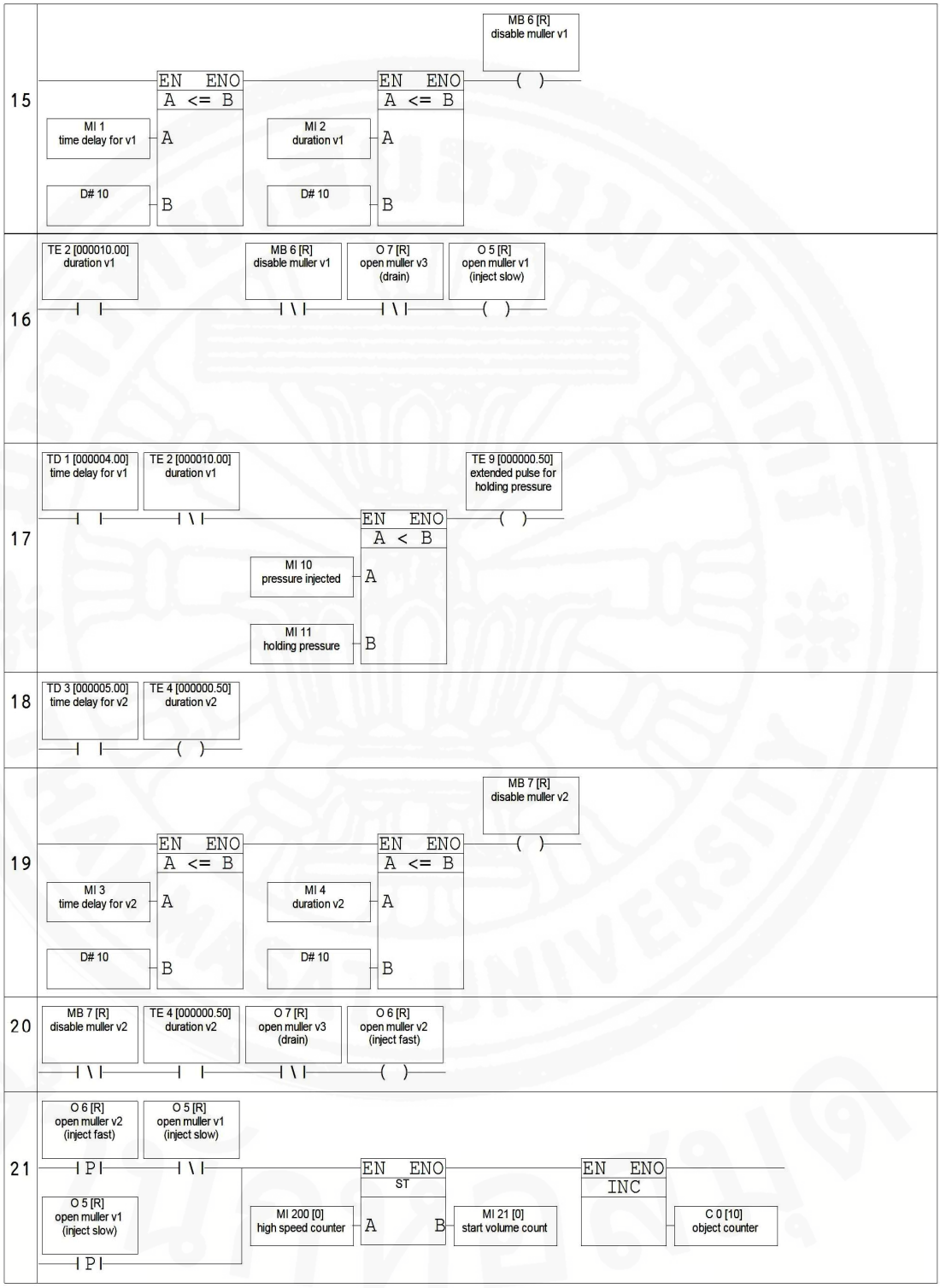
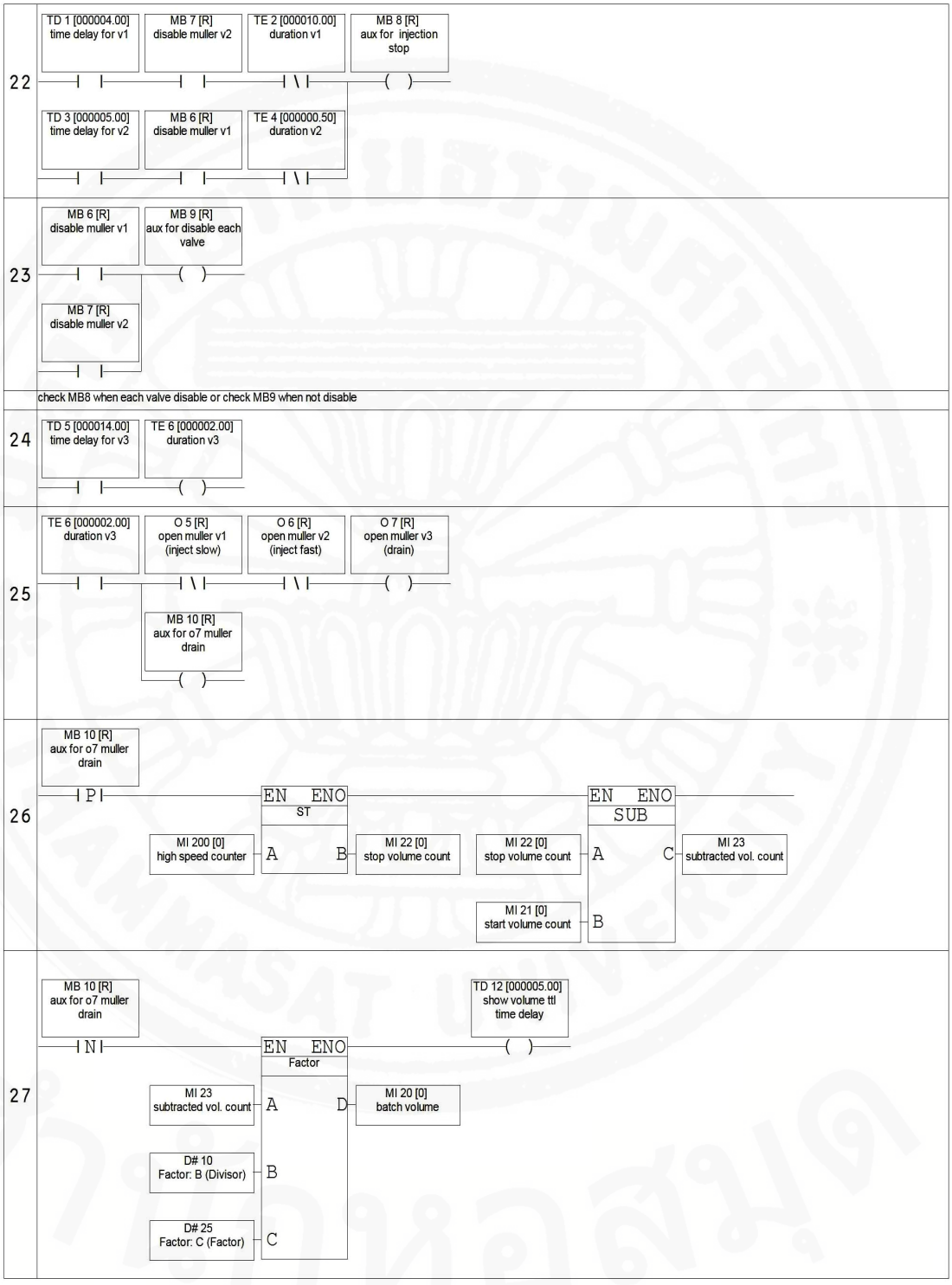
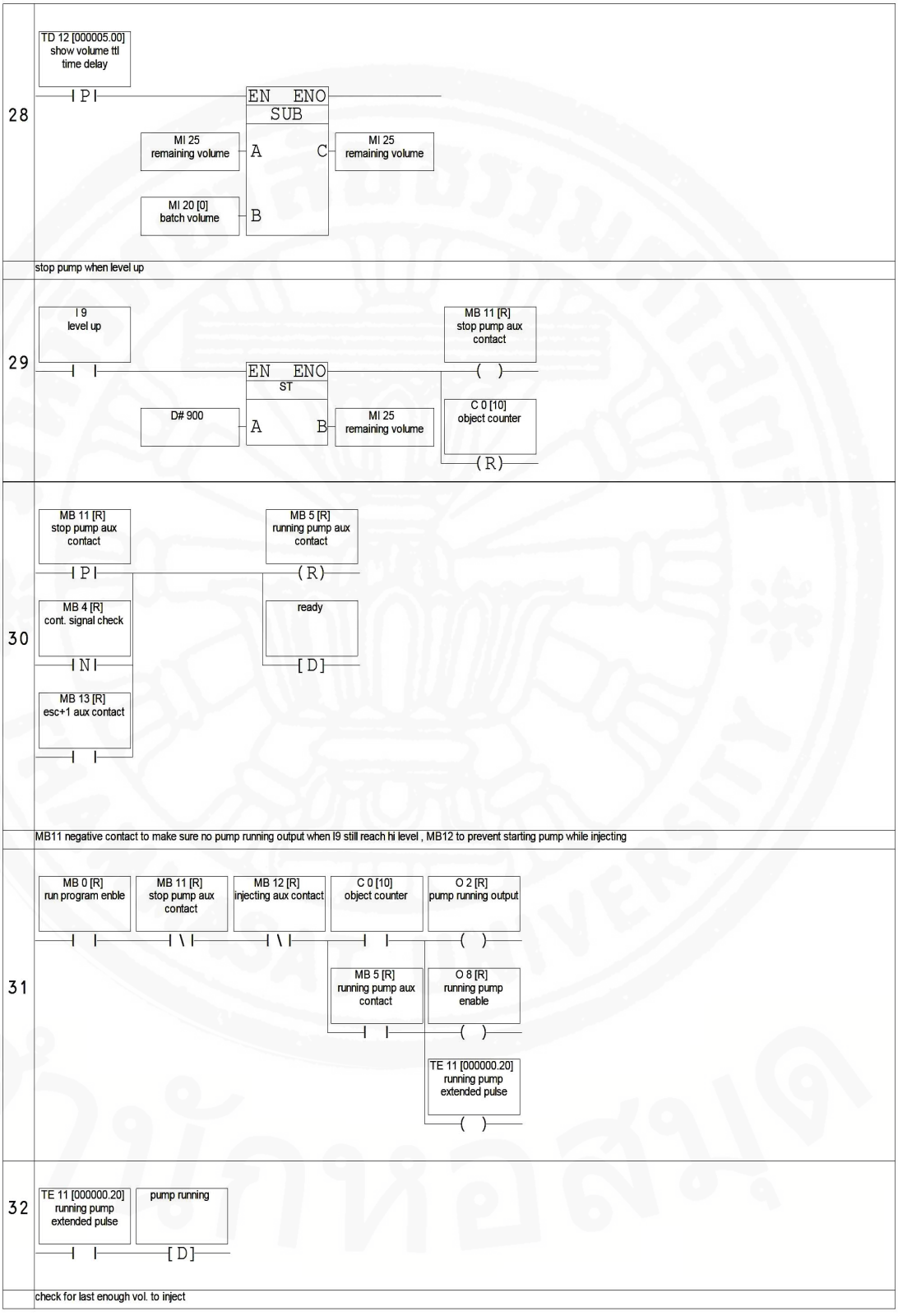


