



INSTALLATION, OPERATION, & MAINTENANCE MANUAL

R Series



MP Systems - 34 Bradley Park Road, East Granby, CT 06026 USA - Phone + 1 (877)-689-1860 - Email mpteam@mp-systems.net



MP SYSTEMS is committed to delivering quality products and providing maximum productivity and uptime. Our engineering team is diligent in eliminating high maintenance issues associated with machine tool accessories, to allow better performing equipment for your business.

Thanks to our quality components, dedicated engineers, sales team and manufacturing personnel, MP SYSTEMS high pressure coolant systems & accessories are low maintenance and longer lasting. MP SYSTEMS prides itself on building and supporting a dependable product.

Our team works closely with CNC machine tool manufactures, distributors and customers to provide excellent customer service. These relationships facilitate superior application experiences. Our goal is to help make you more productive with less downtime, decreased cycle times, improved tool life and more parts out the door.



R SERIES INSTALLATION, OPERATION, MAINTENANCE MANUAL

DOCUMENT PART #: B R OPERATOR

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1. Introduction

This manual contains instructions for installation, operation and maintenance of R Series auxiliary coolant and chip control systems as well as indicating residual risk associated with them. This manual has been specifically compiled and produced to enable easy and safe use by appropriate personnel.

All associated rights, in particular the rights of reproduction, publication and translation, are retained by the producer in accordance with authors rights.

MP SYSTEMS does not accept responsibility for any inaccuracies contained in this manual, whether due to errors in printing or transcription.

It furthermore reserves the right to carry out such modifications to its products as it considers necessary and/or useful, without compromising their essential characteristics.



MP SYSTEMS does not accept responsibility for improper use of the equipment, unauthorized modifications to the same non-observance of the instructions contained in the manual. The manual must be kept in a safe place and made available to personnel qualified to use and maintain R Series auxiliary coolant and chip control systems.

1.1. Symbology

Symbology contained in this manual.



DANGER: Indicates possible danger. Failure to heed this warning carries a risk of accident or injury.



DANGEROUS VOLTAGE: Indicates dangerous voltage. Failure to heed this warning carries a risk of injury or death.



WARNING: Indicates a possible danger situation. Failure to heed this warning carries a risk of injury.



INFORMATION: Indicates important information or advice on the use of the machine.



FLAMMABLE: Indicates possible flammable material.



LOCK-OUT/TAG-OUT: Lock-Out/Tag-Out R Series before service can be done.

2. Safety Measures

MP SYSTEMS disclaims all responsibility for non-observance of the instructions and advice contained in this manual. It furthermore disclaims all responsibility for damage caused by improper or inappropriate use of the machine or by modifications made without authorization.

These safety instructions contain all the general rules that must be observed during commissioning, operations and all periods of attendance to the machine.

It is essential that these instructions are supplied and always available to the installer, competent operators, and authorized maintenance personnel.

The following basic instructions must be observed when using the R Series;

- Operation and maintenance must be carried out only by qualified personnel following the instructions contained in this manual.
- Always keep a copy of this manual near the machine.
- Carry out routine maintenance operations with great care; have worn or damaged parts replaced by qualified personnel and use original parts or those recommended by *MP SYSTEMS*.
- To function correctly and for operator security, the R Series must be operated with all panels in place and secured.
- Dangerous voltage contained within R Series; before carrying out any operations on R Series, ensure that the electrical supply has been switched off.
- Operating R Series with safety protection removed is strictly forbidden.
- Before installing R Series ensure operating conditions are suitable for intended use.



MP SYSTEMS disclaims all responsibility for damage to person(s) or things resulting from non-standard assembly of the machine or from re-use of its individual components. Unauthorized replacement or removal of one or more parts of the machine is forbidden.

2.1. General Rules

R Series has been designed and constructed in such a way to minimize any possible cause of danger to the operator and their surroundings. However, residual risk still remains and can arise through improper use of the machine and can be of various types;

- Risk due to escaped coolant/cutting fluid.
- Risk due to excessive noise caused by operating outside permitted limits.
- Risk of accidents caused by scraping against edged sheet metal profiles.
- When using oil-based coolant, there must be a fire suppression system in place

2.2. Prevention of Mechanical Risks

In operation, R Series contains some moving parts. These parts constitute a possible source of danger to the operator, therefore in order to avoid any possible danger it is necessary to observe the following operational rules;

- Before removing any panels/guards, ensure electricity supply to the machine has been switched off.
- Never start R Series with any panel/guards removed.
- The additives present in coolant/cutting fluid may have a corrosive action that can irritate the skin and eyes.
 - Always wear gloves & eye protection when handling coolant/cutting fluid.

2.3. Prevention of Electrical Risks

When power to the machine is switched on, the machine is a source of danger, especially if the basic safety rules are not followed. In order to avoid any possible danger it is necessary to observe the following basic operation rules;

- When making electrical connections to the R Series, observe state and federal electrical codes or those otherwise in force. Observe the technical supply conditions imposed by the power supply companies.
- Before carrying out any work on the R Series, switch off the electrical supply at the main isolator.
- Work on the R Series must only be carried out by authorized personnel.
- Always replace worn out or defective components.
- Before working on electrical equipment always read the manual that contains the machines circuit diagram.
- Always make sure there is no electric power to the equipment.
- Check to ensure the machine is earthed before powering on the R Series.
- Check all electrical connections and connecting cables are well insulated and replace any cables that are evidently worn or damaged.
- Be sure to use power cables supplied by *MP SYSTEMS* or that have been approved by *MP SYSTEMS*.

3. Intended Uses

- *MP SYSTEMS* auxiliary coolant and chip control systems are constructed for use on milling and turning machines that have existing coolant tanks, complete machining environment enclosures, CNC controls with interlocks and low pressure pumps, typically referred to as flood pumps.
- *MP SYSTEMS* auxiliary coolant and chip control systems are intended to work alongside the standard low pressure pump. The high pressures generated can dramatically improve tool life and reduce cycle time, but should only be used where process improvements warrant its use.
- *MP SYSTEMS* auxiliary coolant and chip control systems includes 2 large capacity filters. The filters primarily protect the high pressure pump and the cutting tools present in the machine tool. The presence of the 2 large capacity filters keeps the machine tool and its coolant much cleaner.
- *MP SYSTEMS* auxiliary coolant and chip control systems are intended for use with water based coolants or oils with viscosities between 90 and 140 SUS @ 100° Fahrenheit.

3.1. Features & Benefits

- When properly applied, high pressure coolant can considerably reduce cycle time, dramatically improve tool life, and remove many of the requirements for operator intervention.
- Cutting operations that suffer from chip evacuation problems can see improved speed, accuracy, surface finish and reliability when using the R Series high pressure system.
- In problem holes, high pressure can allow for higher speeds and higher feed rates, with little to no pecking. This allows for 5-20% faster drilling.
- Coolant fed reamers & boring tools, either through tool or close nozzle, can greatly improve finish, tool life and accuracy.
- In severe milling applications, the improvements will be easily recognized through the lack of re-cutting of chips.
- Heavy cuts can be made far more reliably with high pressure coolant. Tools that smoke or burn will see tool life greatly improved. This allows for much 'heavier' cuts with tools that can be pushed much harder, greatly improving cycle times.
- Jobs already being run with 'flood' coolant will see dramatic increase in productivity with high pressure coolant.
- Often, time consuming programming methods such as rough/finish cuts, interrupted feed, non-optimum tool and feed speeds can be eliminated with the use of high pressure coolant. High pressure coolant gives the ability to break and/or control the chips that typically cause slow speeds.
- Rings of material left on drills and boring bars can be blown off with high pressure coolant.
- Coolant through sub spindle can eliminate improper chucking and reduce parts being marked by chips left in the collet.

4. Specifications

MP SYSTEMS equipment ships with an identification label. The label is located by the main disconnect on the front of the machine.

Information listed on Identification Label;

- **Pump Type**
- **Serial Number**
- **Build Date**
- **Operating Voltage (208-230VAC/460VAC)**
- **FLA (Full load Amps). Largest load, for determining power service requirements.**



The operating voltage may be changed in the field if necessary. Changing the operating voltage can only be done by specialized personnel. Not available on all systems.

*All specifications are subject to change.

4.1. Electrical Specifications

MODEL	FLA @ 208/230VAC (STANDARD VAC)	FLA @ 460VAC	kVA
RF8 / VR8	23.8-22.4	11.2	9
RF CE / VR CE (200/400V)	28 @ 200	14 @ 400	10
RFO5	24.9	11.75	9
RFC8 / VRC8	38.8-37.4	19.2	14
RA11	35	16	13
RAC11	50	24	18
RT / VRT	48	23	18
RF16 / VR16			
RTC	63	31	23
RFC16			
VR10	56	27	20
VR20	48	23	18
VRT40	N/A	38	30
RT40			
Mountable Chillers			
RC36	11.5	6.3	8

*Approximate FLA values. All electrical specifications are subject to change.

Component/Accessory	HP	RPM	FLA @ 208/230VAC	FLA @ 460VAC
High Pressure (Primary/Secondary)	7.5	1750	19.8-18.4	9.2
High Pressure VR40 (Primary/Secondary)	15	1750	N/A	19
High Pressure VR20 (Primary)	20	1800	N/A	25
High Pressure RT30/VRT30 (Primary/Secondary)	20	1800	N/A	25
High Pressure VR10	20	1450	N/A	25
High Pressure (Secondary) *RA11 Only	2.0	1750	6.2-6	3
Feed/Supply Pump *StandardRC36	1.0	3450	4	2
Feed/Supply Pump *VR20 Only	1.5	3450	4.6-4.5	2.25
Feed/Supply Pump *VRT40/RT40 Only	2.0	3450	6	4
Heat Exchanger (HX)	1/3	3425	1.1	0.55
MP1200 Mist Collector (MC)	2	N/A	5	3

<u>Control Power</u>	<u>Control Signals</u>	<u>Alarm Circuit</u>
150VAC Transformer	24VDC	NC
110VAC Secondary		NO
Primary Fused		