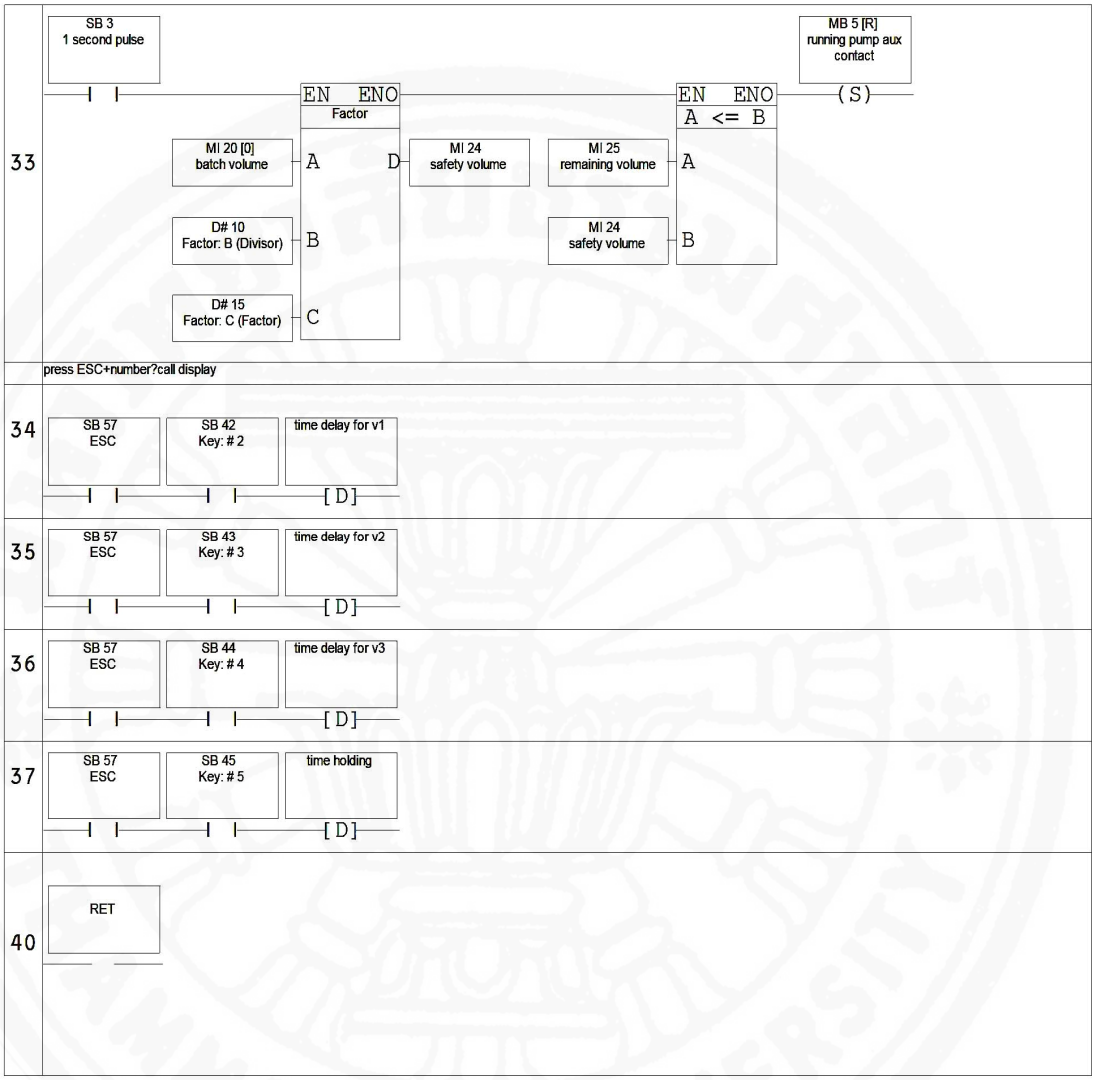
ภาพที่ 1ก. (ต่อ) แสดงวงจรไฟฟ้าและโปรแกรมควบคุม



ภาพที่ 1ก. (ต่อ) แสดงวงจรไฟฟ้าและโปรแกรมควบคุม

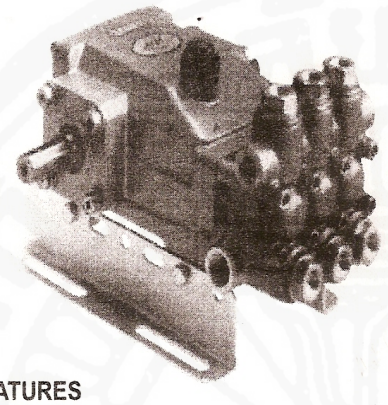


ภาพที่ 1ก. (ต่อ) แสดงวงจรไฟฟ้าและโปรแกรมควบคุม



ภาพที่ 1ก. (ต่อ) แสดงวงจรไฟฟ้าและโปรแกรมควบคุม

CAT PUMPS



5CP Plunger Pump

Models 5CP3120
5CP3120G1, 5CP3130G1
5CP5120, 5CP5150G1
5CP6120, 5CP6120G1

FEATURES

Superior Design

- Triplex plunger design gives smoother liquid flow.
- Hi-Pressure Seals or V-Packings are completely lubricated and cooled by the liquid being pumped.
- Inlet and discharge valve assemblies interchange for easier maintenance.
- Lubricated Lo-Pressure Seals provides double protection against external leakage.
- Oil bath crankcase assures optimum lubrication.
- Close tolerance concentricity of the ceramic plunger maximizes seal life.

Quality Materials

- All stainless steel valves are heat treated and seats are roller burnished for a positive seal and extended valve life.
- Forged brass manifolds for strength and corrosion resistance.
- Special concentric, high density, polished, graphite impregnated, solid ceramic plungers are abrasion resistant and result in extended seal life.
- Specially formulated, CAT PUMP exclusive, Hi-Pressure Seals or V-Packings offer unmatched performance and seal life.
- Die cast aluminum crankcase provides high strength, minimum weight and precision tolerance control.
- Chrome-moly crankshaft gives unmatched strength and surface hardness.
- Oversized crankshaft bearings with greater loading capacity mean longer bearing life.

Easy Maintenance

- Convenient "press-in" style seal case for ease in servicing.
- Wet-end is easily serviced without entering crankcase, requiring less time and effort.
- Valve assemblies are accessible without disturbing piping, for quick service.
- Preset packings mean no packing gland adjustment is necessary, reducing maintenance costs.

DETERMINING THE PUMP R.P.M.	Rated G.P.M. / Rated R.P.M.	=	"Desired" G.P.M. / "Desired" R.P.M.
DETERMINING THE REQUIRED H.P.	GPM x PSI / 1460	=	Electric Brake H. P. Required
DETERMINING MOTOR PULLEY SIZE	Motor Pulley O.D / Pump R.P.M.	=	Pump Pulley O.D. / Motor R.P.M.

Note: Consult engine manufacturer when using gas or diesel engine.
Refer to pump Service Manual for important Inlet Condition Check-List, Start-up Procedure, Tech Bulletins and Pump Maintenance information.

SPECIFICATIONS

	U.S. Measure	Metric Measure	U.S. Measure	Metric Measure
MODEL	**5CP3120 and 5CP3120G1**		**5CP3130G1**	
Flow	4.5 GPM	(17 L/M)	3.8 GPM	(14.3 L/M)
Pressure Range	100-3500 PSI	(7-245 BAR)	100-3500 PSI	(7-245 BAR)
RPM	1645 RPM	(1645 RPM)	1570 RPM	(1570 RPM)
Bore	**0.630"**	**(16 mm)**	**0.630"**	**(16 mm)**
Stroke	0.709"	(18 mm)	0.650"	(16.5 mm)
Weight	20.02 lbs.	(9.1 kg)	20.02 lbs.	(9.1 kg)
MODEL	**5CP5120**		**5CP5150G1**	
Flow	5.0 GPM	(19 L/M)	5.0 GPM	(19 L/M)
Pressure Range	100-3000 PSI	(7-210 BAR)	100-3000 PSI	(7-210 BAR)
RPM	1415 RPM	(1415 RPM)	1570 RPM	(1570 RPM)
Bore	**0.709"**	**(18 mm)**	**0.709"**	**(18 mm)**
Stroke	0.709"	(18 mm)	.650"	(16.5 mm)
Weight	20.02 lbs.	(9.1 kg)	20.02 lbs.	(9.1 kg)
MODEL	**5CP6120**		**5CP6120G1**	
Flow	6.0 GPM	(23 L/M)	7.0 GPM	(27 L/M)
Pressure Range	100-1600 PSI	(7-110 BAR)	100-1600 PSI	(7-110 BAR)
RPM	1400 RPM	(1400 RPM)	1668 RPM	(1668 RPM)
Bore	**0.787"**	**(20 mm)**	**0.787"**	**(20 mm)**
Stroke	0.709"	(18 mm)	0.709"	(18 mm)
Weight	20.02 lbs.	(9.1 kg)	20.02 lbs.	(9.1 kg)

COMMON SPECIFICATIONS

Inlet Pressure Range	Flooded to 60 PSI	(Flooded to 4 BAR)
Crankcase Capacity	17 oz.	(0.51 L)
Max. Liquid Temperature	160°F	(71°C)
Inlet Ports (2)	1/2" NPTF	(1/2" NPTF)
Discharge Ports (2)	3/8" NPTF	(3/8" NPTF)
Shaft Diameter	0.787"	(20 mm)
Dimensions (3120-5150)	10.35 x 10.0 x 5.78"	(263 x 254 x 147 mm)
(6120)	10.82 x 10.0 x 5.78"	(275 x 254 x 147 mm)