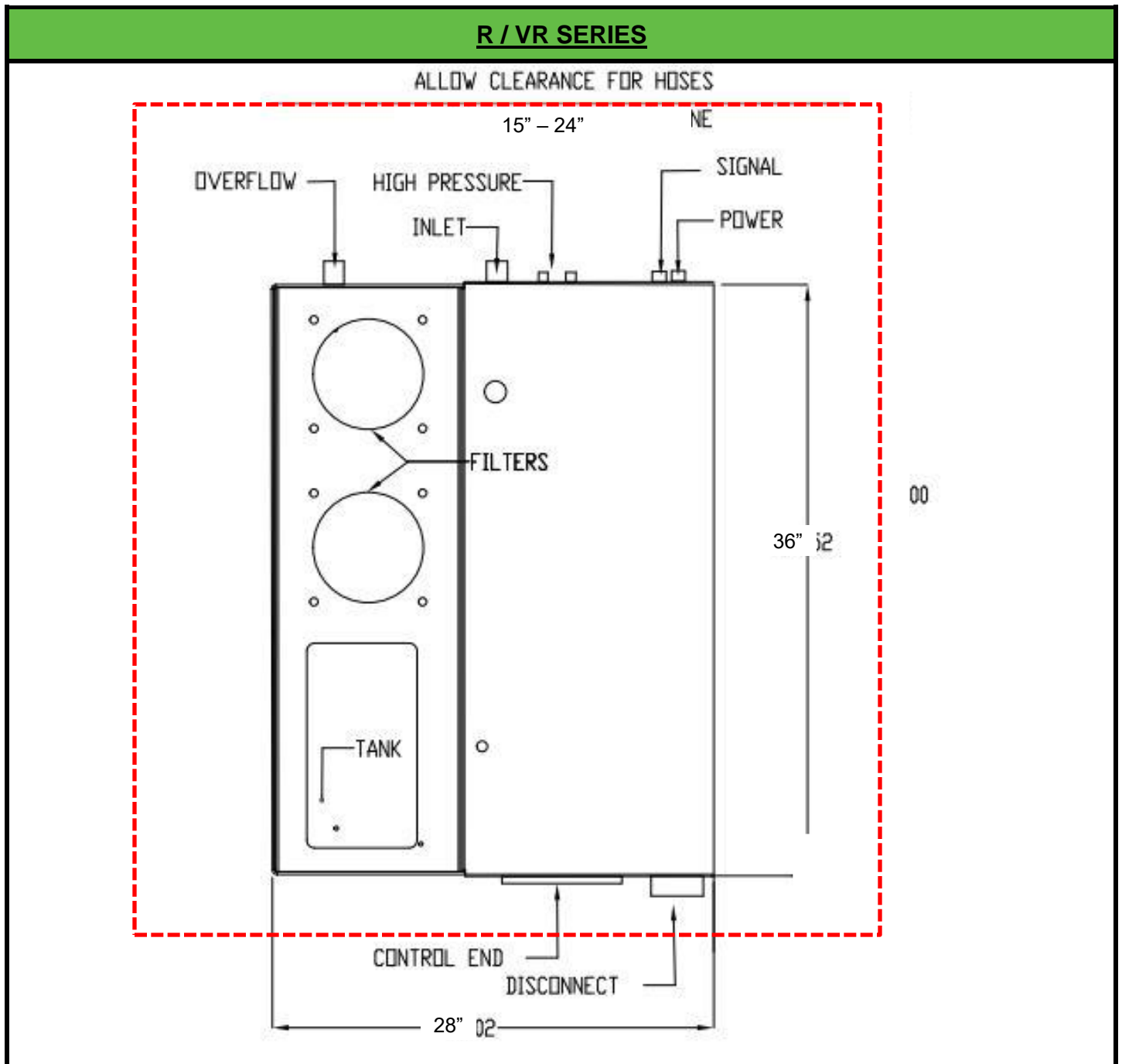
4.2. Mechanical Specifications

5. <u>MODEL</u>	<u>LENGTH</u> <u>(in)</u>	<u>WIDTH</u> <u>(in)</u>	<u>HEIGHT</u> <u>(in)</u>	<u>CAPACITY</u> <u>(gal)</u>	<u>WEIGHT</u> <u>(lbs)</u>
VR8	36	28	42	50	800
RF8					
RA11	36	28	42	50	900
VR16	42	38	42	70	1250
VRT					
RF16					
RT					
VR20	42	38	42	70	1315
VRT40	52	49	53	80	2000
RT40					
<u>Accessories</u>					
RC36	39	26	23	N/A	450
MP1200	24	25	40	N/A	400

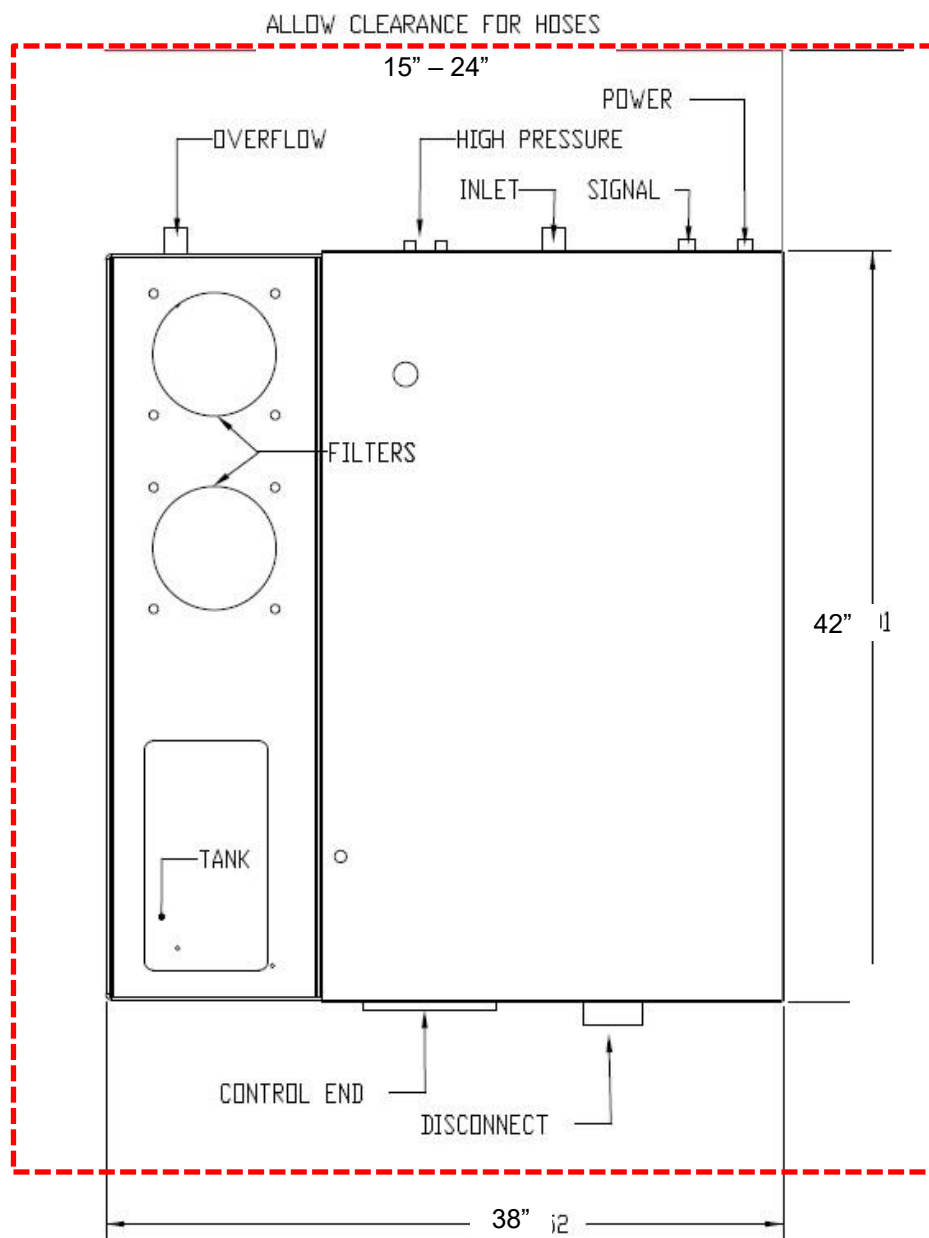
*Approximate values. All mechanical specifications are subject to change.

<u>MODEL</u>	<u>OUTPUT PRESSURE</u>	<u>VARIABLE PRESSURE</u>	<u>FLOW RATE</u>	
			<u>Motor 1</u>	<u>Motor 2</u>
VR8	250-1000 PSI	<input checked="" type="checkbox"/>	8 GPM	N/A
RF8	250-1000 PSI	<input type="checkbox"/>	8 GPM	N/A
RA11 (Adaptive Flow Rate)	250-1000 PSI	<input type="checkbox"/>	8 GPM	3 GPM
			3,8 or 11 GPM Total	
VR16	250-1000 PSI	<input checked="" type="checkbox"/>	16 GPM Total	
VRT			8 GPM	8 GPM
RF16	250-1000 PSI	<input type="checkbox"/>	16 GPM Total	
RT			8 GPM	8 GPM
VR10	500-3000 PSI	<input checked="" type="checkbox"/>	10 GPM	N/A
VR20	250-1000 PSI	<input checked="" type="checkbox"/>	20 GPM	N/A
VRT40	250-1000 PSI	<input checked="" type="checkbox"/>	20 GPM	20 GPM
RT40	250-1000 PSI	<input type="checkbox"/>	20 GPM	20 GPM

4.2.1. Floor Layout



RF16 / RT / VR16 / VRT SERIES



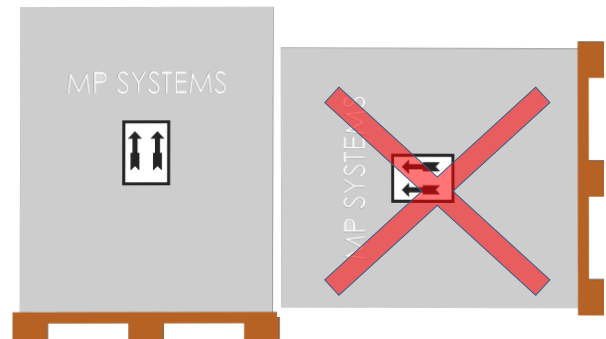
4.3. Options & Accessories

<u>ABRV.</u>	<u>NAME</u>	<u>DESCRIPTION</u>
AC	Auto Cross	System automatically switches between the two filter vessels present in unit. Once a filter bag becomes depleted, the AC system senses the lack of flow and will switch to the clean filter. PLC will display depleted filter #.
DP	Dual Pressure	Allows for 2 set pressures that can be controlled using M-Codes. Primary pressure 1000psi, Secondary pressure 500psi.
DSP	Dual Simultaneous Pressure	Each port has set pressure. Port 1 & Port 2 can run at set pressure simultaneously. Port 1 1000psi - Port 2 500psi
MC	MP1200 Mist Collector	Can be mounted on top of R Series or mount directly to machine tool. Removes mist from machine tool cabinet.
HX	Heat Exchanger	Removes heat from oil using ambient air temperature.
RC	Mountable Chiller	Cools fluid using refrigerant, allows for greater fluid temperature control.

5. Moving & Storage

5.1. Delivery Checks

When taking delivery of machine, carefully check the physical condition of the packaging. Having removed the packaging, check that the machine has not suffered any knocks or damage. Check that the machine has been transported in the correct position. In case of damage, do not accept the goods and immediately inform *MP SYSTEMS*.



DO NOT accept the machine in the event of irregularities during transit. The hauler will bear the full responsibility for any damage suffered.

5.2. Transport & Carriage

The machine must be transported in a vertical position (casters/wheels down). Machine tank **MUST BE EMPTY** before moving. R Series has been constructed so, as to be moved by fork truck or rolled around on casters on base of unit.

The machine must be moved in such a way as to avoid the risk of damage.

Do not attempt to lift the machine with equipment that is inadequate or unsuitable, especially with equipment that is too small for overall weight of machine. Refer to **Section 4.2. Mechanical Specifications** for unit weight.

Before moving machine, take care to ensure that all removable panels are firmly attached to the unit to prevent them from falling.