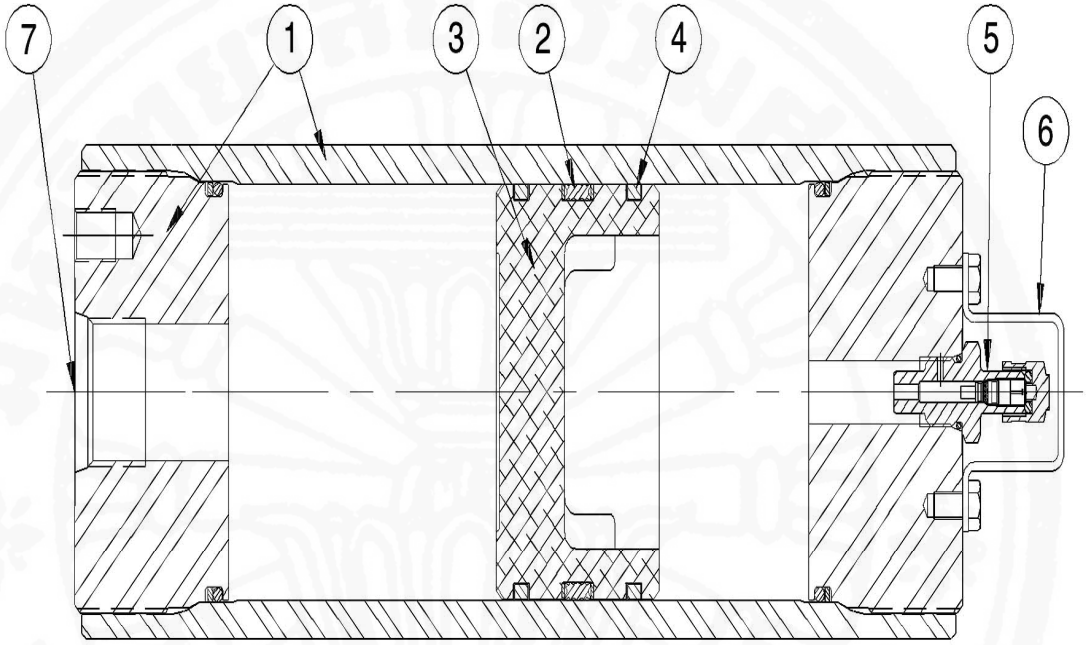
HORSEPOWER REQUIREMENTS

MODEL	FLOW		PRESSURE						MOTOR PULLEY SIZE Using 1725 RPM Motor & 8" Std. Pump Pulley	
			PSI 1200	PSI 1600	PSI 2000	PSI 2500	PSI 3000	PSI 3500		
	U.S. GPM	L/M	BAR 85	BAR 110	BAR 140	BAR 175	BAR 210	BAR 245	RPM	Pulley O.D.
3120	4.5	17	3.7	4.9	6.2	7.7	9.3	10.8	1645	7.5
3120G1	4.5	17	3.7	4.9	6.2	7.7	9.3	10.8	1645	Gearbox
3130G1	3.8	14.3	3.1	4.2	5.2	5.9	7.8	9.1	1570	Gearbox
5120	5.0	19	4.1	5.5	6.9	8.6	10.3	N/A	1415	6.5
5150G1	5.0	19	4.1	5.5	6.9	8.6	10.3	N/A	1570	Gearbox
6120	6.0	23	4.9	6.6	N/A	N/A	N/A	N/A	1400	6.4
6120G1	7.0	27	5.8	7.7	N/A	N/A	N/A	N/A	1668	Gearbox

See complete Drive Packages [incids: Pulleys, Belts, Hubs, Key] Tech Bulletin 03.

"Customer confidence is our greatest asset"

ภาพที่ 2ก. แสดงลักษณะสมบัติของเครื่องสูบน้ำความดันสูง



ภาพที่ 3ก. แสดงภาพร่างถังกักเก็บความดันชนิดลูกสูบ

1 Shell and Endcap

2 Bearing

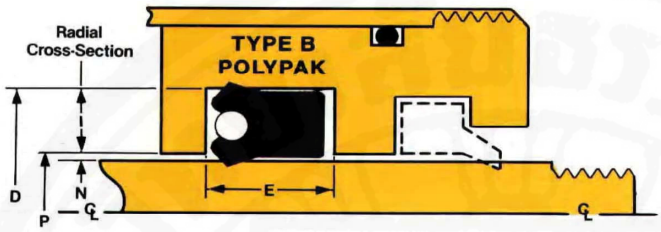
3 Piston

4 Seal system

5 Gas valve

6 Guard

PolyPak ROD DESIGN TABLE



Rod Seal Example:

Given desired rod diameter of 2½" with a nominal seal cross-section of ¼".

Rod Dia. (N) = $2.500 \pm \frac{.000}{.002}$

Throat Dia. (P) = $N_{max} + .001 \pm \frac{.003}{.000} = 2.500 + .001 = 2.501 \pm \frac{.003}{.000}$

Groove Dia. (D) = $N_{max} + 2(l) \pm \frac{.003}{.000} = 2.500 + 2(.250) = 3.00 \pm \frac{.003}{.000}$

Axial Groove Length (E) = Given $.413 \pm \frac{.013}{.000}$

N Nominal Rod I.D. Range	Nominal Radial Cross-Section	l	E Axial Groove Length Standard	E Axial Groove Length Deep & Type B	P Throat Diameter	D Groove O.D.
¼" - 2⅛" $\pm \frac{.000}{.001}$	⅛	.125	.138 $\pm \frac{.015}{.000}$	.275 $\pm \frac{.015}{.000}$	$N_{max} + .001 \pm \frac{.002}{.000}$	$N_{max} + 2(l) \pm \frac{.002}{.000}$
5/16" - 4¼" $\pm \frac{.000}{.002}$	5/16	.187	.206	.343 .413	$N_{max} + .001 \pm \frac{.002}{.000}$	$N_{max} + 2(l) \pm \frac{.002}{.000}$
¼" - 12¾" $\pm \frac{.000}{.002}$	¼	.250	.275	.413 .618	$N_{max} + .001 \pm \frac{.003}{.000}$	$N_{max} + 2(l) \pm \frac{.003}{.000}$
¾" - 9⅝" $\pm \frac{.000}{.002}$	5/16	.312	.343	.550 .688	$N_{max} + .002 \pm \frac{.003}{.000}$	$N_{max} + 2(l) \pm \frac{.004}{.000}$
1½" - 14¾" $\pm \frac{.000}{.002}$	⅜	.375	.412	.550 .688	$N_{max} + .002 \pm \frac{.004}{.000}$	$N_{max} + 2(l) \pm \frac{.005}{.000}$
2¼" - 5" $\pm \frac{.000}{.003}$	7/16	.437	.481	.688 .825	$N_{max} + .002 \pm \frac{.004}{.000}$	$N_{max} + 2(l) \pm \frac{.006}{.000}$
1¾" - 24⅞" $\pm \frac{.000}{.003}$	½	.500	.550	.825	$N_{max} + .002 \pm \frac{.005}{.000}$	$N_{max} + 2(l) \pm \frac{.007}{.000}$
2¾" - 19¾" $\pm \frac{.000}{.003}$	⅝	.625	.688	1.100 1.375	$N_{max} + .003 \pm \frac{.006}{.000}$	$N_{max} + 2(l) \pm \frac{.009}{.000}$
7¼" - 31" $\pm \frac{.000}{.004}$	¾	.750	.825	1.238 1.375	$N_{max} + .003 \pm \frac{.007}{.000}$	$N_{max} + 2(l) \pm \frac{.011}{.000}$
15" - 39" $\pm \frac{.000}{.005}$	1	1.000	1.100	1.650	$N_{max} + .004 \pm \frac{.009}{.000}$	$N_{max} + 2(l) \pm \frac{.015}{.000}$
	F_1	F_2		F_3	F_4	F_5

Notes:

F_1—The Nominal Rod Diameter spread shown is taken from price list PPD3701. Available sizes fall in cross-section range. Consult PPD 3701 Price List for specific size availability. Rod size range given based on Type B Poly Pak availability.

F_2—The Radial Cross-Section l is shown as a fraction for Seal Reference and as a three place decimal for Gland Reference.

F_3—There may be two possible Axial Groove Lengths for some cross-sections. Consult price list PPD3701 for availability.

F_4—The throat diameters are simply figured by taking the maximum Rod Diameter plus the noted clearance.

F_5—The Groove Outside Diameter is calculated by taking the maximum Rod Diameter plus two radial cross-sections l.

Note:

1—Molythane parts can be stretched up to 5% of its diameter or compressed up to 2% for rod applications. Therefore if odd size rods or bores are encountered, existing sizes can be used without special non-available seals. Careful attention must be taken when using the 5% rule so that the radial cross-section "l" must be maintained no matter what dimension the rod or piston actually measures. Careful attention must be taken to select a size that requires 5% max **stretch** on the diameter in piston applications, and 2% max. **compression** on the diameter in rod applications.

2—Axial groove lengths for Poly Paks with non-positively actuated modular back-ups are calculated by: (nominal radial c/s desired × 1.100) + "E".

Parker Hannifin Corporation
Engineered Polymer Systems Division
Salt Lake City, UT 84119

Parker Seals
www.parker.com/eps

ภาพที่ 4ก. ขนาดและพิกัดความเผื่อสำหรับการขึ้นรูปห้องกันรั่ว

http:// www.co-ax.de

coax® data sheet E3.02-01/2004

coaxial valve
type KB 15

2/2 way valve direct acting
pressure range PN 0-400 bar
orifice DN 2-8 mm
connection thread
function valve
normally closed
symbol **NC**

design direct acting, with spring return
body materials The materials refer to parts in contact with the media
⑧ 1.4104/steel, nickel plated ②
③ ⑤
④ ⑥ stainless steel / steel, nickel plated
valve seat synthetic resin on metal
seal materials NBR, PTFE FPM

details needed:
- orifice
- port
- function NC
- operating pressure
- flow rate
- media
- media temperature
- ambient temperature
- nominal voltage

general specifications			options
ports	KB	threads G 3/8	special threads
function		NC (1-coil operation)	NC (2-coil operation)
pressure range	bar	30 | 50 | 80 | 120 | 250 | 300	40 | 70 | 100 | 150 | 300 | 400
	DN	8 | 6 | 5 | 4 | 3 | 2	8 | 6 | 5 | 4 | 3 | 2
K_v value	l/min	24,0 | 17,4 | 13,5 | 11,0 | 4,1 | 1,7	24,0 | 17,4 | 13,5 | 11,0 | 4,1 | 1,7
vacuum	leakage		$< 10^{-4}$ mbar l·s^{-1}
pressure-vacuum	$P_1 \Leftrightarrow P_2$		upon request
back pressure	$P_2 > P_1$		upon request
media		gaseous-liquid	
abrasive media			
damping	opening		
	closing		
flow direction	A ⇔ B	as marked	bi-directional upon request
switching cycles	1/min	260	370
switching time	ms	opening 60 closing 170	opening 40 closing 120
media temperature	°C	DC: -40 to +100	<-40°C and >100°C upon request
		AC: -40 to +100	<-40°C and >100°C upon request
ambient temperature	°C	DC: -40 to +80	
		AC: -40 to +80	
manual override			
approvals			WAZ
mounting			
weight	kg	2,5	
additional equipment			upon request

electrical specifications			options
nominal voltage	U_1	24 V DC	special voltages upon request
	U_2	230 V 40-60 Hz AC	special voltages upon request
	U_3		
	U_4		
actuation	DC	direct-current magnet	
	AC	direct-current magnet with integrated rectifier	above 100°C with seperate rectifier
insulation rating	H	180°C	
protection	IP65		
energized duty rating	ED	100%	
connection		plug acc. DIN EN 175301-803 form A 4 positions x 90° / wire diameter 6-8 mm	connector M12x1
	M16x1,5	terminal box	
additional equipment		illuminated plug, with varistor	
current consumption	1-coil - operation	24 V DC 1,60 A 230 V 40-60 Hz AC 0,15 A	24 V DC 2,30 A 230 V 40-60 Hz AC 0,24 A
	2-coil - operation	pick up power holding power	24 V DC 5,90 A / 230 V AC 0,76 A 24 V DC 1,58 A / 230 V AC 0,16 A
explosion proof			
limit switches			

- specifications not highlighted are standard
- specifications highlighted in grey are optional

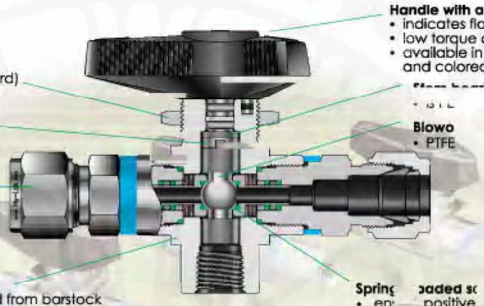
müller co-ax ag · Gottfried-Müller-Str. 1 · D-74670 Forchtenberg · Germany · fon +49(0)7947/828-0 · fax +49(0)7947/828-11 · Email info@co-ax.de

ภาพที่ 5ก. Catalogue โซลินอยด์วาล์วความดันสูง

Hy-Lok T Series

Trunnion Ball Valves for General and CNG Service

Catalog No. H-100TBV
Sep. 2002



Features

- [illegible] rating up to 10000psig(689 bar) at 100°F (37°C)
- End connections available Hy-Lok tube fittings and female NPT
- Compact, maximum flow design
- L[illegible]
- 2-way "Shut Off" and 3-way "Switching" models
- Body materials available in 316 stainless steel and Alloy 400
- 100% factory tested

The [illegible] on top of the stem [illegible] hen the handle is re[illegible]

Technical Data

Pre[illegible]-Temperature Rating

Se[illegible] Mat[illegible]	[illegible]emperature Rating	Pres[illegible] at 100°F(37°C)	
		Stainless Steel	Alloy 400
T Series			
PCTFE	0°F to 250°F (-17°C to 121°C)	6000 psig (413 bar)	5000 psig (344 bar)
PEEK	0°F to 450°F (-17°C to 232°C)		
PTFE		1500 psig (103 bar)	
TH Series			
PEEK	0°F to 450°F (-17°C to 232°C)	10000 psig (689 bar) depending on end Connection	-

Testing

- Each valve is tested with nitrogen @1000psig(69 bar) to max. leak rate of 0.1SCCM.
- Hydrostatic shell test is performed at 1.5 times the working pressure as an option.
- Other tests are available upon request.