WARNING: Do not transport machine with fluid in tank.

5.3. Moving with a Fork Truck

To move the machine with a fork truck, the two blades must be inserted under the long side of the machine. The base is designed for transportation by fork truck. Insert blades symmetrically with respect to the center of gravity of the machine, and push them in through the whole depth of the machine. Lifting can then be carried out. Carry out the moving operation at a very slow speed.

Ensure the tank is completely empty of coolant when moving.



5.4. Storage

The R Series must be stored in a cool and dry environment, avoiding all extreme conditions. Avoid freezing conditions. All coolant must be drained from machine before being stored. If utilizing water based coolants, the system must be flushed before storage, please refer to coolant manufacture for correct flushing agent. Removing all coolant from the system will ensure coolant does not become contaminated while in the system. Contaminated coolant may lead to malfunctions.



Not properly draining/flushing R Series before storage can lead to jammed solenoids, diaphragms that become stuck and bacterial growth. Bacterial growth will contaminate any coolant it comes in contact with. Contaminated coolants effectiveness is also greatly reduced.

6. Installation

All *MP SYSTEMS*, R Series are shipped on wooden pallets designed for the safe transport of the R Series auxiliary coolant and chip control system. A large *MP SYSTEMS* container protects the R Series from any unnecessary damage during transportation.

6.1. Installation Kit Components

<u>COMPONENT</u>	<u>QUANTITY/LENGTH</u>
Power Harness	1
Control Signal Harness	1
Jumper Plug for Signal Harness	1
Spare 5 Micron Filter Bag	2
Operation & Installation Manual	1
Inlet Dip Tube	1
Return Dip Tube	1
1 1/4" Diameter Inlet Hose	14'
1 1/4" Diameter Return Hose	14'
2" Hose Clamp	4
Weld Clamp (Mounting Dip Tubes)	2
Self-Taping Hex Screws (Mounting Weld Clamps)	2
Machine Tool Specific Installation Components	1

6.2. Recommended Tools for Installation



- Philips (Cross) Head Screwdriver
- Flat Blade Screwdriver
- Electric Drill
- 7/8" UniBit (Step Drill)
- 1 1/4" Conduit Punch or equivalent size hole saw
- 12" Pipe Wrench (Minimum)
- Metric Hex Keys
- Teflon Pipe Tape / Liquid Pipe Sealant


6.3. Electrical Installation

Before connecting electrical power, pay close attention to the electrical data on machine plate.
Ensure that the voltage of the power supply is compatible with that specified on plate.

All installation work must be carried out by qualified personnel.

Always consult machine tool wiring diagram before connecting power.

		LOCK OUT/TAG OUT any and all power disconnect switches before performing any work on equipment.
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	Be sure to observe local and federal electrical codes in effect. Observe the technical supply conditions imposed by the power supply company.
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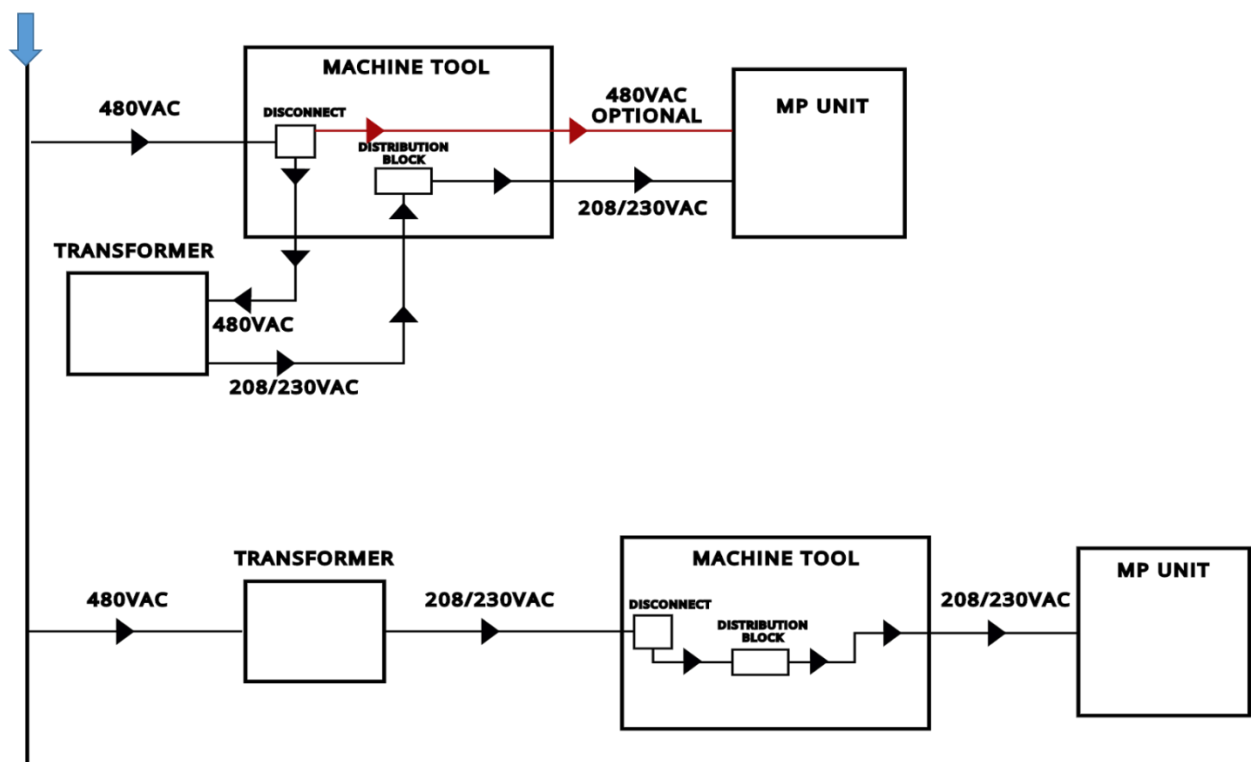
6.3.1. Selecting Voltage

Many large industrial facilities run on 480v 3phase @ 60Hz electricity. Most machine tools in the United States require a step down transformer as the machine tools, typically, run on 200 +/- 10% VAC. 208-230v is the standard voltage for MP Systems units.

Utilizing machine tool voltage makes lockout/tag-out far easier and allows it to comply with, most, local regulations.



Please see diagram below.



6.3.2. Power Harness Installation

1. Mount supplied power harness with hardware provided in installation kit and route cable:
 - Make sure R Series power cable is able to reach mounted power harness.
 - i. Mount the power harness as close to the ground as possible
 - Look for a soft seal or a machine knock out for the power harness and signal cable to come through to machine tool cabinet (see picture below)
 - If 3/4" conduit plug is not available, knock out hole and use supplied cord grip.
2. Wire power cable in parallel with machine tool power:
 - Be sure to leave enough cable to properly earth the unit.
3. Locate proper earthing point. Attach using supplied ring terminals.



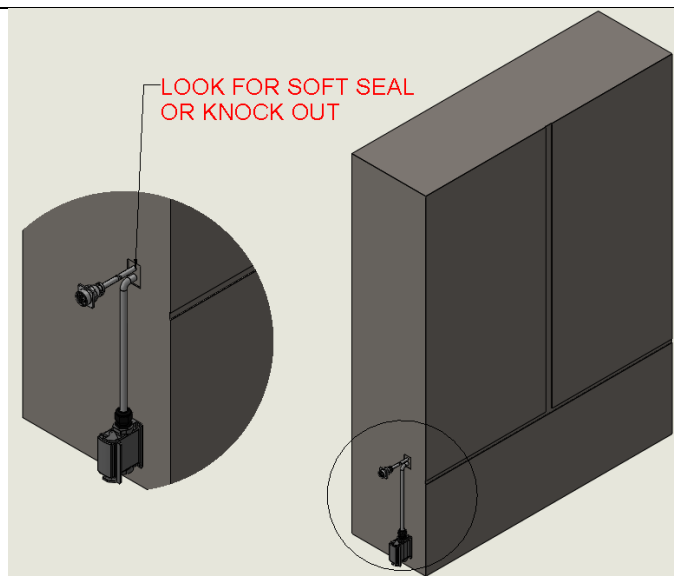
3 phase power installation should be performed by qualified personnel.

Circuit breaker kits are available in a wide range of capacities.

MODEL / TYPE	Part #
R/VR Series - 208/230VAC	AK CB40 KIT
w/ RC36	AK CB50 KIT
R/VR Series - 460VAC	AK CB20 KIT
w/ RC36	AK CB40 KIT
RF16/RT/VR16/VRT Series - 208/230VAC	AK CB70 KIT
RF16/RT/VR16/VRT Series - 460VAC	AK CB40 KIT



Please refer to machine FLA to ensure proper circuit breaker kit is used.



6.3.3. Control Signal Harness Installation

1. Mount supplied control signal harness with hardware provided in installation kit and route cable;
 - Make sure R Series signal cable is able to reach mounted control signal harness.
 - If 1/2" conduit plug is not available, knock out hole and use supplied cord grip.
 - Be sure to leave enough cable to properly earth the unit.
 - Attach supplied jumper plug to control signal harness, using supplied zip tie.



If unit must be disconnected from machine tool, install supplied jumper plug to control signal harness. This will allow machine tool to operate normally without alarm.

2. Wire signals required for desired pump function (R Series electrical diagrams are located in electrical cabinet);
 - *MP SYSTEMS* utilizes 24VDC signals for control.
 - i. 110VAC signals, relays will need to be installed.
 - Signals and M-Codes may vary between machine tools.
 - i. Please refer to machine tool electrical drawings booklet.
 - External M-Codes may require latching functions.
 - 'Normally Closed' alarms are typically wired in **SERIES** with machine tool low pressure pumps.
 - 'Normally Open' alarms are typically wired in **PARALLEL** with machine tool low pressure pumps.
3. Locate proper earthing point. Attach using supplied ring terminals.