T Series

Body Material	SS316					
Seat Material	PCTFE	PEEK	PTFE	PCTFE	[illegible]	PTFE
[illegible],°F(°C)	Working Pressure, psig(ba[illegible]					
[illegible]0(37)	600[illegible](413)	[illegible](413)	[illegible]500(103)	5000(344)	[illegible](344)	[illegible]
[illegible]0(65)	3000(206)	5800(399)	1125(77.5)	3000(206)	4690(323)	[illegible]
[illegible]0(93)	2000(137)	5000(344)	750(51.6)	2000(137)	4390(302)	[illegible]
250(121)	1000(68.9)	4100(282)	625(43.0)	1000(68.9)	4100(282)	625(43.0)
300(148)	-	3200(220)	500(34.4)	-	3200(220)	500(34.4)
350(176)	-	2300(158)	375(25.8)	-	2300(158)	375(25.8)
400(204)	-	1400(96.4)	250(17.2)	-	1400(96.4)	250(17.2)
450(232)	-	500(34.4)	125(8.6)	-	500(34.4)	125(8.6)

TH Series

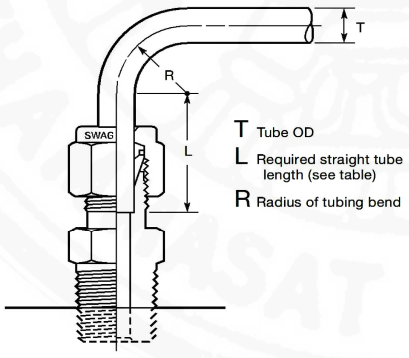
Body Material	SS316					
End Connection	Female 1/8",1/4" Hy-Lok 1/4",6mm	Hy-Lok 8mm	Hy-Lok 12mm	Hy-Lok 3/8"	Hy-Lok 1/2"	Hy-Lok 10mm
Temperature,°F(°C)	Working Pressure, psig(bar)					
0(-17) to 100(37)	10000(689)	7500(516)	6600(454)	6500(447)	6700(461)	6000(413)
150(65)	7500(516)	7500(516)	6600(454)	6500(447)	6700(461)	5900(406)
200(93)	5000(344)	5000(344)	5000(344)	5000(344)	5000(344)	5000(344)
250(121)	4100(282)	4100(282)	4100(282)	4100(282)	4100(282)	4100(282)
300(148)	3200(220)	3200(220)	3200(220)	3200(220)	3200(220)	3200(220)
350(176)	2300(158)	2300(158)	2300(158)	2300(158)	2300(158)	2300(158)
400(204)	1400(96.4)	1400(96.4)	1400(96.4)	1400(96.4)	1400(96.4)	1400(96.4)
450(232)	500(34.4)	500(34.4)	500(34.4)	500(34.4)	500(34.4)	500(34.4)

Hy-Lok HY-LOK CORPORATION

ภาพที่ 6ก. Catalogue บอลวาล์วความดันสูง

Tube Fitting

Tubing Installation



Fractional, in.	
T Tube OD	L①
1/16	1/2
1/8	23/32
3/16	3/4
1/4	13/16
5/16	7/8
3/8	15/16
1/2	1 3/16
5/8	1 1/4
3/4	
7/8	1 5/16
1	1 1/2
1 1/4	2
1 1/2	2 13/32
2	3 1/4

① Required straight tube length.

Metric, mm	
T Tube OD	L①
3	19
6	21
8	23
10	25
12	31
14	32
15	
16	
18	
20	34
22	
25	40
28	46
30	50
32	54
38	63
50	80

Tubing properly selected and handled, when combined with the quality of Swagelok fittings, will give you leak-tight systems. Properly installed on such tubing, Swagelok fittings provide reliable service under a wide variety of fluid applications.

When installing fittings near tube bends, there must be a sufficient straight length of tubing to allow the tube to be bottomed in the Swagelok fitting (see tables).

For maximum assurance of reliable performance, use Swagelok tube fittings assembled in accordance with catalog instructions, and use properly selected and handled high-quality tubing—such as provided by Swagelok.

Hydraulic Swaging Unit

When installing carbon steel or stainless steel Swagelok tube fittings over 1 in. (25 mm), a Swagelok hydraulic swaging unit must be used. This unit provides sufficient pre-swaging of the ferrules onto the tubing for 1 1/4, 1 1/2 and 2 in. and 28, 30, 32, 38, and 50 mm Swagelok tube fittings. Ask your authorized Swagelok sales and service representative for a demonstration.

ภาพที่ 7ก. อุปกรณ์ท่อและประกอบท่อ

V120-22-UN2 Graphic Operator Panel & Programmable Logic Controller

12/24VDC, 12 pnp/npn digital inputs, 2 universal inputs*, 2 high-speed counter/shaft encoder inputs, 12 transistor outputs, 2 high-speed outputs, I/O expansion port, 2 RS232/RS485 ports

Power supply	12VDC or 24VDC
Permissible range	10.2VDC to 28.8VDC with less than 10% ripple
Maximum current consumption	130mA@24VDC (pnp inputs) 230mA@24VDC (npn inputs) 240mA@12VDC (pnp inputs) 280mA@12VDC (npn inputs)
Digital inputs	12 pnp (source) or npn (sink) inputs. See Note 1.
Nominal input voltage	12VDC or 24VDC. See Notes 2 and 3.
Input voltages for pnp (source): For 12VDC For 24VDC	 0-3VDC for Logic '0' 8-15.6VDC for Logic '1' 0-5VDC for Logic '0' 17-28.8VDC for Logic '1'
Input voltages for npn (sink): For 12VDC For 24VDC	 8-15.6VDC/<1.2mA for Logic '0' 0-3VDC/>3mA for Logic '1' 17-28.8VDC/<2mA for Logic '0' 0-5VDC/>6mA for Logic '1'
Input current	4mA@12VDC 8mA@24VDC
Input impedance	3KΩ
Response time (except high-speed inputs)	10mS typical
Galvanic isolation	None
Input cable length	Up to 100 meters, unshielded
High-speed counter	Specifications below apply when inputs are wired for use as a high-speed counter input/shaft encoder. See Notes 4 and 5.
Resolution	32-bit
Input frequency	10kHz max.
Minimum pulse	40µs

Notes:

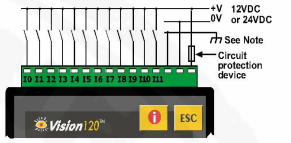
1. All 12 inputs can be set to pnp (source) or npn (sink) via a single jumper and appropriate wiring.
2. All 12 inputs can function in 12 VDC or 24 VDC; set via a single jumper and appropriate wiring.
3. npn (sink) inputs use voltage supplied from the controller's power supply.
4. Inputs #0 and #2 can each function as either high-speed counter or as part of a shaft encoder. In each case, high-speed input specifications apply. When used as a normal digital input, normal input specifications apply.
5. Inputs #1 and #3 can each function as either counter reset, or as a normal digital input; in either case, specifications are those of a normal digital input.
   These inputs may also be used as part of a shaft encoder.
   In this case, high-speed input specifications apply.

* Certain inputs can function as normal digital inputs, analog inputs, RTD inputs or thermocouple inputs, in accordance with jumper settings and wiring connections.

Warnings:

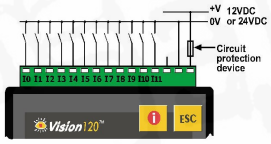
- Unused pins should not be connected. Ignoring this directive may damage the controller.
- Improper use of this product may severely damage the controller.
- Refer to the controller's User Guide regarding wiring considerations.
- Before using this product, it is the responsibility of the user to read the product's User Guide and all accompanying documentation.

Power supply, pnp (source) inputs

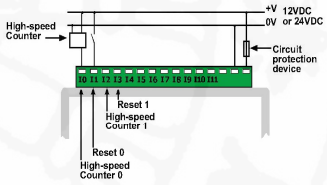


Note:
To avoid electromagnetic interference, mount the controller in a metal panel/cabinet and earth the power supply. Earth the power supply signal to the metal using a wire whose length does not exceed 10cm. If your conditions do not permit this, do not earth the power supply.

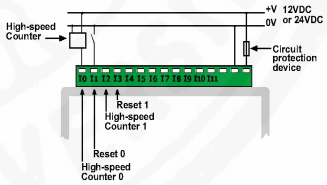
npn (sink) inputs



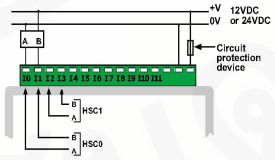
pnp (source) high-speed counter



npn (sink) high-speed counter



Shaft encoder



UNITRONICS

ภาพที่ 8ก. Catalogue ตัวควบคุมซีเควันซ์ (Programmable Logic Controller)

ตาราง 1ก. สมบัติของท่อไฮดรอลิกและสูตรการคำนวณ

COLD DRAWN TUBES

(DIN 2391, seamless; DIN 2393, welded)

Steel Grade

Inside dia. mm	Machining operation	Steel grade	
20 up to 210	Skiving and roller burnishing	St 52– STE 460 on request	BK+S or NBK
> 220 or special dia.	Boring and honing	St 52 –on request MV450 / 20MnV6	W
St 52 Similar to UNI Fe510D- BS 5242/ HP 5 – SS 212, common steel grade for cylinder tubes			
Ste460 BS 5242 /HP 6 – SS 2142 , for heavy duty applications			

Chemical Analysis

STEEL GRADE	C%	Mn%	Si%	V%	P max%	S max%
St 52	≤ 0.20	≤ 1.50	≤ 0.50		0.025	0.02 / 0.035
StE 460	≤ 0.20	≤ 1.70	≤ 0.50	≤ 0.15	0.025	0.015

Mechanical Property

STEEL GRADE	HEAT TREATMENT	YIELD POINT Mpa wall thickness		psi wall thickness		U.T.S. Rm min. Mpa	psi	ELONGATION A % min
		<16 mm	>16 mm	<16 mm	>16 mm			
ST 52	BK+S	520	490	75.395	71.045	600	86.994	14
	NBK	355	355	51.471	51.471	490-630	71.045-91.344	22
StE 460	BK+S	620	620	89.894	89.894	700	101.493	15
	NBK	460	460	66.695	66.895	560-700	81.194-101.493	22

WALL THICKNESS REQUIRED FOR A CYLINDERTUBE SUBJECT TO INTERNAL HYDRAULIC PRESSURE

Metric sizes

$$t = \frac{0{,}05 \; Øi \times P \times F}{Y}$$

where:

t = wall thickness (mm)

Øi = inside diameter (mm)

P = inside pressure (bar)

F = safety factor (≥ 2)

Y = yield point

Imperial sizes

$$t = \frac{7{,}249 \; Øi \times P \times F}{Y}$$

where:

t = wall thickness (inches)

Øi = inside diameter (inches)

P = inside pressure (bar)

F = safety factor (≥ 2)

Y = yield point

ตาราง 2ก. ขนาดและพิกัดความดันของท่อมาตรฐาน

Suggested Allowable Working Pressure for *Stainless Steel Tubing*

Table 3—Fractional Stainless Steel Seamless Tubing

Allowable working pressures are calculated from an *S* value of 20 000 psi (137 800 kPa) for ASTM A269 tubing at –20 to 100°F (–28 to 37°C), as listed in ASME B31.3, except as noted. Multiply stainless steel rating by 0.94 for working pressure in accordance with ASME B31.1.

For Welded Tubing

For welded and drawn tubing, a derating factor must be applied for weld integrity:

- for double-welded tubing, multiply pressure rating by 0.85
- for single-welded tubing, multiply pressure rating by 0.80.

Tube OD in.	Tube Wall Thickness, in.															Swagelok Fitting Series
	0.010	0.012	0.014	0.016	0.020	0.028	0.035	0.049	0.065	0.083	0.095	0.109	0.120	0.134	0.156	0.188	
	Working Pressure, psig **Note:** For gas service, select a tube wall thickness outside of the shaded area. (See **Gas Service,** page 2.)															
1/16	5600	6800	8100	9400	12 000												100
1/8						8500	10 900										200
3/16						5400	7 000	10 200									300
1/4						4000	5 100	7 500	10 200①								400
5/16							4 000	5 800	8 000								500
3/8							3 300	4 800	6 500	7500①②							600
1/2							2 600	3 700	5 100	6700							810
5/8								2 900	4 000	5200	6000						1010
3/4								2 400	3 300	4200	4900	5800					1210
7/8								2 000	2 800	3600	4200	4800					1410
1									2 400	3100	3600	4200	4700				1610
1 1/4										2400	2800	3300	3600	4100	4900		2000
1 1/2											2300	2700	3000	3400	4000	4900	2400
2												2000	2200	2500	2900	3600	3200

① For higher pressures, see the Swagelok *Medium-Pressure Fittings* catalog, MS-02-335, or the Swagelok *High-Pressure Fittings* catalog, MS-01-34.

② Rating based on repeated pressure testing of the Swagelok tube fitting with a 4:1 design factor based upon hydraulic fluid leakage.