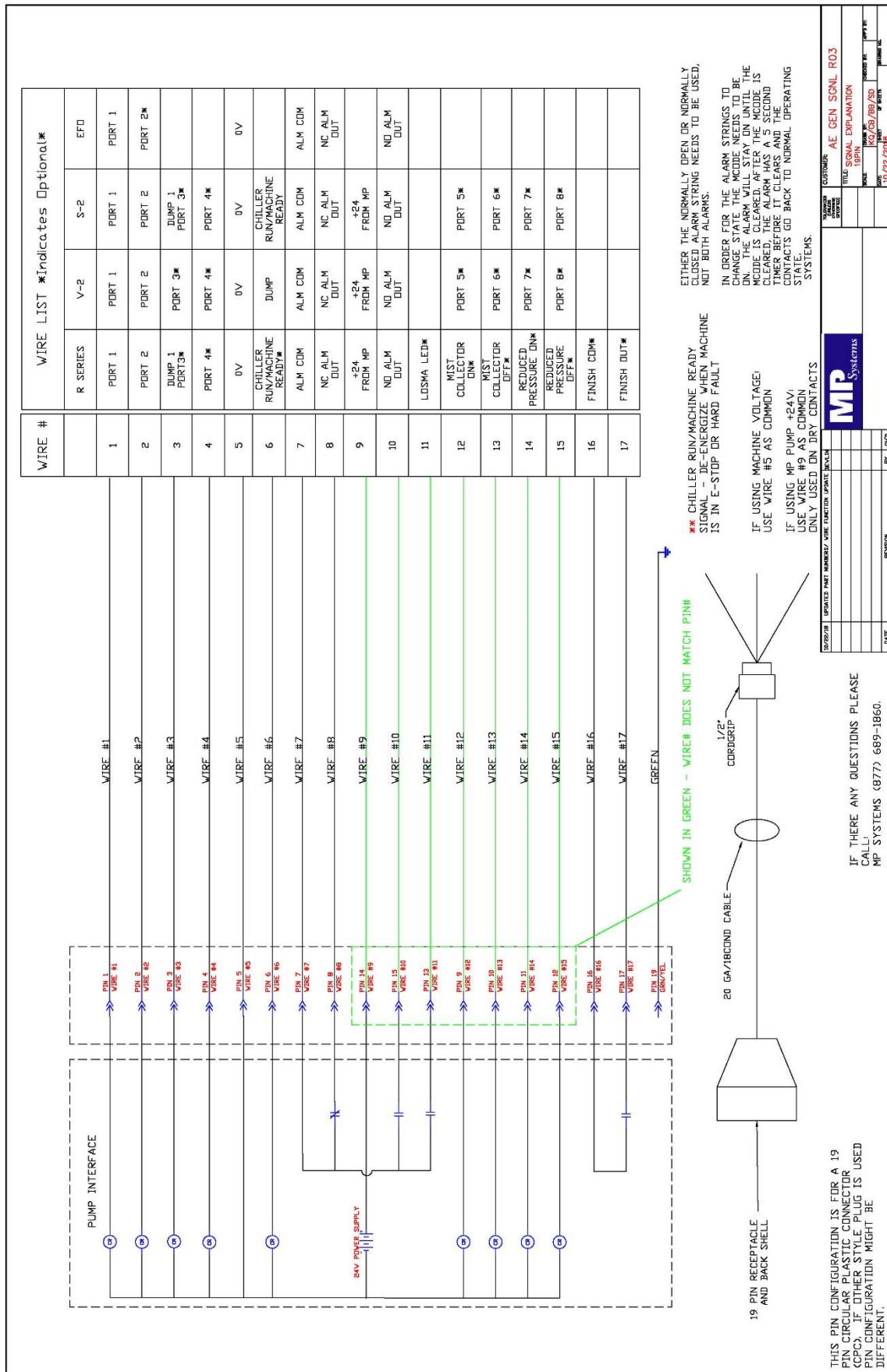


MP SYSTEMS recommends the use of the 'Normally Closed' alarm circuit when wiring in to machine tool electrical cabinet.

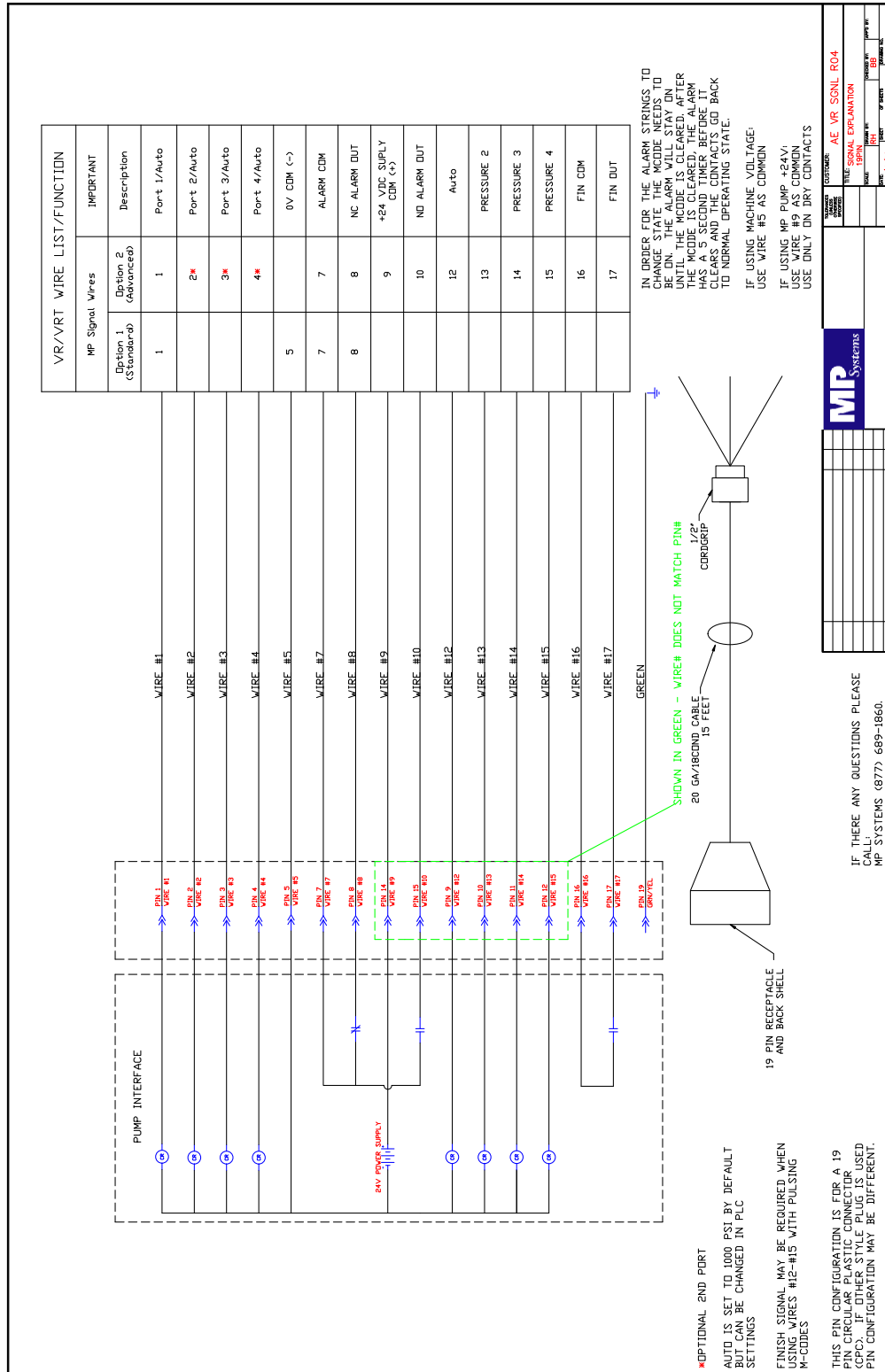


When wiring control signals, be sure to take account of any accessories that were purchased with R Series. Dual Pressure (DP), RC Chiller (RC), Variable Pressure, etc.

6.3.3.1. R/RA11 Series Control Signal Explanation



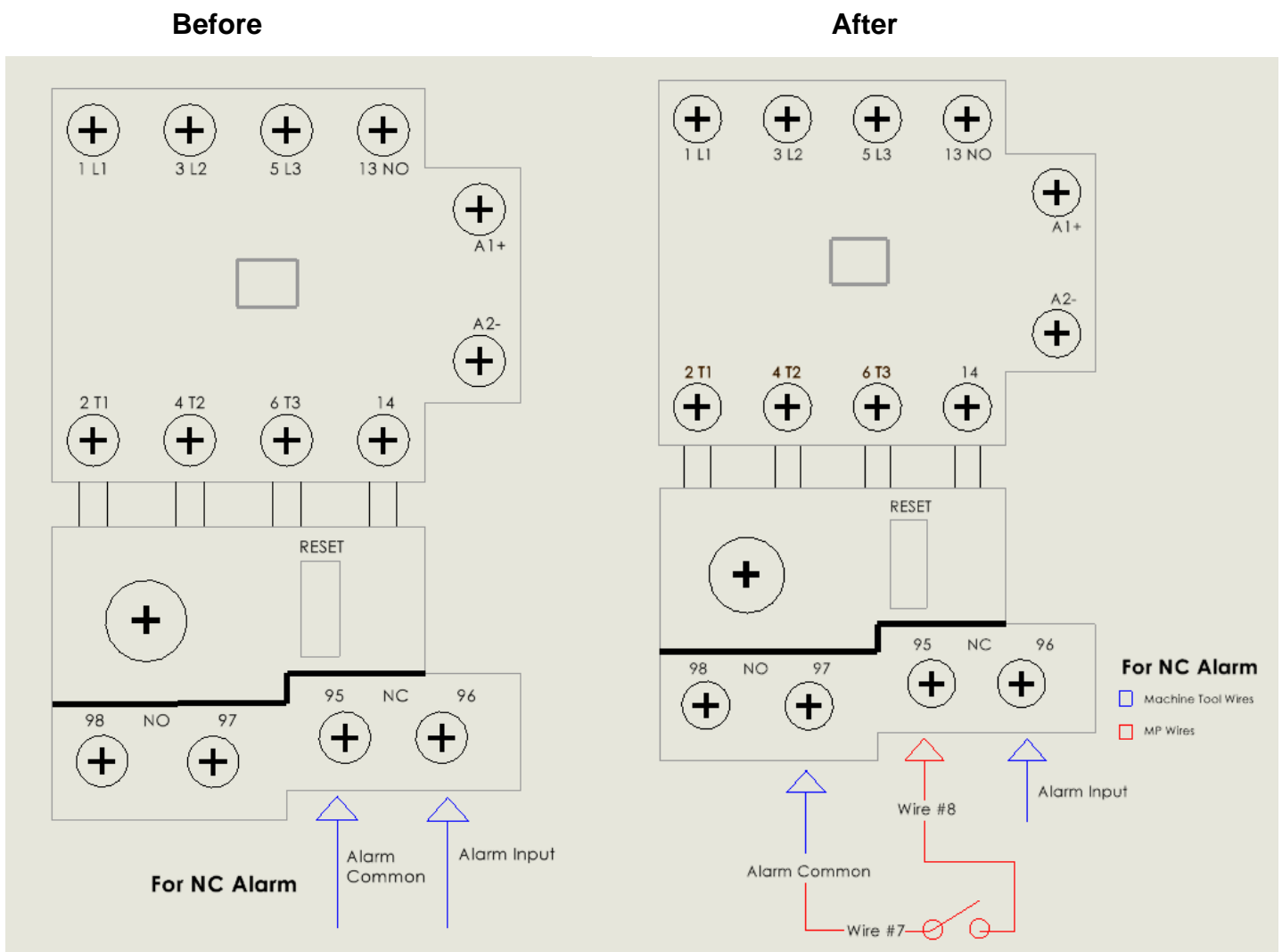
6.3.3.1.1. Variable/Adaptive Series Control Signal Explanation (VR)