ตาราง 3ก. พิกัดกระแสไฟฟ้ามอเตอร์มาตรฐาน

C : ตารางกระแสเฉลี่ยของมอเตอร์มาตรฐาน

squirred-cage induction motors rated motor current

Single phase

[kw]	[HP]	220V [A]	240V [A]
0.37	0.5	3.9	3.6
0.55	0.75	5.2	4.8
0.75	1	6.6	6.1
1.1	1.5	9.6	8.8
1.5	2	12.7	11.7
1.8	2.5	15.7	14.4
2.2	3	18.6	17.1
3	4	24.3	22.2
3.5	5	29.6	27.1
4.4	6	34.7	31.8
5.2	7	39.8	36.5
5.5	7.5	42.2	38.7
6	8	44.5	40.8
7	9	49.5	45.4
7.5	10	54.4	50

Three phase 4 poles 50 and 60Hz

[kw]	[HP]	220V [A]	230V [A]	380V [A]	400V [A]	415V [A]	440V [A]	500V [A]	660V [A]	690V [A]	1000V [A]
0.37	0.5	1.8	107	1.04	0.9	0.9	0.9	0.8	0.6	0.6	0.4
0.55	0.75	2.5	2.4	1.5	1.4	1.4	1.3	1.1	0.9	0.9	0.6
0.75	1	3.4	3.2	2	1.9	1.8	1.7	1.5	1.1	1	0.75
1.1	1.5	4.5	4.3	2.6	2.5	2.4	2.3	2	1.5	1.4	1
1.5	2	6.1	5.8	3.5	3.5	3.3	3	2.7	2	1.9	1.35
2.2	3	8.8	8.4	5.1	4.8	4.7	4.4	3.8	3	2.9	2
3	4	11.4	10.9	6.6	6.3	6	5.7	5	3.8	3.6	2.5
3.7	5	14	13.3	8	7.6	7.4	7	6.1	4.6	4.4	3
4	5.5	14.8	14.1	8.6	8.1	8	7.5	6.5	5	4.8	3.3
5.5	7.5	20	19.1	11.7	11.1	11	10	9	6.7	6.4	4.5
7.5	10	27	25.8	15.5	14.7	14.3	13.5	12	9	8.6	6
9	12	32	30.6	18.7	17.7	17	16	14	10.7	10.2	7
10	13.5	36	34.4	20.5	19.5	19	18	15.6	12	11.5	8
11	15	38.5	36.8	22	20.9	20.5	19.5	17	13	12.4	9
15	20	52.5	50.2	30	28.5	28	26.5	23	17.5	16.7	12
18.5	25	64	61.2	37	35.1	34	32	28	21.3	20.3	14
22	30	76	72.6	44	42	40	38	33.5	25.3	24.2	17
25	35	86	82.2	50	47.5	46	43	38	29	27.7	19
30	40	102	97.5	59	56	54	51	45	34	32.5	23
33	45	112	107	65	62	60	56	50	38	36.3	25
37	50	124	119	72	68.4	66	62	55	42	40	28
40	54	133	127	77	73	71	67	58.5	45	43	30
45	60	146	140	85	81	78	73	65	49	47	33
51	70	167	160	97	92	89	84	74	56	53	37
55	75	179	171	104	99	95	90	79	60	57	40
59	80	192	184	111	105	102	96	85	64	61	43
63	85	204	195	118	112	109	103	90	69	66	45
75	100	240	230	139	132	128	121	106	81	77	53
80	110	257	246	149	141	136	129	113	86	82	57
90	125	295	282	171	162	157	148	130	99	95	65
100	136	321	307	186	177	171	161	142	107	102	71
110	150	353	336	205	195	188	177	156	118	113	78
129	175	415	397	240	228	220	207	183	138	132	92
132	180	424	406	245	233	225	212	187	142	136	94
140	190	450	430	260	247	239	225	198	150	143	99
147	200	472	451	273	259	250	236	208	158	151	104
150	204	482	461	280	266	256	241	212	161	164	106
160	220	520	497	300	285	276	260	229	174	166	115
180	245	578	553	335	318	306	289	254	193	185	128
185	250	591	565	342	325	314	296	260	197	188	130
200	270	637	609	372	353	341	321	283	214	205	142
220	300	706	675	409	389	375	353	311	236	226	156
250	340	803	766	465	442	426	402	353	268	256	177
257	350	825	789	478	454	438	413	363	275	263	182
280	380	900	861	520	494	476	450	396	300	287	200
295	400	944	903	547	520	500	472	416	315	301	208
300	408	963	921	558	530	511	482	424	321	307	212
315	430	1000	956	580	551	530	500	440	334	319	220
335	455	1065	1020	616	585	565	531	468	355	339	234
358	480	1120	1070	650	617	594	560	493	374	358	247
368	500	1170	1120	676	642	620	584	514	390	373	260
400	545	1270	1115	735	698	673	635	560	423	405	280
425	580	1350	1290	781	742	715	675	594	450	430	297
440	600	1400	1340	810	769	742	700	616	467	447	308
450	610	1430	1370	827	786	757	714	629	476	455	315
475	645	1510	1445	873	829	800	754	664	503	481	332
500	680	1590	1520	920	874	841	794	698	529	506	350
530	720	1660	1590	950	902	870	825	720	545	521	360
560	760	1760	1680	1000	950	920	870	760	575	550	380
600	810	1880	1800	1090	1035	978	920	830	630	603	410

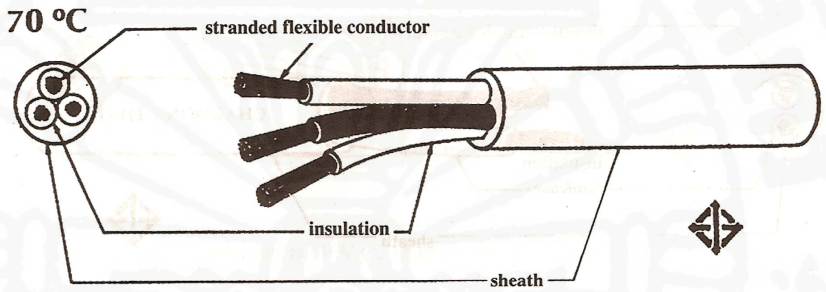
Stated current values are only indicative and can slightly vary depending on the type of motor and manufacturer

ตาราง 4ก. พิกัดกระแสไฟฟ้าสายไฟชนิด VCT

COPPER WIRE TYPE "VCT"

Ref. Table 9 of TIS 11-2531
Application : Flexible Control Cables.

3- CORE STRANDED PVC INSULATED, PVC SHEATHED 750V 70° C



สายส่งกำลังไฟฟ้าชนิดกลม หุ้มด้วยฉนวน P.V.C. แรงดัน 750 V อุณหภูมิ 70°C ตามมาตรฐาน ม.อ.ก. 11-2531 TABLE 9

Code	Wire Size	Number/ Wire Nominal Diameter	Cable Overall Diameter	Insulation Thickness	Sheath Thickness	Minimum Insulation Resistance at 60°C	* Ampacity (A) in FreeAir
	(mm^2)	(mm)	(mm)	(mm)	(mm)	(M Ω - km)	60°C
# 62612	0.5	16/0.20	8.6	0.8	1.2	0.032	7
# 62613	0.75	24/0.20	9.0	0.8	1.2	0.028	9
# 62614	1	32/0.20	9.8	0.8	1.4	0.025	10
# 62615	1.5	30/0.25	10.4	0.8	1.4	0.022	13
#62616	2.5	50/0.25	11.4	0.8	1.4	0.018	17
# 62617	4	56/0.30	13.6	0.9	1.6	0.017	23
# 62618	6	84/0.30	15.3	0.9	1.8	0.014	29
# 62619	10	80/0.40	18.7	1.1	2.0	0.013	41
# 62620	16	126/0.40	22.0	1.1	2.4	0.011	54
# 62621	25	196/0.40	26.0	1.3	2.6	0.011	70
# 62622	35	276/0.40	29.0	1.3	2.8	0.009	86