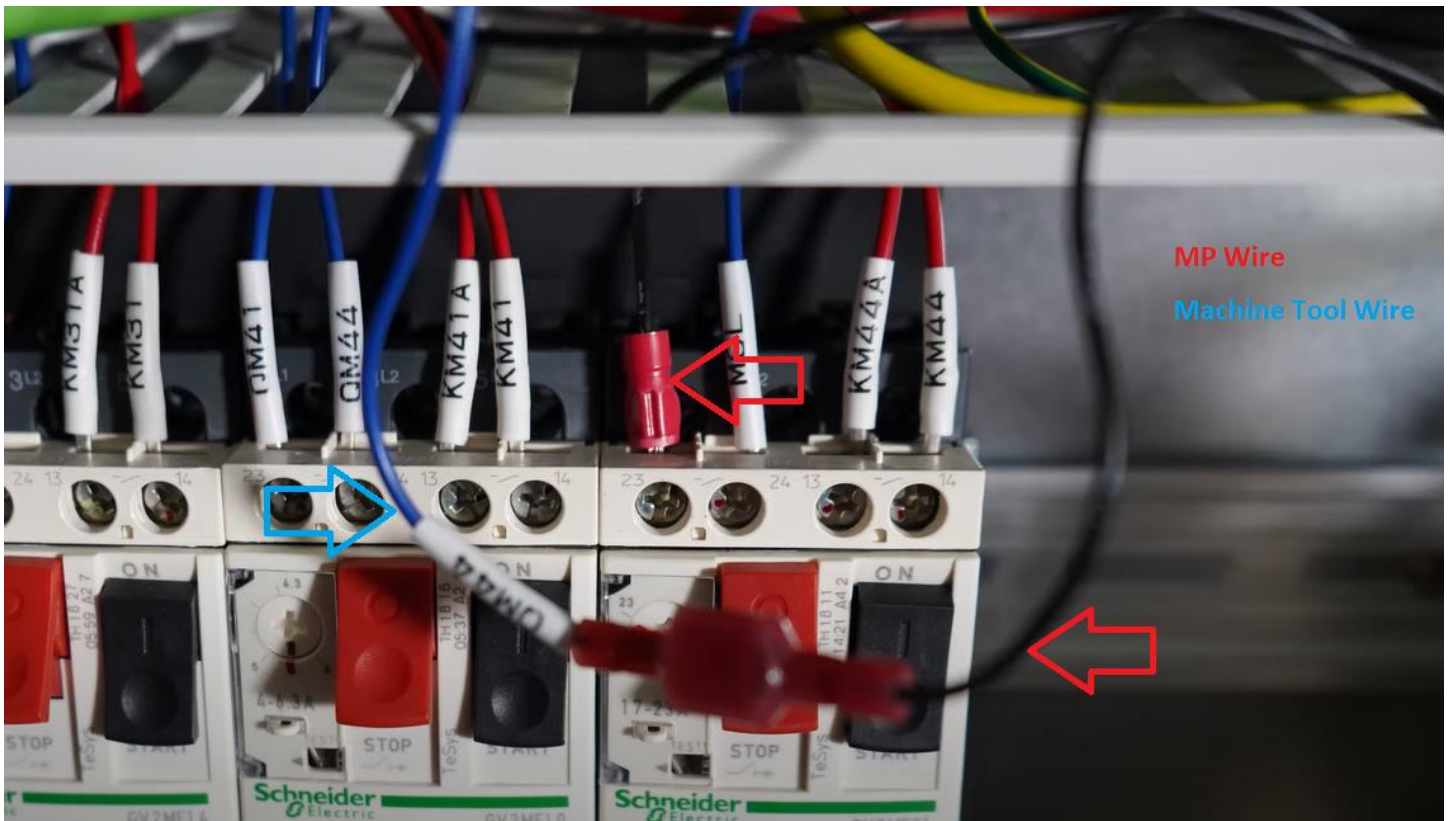


6.3.3.2. Generic Mill Applications

- Typical Mill installations require 1 port and 1 alarm signal.
- Locate TSP (Through Spindle) contactor in machine tool cabinet.
 - Refer to machine tool electrical drawings booklet.
- Remove 3 phase power from bottom of low pressure TSP contactor.
- Some machine tools require the removal of secondary TSP 3 phase power.
- Wire 'Normally Closed' connections in **SERIES** with TSP overload circuit.
- Wire 'Normally Open' connections in **PARALLEL** with TSP overload circuit.
- Additional machine tool alarms may need to 'jumped out'.
- Refer to machine tool electrical drawings booklet.

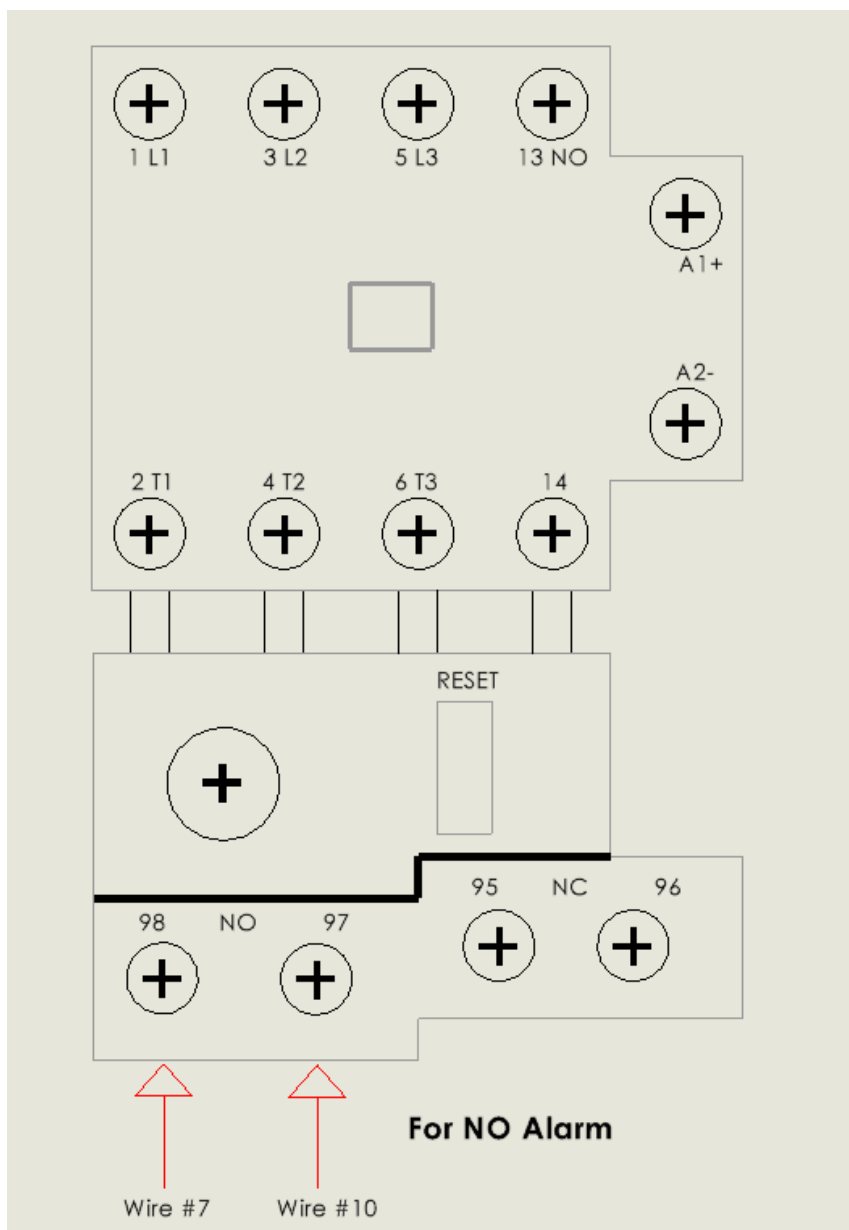
6.3.3.3. Normally Closed Alarm Wiring Diagrams





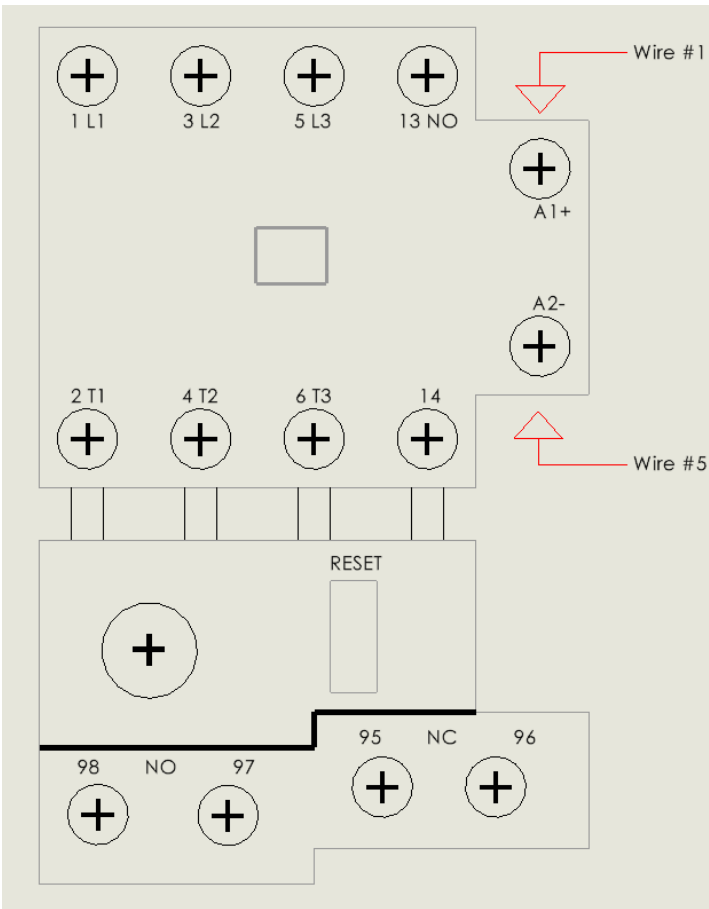
- MP wire 8 is in port 23 of the machine tool overload
- The black wire with the female crimp is MP wire 7
- The blue wire with the male crimp is the machine tool alarm common wire

6.3.3.4. Normally Open Alarm Wiring Diagram

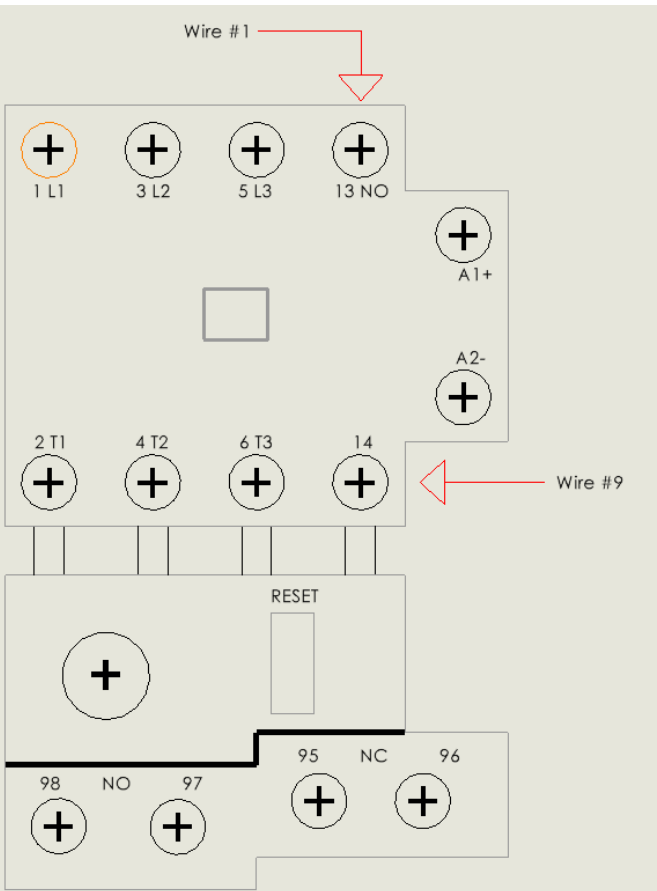


6.3.3.5. Machine Tool Voltage vs. MP Unit Voltage diagrams

Using Machine Tool +24 VDC



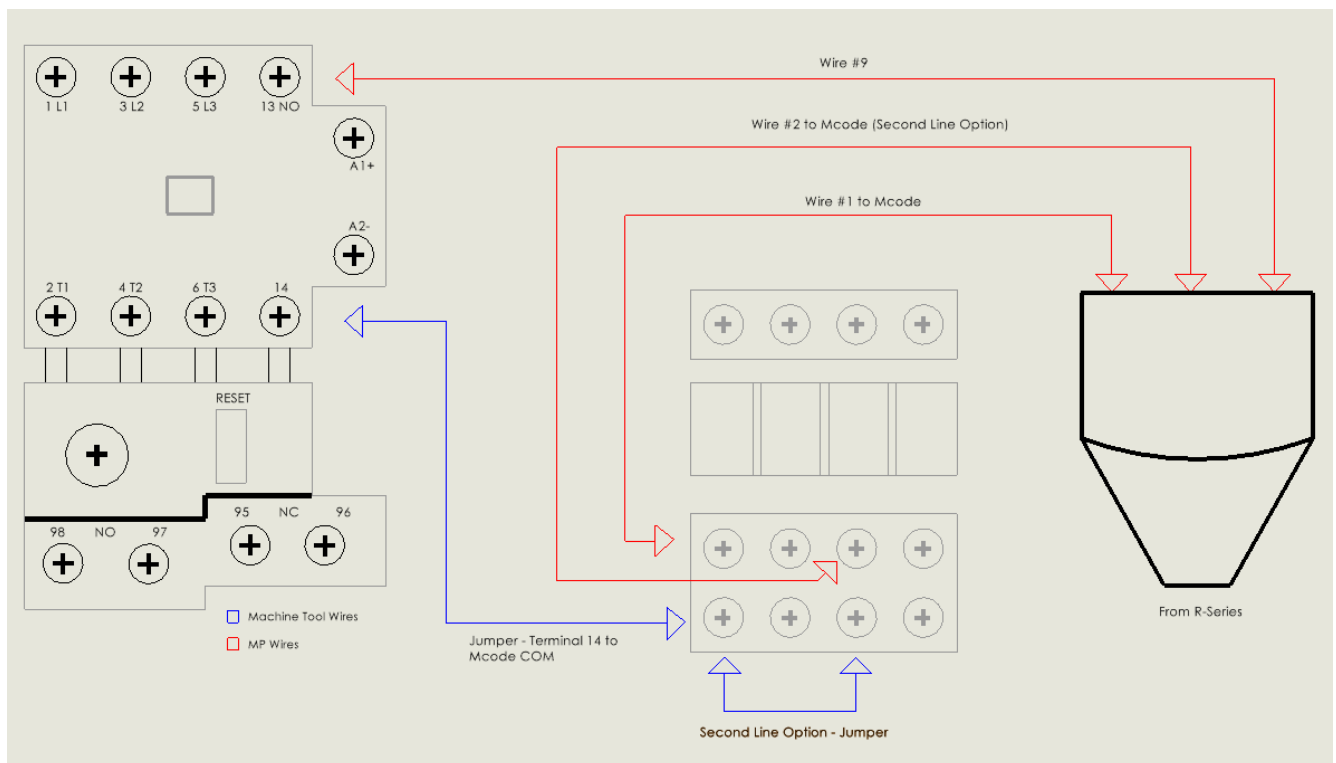
Using MP Unit +24 VDC



6.3.3.6. Generic Lathe Applications

- Typical lathe configurations consist of wiring control signals in **SERIES** with existing low pressure contactor along with an external M-Code. This allows for both machine tool low pressure and high pressure pumps to be utilized.
- Wiring control signals through machine tool low pressure contactor before M-Codes will ensure the unit shuts down when machine tool goes into a hard alarm.
- Wire 'Normally Closed' connections in **SERIES** with machine tool low pressure coolant overload circuit contactor.
- Wire 'Normally Open' connections in **PARALLEL** with machine tool low pressure coolant overload circuit contactor.
- Additional machine tool alarms may need to be 'jumped out'.
 - Refer to machine tool electrical drawings booklet.
- Machine tool parameters may need to be set in order to latch external M-Code functions.

6.3.3.7. Generic Lathe Wiring Diagram

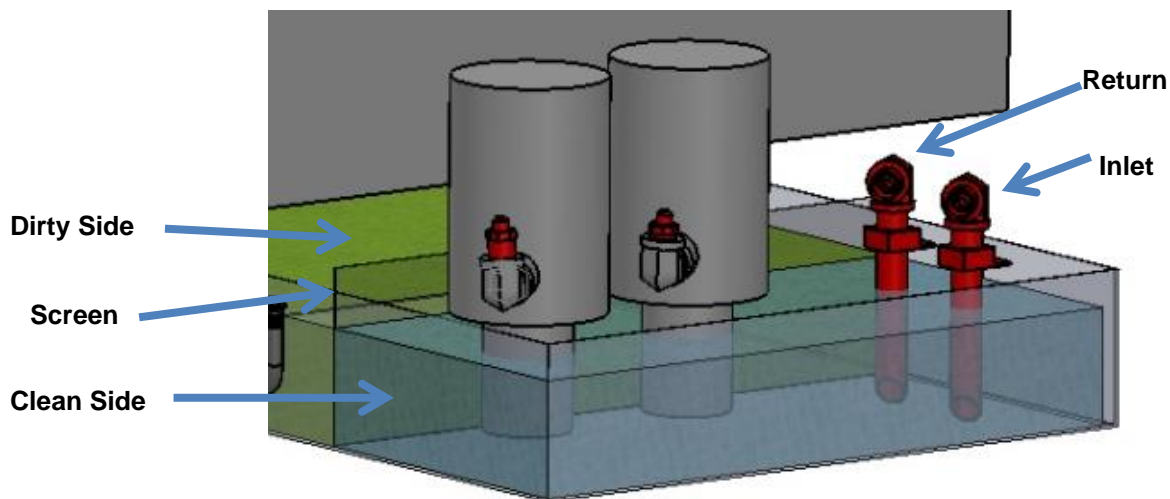


6.4. Low Pressure Installation

1. Mount supplied weld clamps on clean side of machine tool coolant tank, after the screens, typically near the low pressure pumps already installed in tank;
 - Use open area of tank. If no opening available, use 1 1/4" conduit punch or equivalent size hole saw.
 - Be sure to place inlet dip tube away from low pressure pumps present in machine tool tank and that dip tube stays in contact with bottom of the tank. This will ensure proper suction of coolant.
2. Run inlet & return hoses to their respected connections on unit;
 - Inlet & return are clearly marked on unit.
 - Inlet dip tube will always be longer than return dip tube.
 - If low level plate will not fit in tank, use supplied 45" pipe fitting
 - Use supplied hose clamps to install hoses.
 - Inlet & return hoses should be no longer than 15'.
 - Hoses must be placed below inlet of unit, to ensure proper priming of the unit.



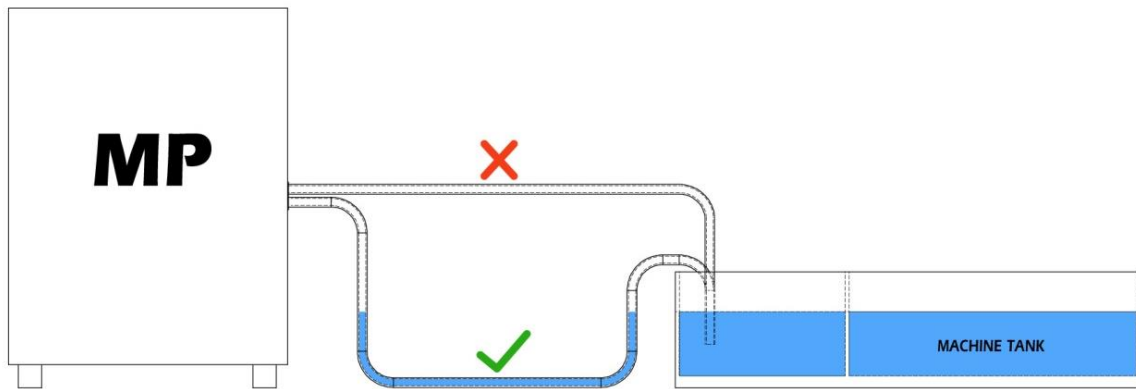
Do not place hoses on top of unit or stand vertically.





6.4.1. Low Pressure Hose Routing

For best results be sure 1 1/4" low pressure hoses are lying flat on the floor. This will ensure coolant from unit will not drain back to machine tool coolant tank. Hoses not lying on the floor may lead to air becoming entrained in coolant and can also lead to supply pump losing prime.

The image below illustrates proper hose routing.




6.5. High Pressure Installation

	Caution: Please refer to <u>Section 11: Hose Identification</u> to properly identify hoses and fittings or contact machine tool manufacture. Hoses must be rated for proper pressure. If properly rated hoses are not present in machine tool, replacement hoses will be needed.
	Coolant distributors present in machine tool <u>MUST</u> be able to withstand the pressure created by unit. If coolant distributors are inadequate, they will need to be modified. If unsure contact <i>MP SYSTEMS</i> (877-689-1860).

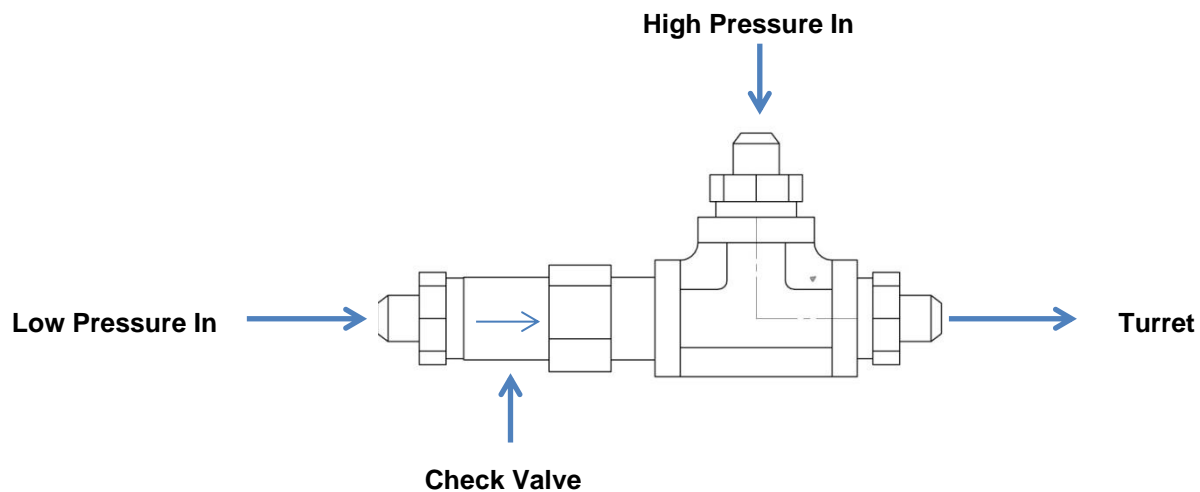
6.5.1. Generic Mill Installation

1. Disconnect hose from machine tool through spindle pump;
 - Through spindle pump, typically mounted to plate that covers machine tool tank.
2. Use supplied JIC to JIS adapter(s) to connect supplied high pressure hose to machine tool high pressure hose;
 - Installation kit ships with all necessary adapters for installation.

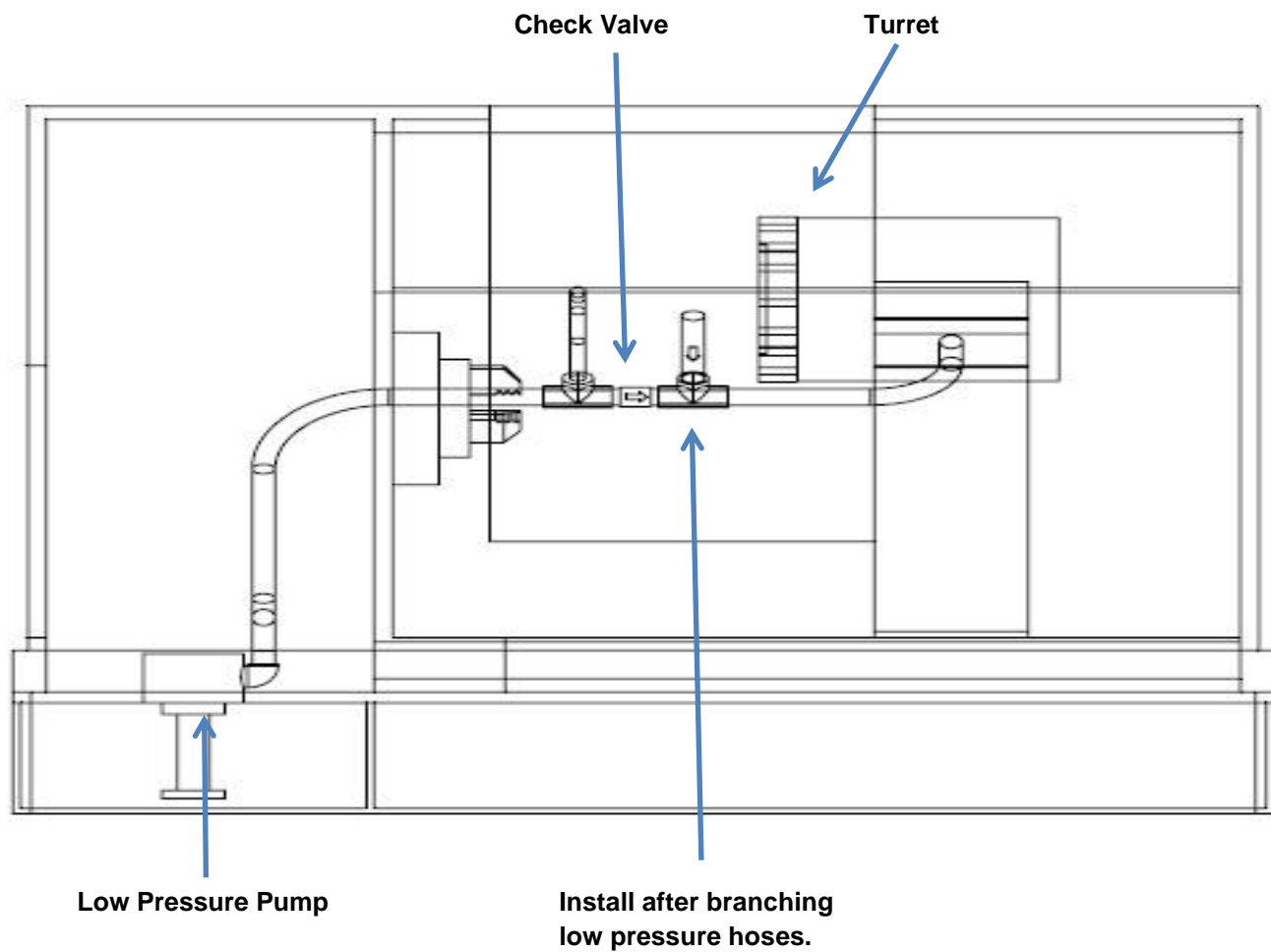
	Warning: Ensure high pressure hose(s) <u>DO NOT</u> rub on any hard edge of machine tool. Rubbing hose(s) can cause unnecessary wear which can lead to hose rupture.
---	--

6.5.2. Generic Lathe Installation

1. Disconnect hose leading to turret, from low pressure pump, as well as the fitting the hose was connected to;
2. Install supplied check valve in place of removed fitting;
 - Arrow pointing towards turret, away from low pressure pump.
3. Install supplied NPTF tee;
4. Install NPT x JIC fitting on side and end of tee;
5. Re-install machine coolant pump fitting that was removed;
 - Install removed machine tool fitting into open space of supplied check valve.
6. Install supplied high pressure hose to side of tee.



6.5.2.1. Generic Lathe Installation Cont.



6.5.3. 8JIC to 6JIS Fitting Explanation

Going from a -8JIC to a -6JIS



MP Systems provides an assortment of fittings to connect the outlet hose to the coolant hose of the machine tool. MP Systems uses -8 JIC connections on the pump, sizes on machine tools can vary. Shown is an adapter to go from -8 JIC to -6 JIS using a BSPP fitting and ferrule



Check to make sure there is no debris between fitting and ferrule that could prevent a metal on metal seal



Place ferrule into cone making sure pieces are properly seated



Tighten connections

7. Operation



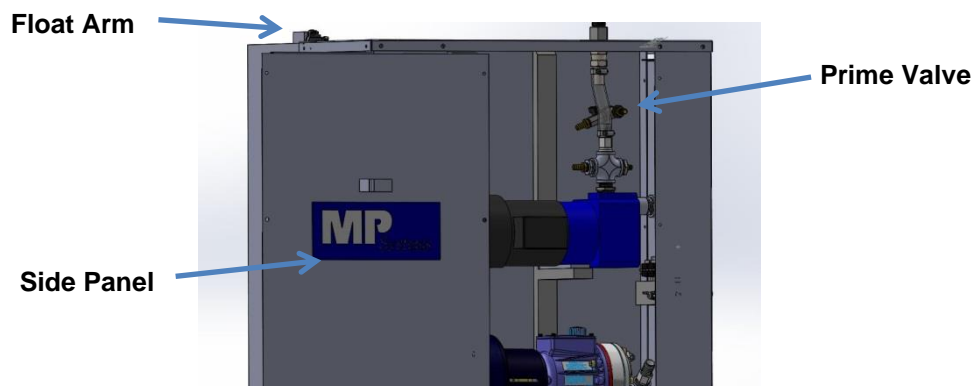
A few steps must be taken before *MP SYSTEMS* auxiliary coolant and chip control system can be put into operation.

7.1. Filling & Priming

1. Fill machine tool coolant tank with coolant/cutting fluid;
2. Fill tank of R Series with coolant/cutting fluid;
 - Fill to just below opening of return.
 - Be sure to use same coolant/cutting fluid being used in machine tool tank.
3. Remove side panel of unit;
 - Labeled with '*MP SYSTEMS*', opposite coolant tank.
 - Allows access to supply pump for priming.
4. Open wye valves on top of machine;
5. Open prime valve for supply pump;
 - Located in main cabinet of unit.
 - Upper right hand side of unit.
 - Allow time for coolant to fill supply pump. Supply pump is fully primed once inlet hose has become filled with coolant/cutting fluid.
6. Once supply pump/Inlet hose have been filled with fluid, close prime valve;
7. Power the machine 'ON';
8. Press the float arm, present in machine tank, to activate supply pump;
 - Ensure fan on rear of pump rotates clockwise.
9. Press the float arm, present in tank, to activate supply pump, to fully prime;
 - Lower float for a few seconds, release and repeat as needed.



Supply pump may need to be run multiple times to pull full prime. Reset alarm on PLC, using the ↶ key to allow unit to run, if necessary.



7.2. Testing

- Ensure all connections are secure and no hoses are rubbing.
- Supply pump properly primed.
- Prime valve has been closed.
- Ensure motor rotation for all motors present in unit rotate clockwise.
- Activate M-Codes and ensure corresponding port on unit activates.
- Power off unit, machine tool should indicate an alarm.
 - Power unit back on, machine tool alarm should reset after 10 seconds.

7.3. Start Up

Coolant/cutting fluid is pumped from the machine tool tank into the unit. The coolant/cutting fluid enters the machine tank through (2) 5 micron #2 polyester filter bags. Filters utilized, use a specialized rubber O-ring manufactured into filter bag, this allows for less debris to bypass filter bag during normal operation.



Set maximum pressure before first use!

1. Turn main disconnect on unit to 'OFF' position;
2. Open wye valve(s) on top of unit;
3. Detach high pressure hose from unit;
 - Re-install caps supplied with machine.
4. Back out regulator (counter clockwise) on manifold all the way;
5. Turn main disconnect to 'ON' position;
6. Activate M-Code for high pressure;
7. **Slowly** rotate regulator (clockwise) until maximum pressure is achieved;
 - Maximum pressure listed above pressure gauge.
 - Typically 1000 psi.
8. Once maximum pressure has been reached, disengage M-Code;
9. Using lock nut behind regulator knob, lock in place, to avoid over pressurizing unit;
10. Turn main disconnect on unit to 'OFF' position;
11. Re-install high pressure hoses.



Warning: Failure to follow these instructions can lead to pump failure and/or void warranty.

7.4. Settings

	Caution: Modifying PLC settings may result in malfunction. Please contact <i>MP SYSTEMS</i> before modifying PLC settings.
	Parameters can be modified through PLC. Fill options, ON/OFF delay, skimmer options, etc. Only 'standard' PLC settings listed. PLC SETTINGS SUBJECT TO CHANGE



7.4.1. R/R2 Series PLC Settings

MAIN SCREEN

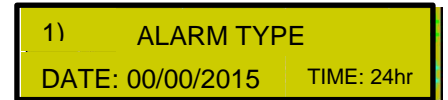
HP – High pressure ON/OFF
LVL – Current tank level
FILL – Indicates supply pump fill.



HP ### LVL ####
FILL ###

ALARM HISTORY

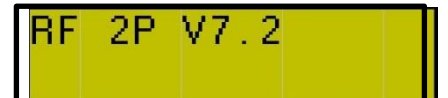
Using the down arrow (▼), from PLC main screen control pad, will display 10 most recent alarms.



1) ALARM TYPE
DATE: 00/00/2015 TIME: 24hr

INFO SCREEN

ⓘ key on PLC will display current PLC version.



RF 2P V7.2

Press [1] & [2] keys simultaneously to access password screen. Use this function to access the following menus.

0515 [↵]

SET TIME - 24hr Clock Format



SET TIME
HH:MM:SS

DATE - DD/MM/YY



DATE DD/MM/YY
#####

ON/OFF DELAY - High pressure delay on Start/Stop. Set in 01 second increments.



on dly##
off dly##

FILL SETTINGS

ACT – Actual tank level. **LO** – Level when supply pump begins to fill tank.
ALM – Level when machine will go into alarm. **HIGH** – Level when tank is full.



ACT #### LO ####
ALM #### HI ####


SKIM LEVEL - Fills tank to over flow level, allows film to removed from tank (950 maximum).



Skim Level:####
Skim Timer:####

SKIM TIMER - Interval between skim function. Minutes:Seconds (MM:SS)

DEFAULT RESET - Reset PLC to factory defaults.
Code = 1234



DEFAULT RESET
ENTER CODE####

7.4.1.1. R/R2 Series PLC Settings

3434 [↵]

SKIM ON/OFF – Activate/Deactivate skim function. 1=ON 0=OFF

Skim On=1	Off=0
Select #	#####

LATCH ON/OFF – Latching or Pulsing alarm signal. 1=ON 0=OFF

Latch On=1	Off=0
Select #	

RD P PULSE/LATCH – Operate Reduced Pressure (RD) option with Pulsing/Latching M-Codes. 0=Pulsing 1=Latching.

RD P PULSE/LATCH
0=PLS 1=LAT #

6478 [↵] **MIST COLLECTOR SETTINGS**

MC HS RUN – Mist collector will run at high speed for set amount of time after high pressure has stopped. Assists in clearing mist from machine tool cabinet. Set in 1 second increments.

MC HS RUN	##
-----------	----

MC PULSE/LATCH – Ability to use Mist Collector option with Pulsing/Latching M-Codes. 0=PULSE 1=LATCH

MC PULSE/LATCH
0=PLS 1=LAT #

MC ON WITH HP – Run Mist Collector option when high pressure is being used. 1=ON 0=OFF

MC ON WITH HP
0=OFF 1=ON #

MON-FRI STR/STP – Set start and stop times Monday – Friday. 24hr format.

MON - FRI	STRT/STP
#####	#####

SAT-SUN STR/STP - Set start and stop times Saturday – Sunday. 24hr format.

SAT - SUN	STRT/STP
#####	#####

7.4.2. Variable/Adaptive Series PLC Settings (VR Series)

MAIN SCREEN

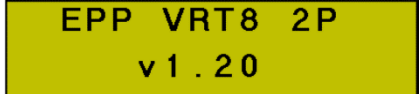
- ### - High Pressure System 1 Status
- ### - High Pressure System 2 Status
- ### - Feed Pump Status
- ### - Reservoir/MP Tank Level (0-1000)
- # - Port 1 Pressure (PSI)
- # - Port 2 Pressure (PSI)



GPM ### LVL ###
PSI ### HP # FP #

INFO SCREEN

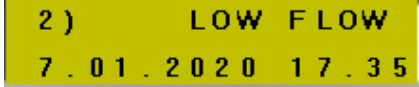
① (Information) Button on PLC control pad will display current program version.



EPP VRT8 2P
v 1 . 2 0

ALARM SCREEN

▲ ▼ (Up, Down) Button on PLC control pad will display the last 10 alarms along with the date and time of occurrence.



2) LOW FLOW
7 . 0 1 . 2 0 2 0 1 7 . 3 5

Press [1] & [2] keys simultaneously to access password screen. Use this function to access the following menu options.

0515 [↩] – User Menu

SET TIME -

Sets system time. 24hr Clock Format
(for scheduling and logging events)

```
TIME:  HH:MM:SS  
      <<~2:46:44>>
```

DATE – DD/MM/YY

Sets system date
(for scheduling and logging events)

```
DATE:  DD/MM/YY  
      <<~1/08/20>>
```

ON/OFF DELAY –

Sets time that must elapse before high pressure system 1 starts when on signal is received. Also sets the wait time before the high-pressure system 1 shuts off after on signal is removed.

Default = (0 sec, 0 sec)

```
ON  DLY1 ~ 0  
OFF DLY1 00
```

TANK LEVEL SETTINGS –

Sets the tank level at which the Reservoir/MP Tank will be refilled (LO), the level at which the tank will stop filling (HI) and the level at which a fill alarm is triggered (ALM). Also shows the current tank level (ACT).

Default = (LO:500, HI:850, ALM:200)

```
ACT   789  LO ~500  
ALM   200  HI   850
```

HP1 PRESSURE OPTIONS –

Sets each of four (4) signal-selectable pressures (PSI) for high pressure system 1.

Default = (P1:1000, P2:750, P3:500, P4:250)

```
P1 - 1 ~000 P1 - 2  750  
P1 - 3  500 P1 - 4  250
```

RESERVOIR SKIM LEVEL/TIMER -

Selects tank level at which system will remove floating oil from tank's surface and the time duration between skim events.

Default = (LEVEL: 950, TIME: 15 min)

```
SKIM LEVEL: ~ 950  
SKIM TM: 00:15:00
```

DEFAULT RESET –

Reset PLC settings to factory defaults.

Code = 1234

```
DEFAULT RESET  
ENTER CODE ~ 0
```

7.4.2.1. Variable/Adaptive Series PLC Settings (VR Series)

3434 [←] – Setup Menu

RESERVOIR SKIM SETUP -

Enable/disable tank skim function and displays time duration between tank skim events when enabled.

Default = (0)

```
SKIM ON=1 OFF=0
SELECT~ 25:00:00
```

ALARM LATCH –

Sets alarm output as a latching signal (which keeps its state constant when triggered) or pulsing signal (which changes state for 5 seconds before reverting).

Default = (0)

```
ALARM LATCH : ~
ON=1 OFF=0
```

REDUCED PRESSURE LATCH –

Sets the reduced pressure input as a latching signal or pulsing signal.

Default = (0)

```
RDP PUL/LAT
0=PUL 1=LAT ~
```

BINARY PRESSURE –

Enables variable pressure to be controlled by binary input signal (two inputs, four pressures).

Default = 0

```
BINARY PRESSURE
ON=1 OFF=0 <<~>>
```

PRESSURE MEMORY –

Starts system up at the last pressure value that was selected before it was previously shut down.

Default = 0

```
KEEP LAST PRESS.
ON=1 OFF=0 <<~>>
```

I7 ASSIGNMENT –

Switches function of input between operation of the mist collector or the selection of pressure options for variable pressure.

Default = 0

```
I7 ASSIGNMENT= ~
PR1=0 MC=1
```

MIST COLLECTOR SIGNAL TYPE –

Allows mist collector signal to exist as pulsing or latching input (when using I7).

Default = 0

```
MC M-CODE MODE : ~
TOGL=1, LATCH=0
```

6478 [↩] – Mist Collector Menu

HIGH SPEED RUN TIMER -

Sets duration of mist collector high-mode after high pressure system is shut down.

Default = (20 sec)

MC HS RUN ~ 0

RUN SIGNAL TYPE -

Sets run signal as latching input or pulsing input.

Default = (0)

MC PULSE / LATCH

0 = PLS 1 = LAT ~

RUN MODE -

Allows mist collector to auto run whenever a high pressure system is active.

Default = (1)

MC ON WITH HP

0 = OFF 1 = ON ~

AUTO RUN WEEKDAY SCHEDULE -

Sets automatic weekday run schedule for the mist collector system.

Default = (0:00 - 0:00)

MON - FRI STRT / STP

~ 0 : 00 0 0 : 0 0

AUTO RUN WEEKEND SCHEDULE -

Sets automatic weekend run schedule for the mist collector system.

Default = (0:00 - 0:00)


SAT - SUN STRT / STP

~ 0 : 00 0 0 : 0 0

7.4.3. Variable/Adaptive Series PLC Settings (VR2 Series)

MAIN SCREEN

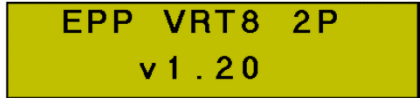
- ### - High Pressure System 1 Status
- ### - High Pressure System 2 Status
- ### - Feed Pump Status
- ### - Reservoir/MP Tank Level (0-1000)
- # - Port 1 Pressure (PSI)
- # - Port 2 Pressure (PSI)



HP1 # HP2 # FP # L # #
P1 # # # # P2 # # # #

INFO SCREEN

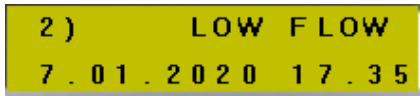
① (Information) Button on PLC control pad will display current program version.



EPP VRT8 2P
v1.20

ALARM SCREEN

▲▼ (Up, Down) Button on PLC control pad will display the last 10 alarms along with the date and time of occurrence.



2) LOW FLOW
7.01.2020 17.35

Press [1] & [2] keys simultaneously to access password screen. Use this function to access the following menu options.

0515 [↵] – User Menu

SET TIME -

Sets system time. 24hr Clock Format
(for scheduling and logging events)

```
TIME : HH : MM : SS  
      < < ~ 2 : 46 : 44 > >
```

DATE – DD/MM/YY

Sets system date
(for scheduling and logging events)

```
DATE : DD / MM / YY  
      < < ~ 1 / 08 / 20 > >
```

ON/OFF DELAY –

Sets time that must elapse before high pressure system 1 starts when on signal is received. Also sets the wait time before the high pressure system 1 shuts off after on signal is removed.

Default = (0 sec, 0 sec)

```
ON DLY1 ~ 0  
OFF DLY1 00
```

ON/OFF DELAY –

Sets time that must elapse before high pressure system 2 starts when on signal is received. Also sets the wait time before the high pressure system 2 shuts off after on signal is removed.

Default = (0 sec, 0 sec)

```
ON DLY 2 ~ 0  
OFF DLY 2 00
```

TANK LEVEL SETTINGS –

Sets the tank level at which the Reservoir/MP Tank will be refilled (LO), the level at which the Tank will stop filling (HI) and the level at which a fill alarm is triggered (ALM). Also shows the current tank level (ACT).

Default = (LO:500, HI:850, ALM:200)

```
ACT   789  LO  ~500  
ALM   200  HI   850
```

HP1 PRESSURE OPTIONS –

Sets each of four (4) signal-selectable pressures (PSI) for high pressure system 1.

Default = (P1:1000, P2:750, P3:500, P4:250)

```
P1 - 1 ~ 000 P1 - 2 750  
P1 - 3 500 P1 - 4 250
```

HP2 PRESSURE OPTIONS –

Sets each of four (4) signal-selectable pressures (PSI) for high pressure system 2.

Default = (P1:1000, P2:750, P3:500, P4:250)

```
P2 - 1 1000 P2 - 2 750  
P2 - 3 500 P2 - 4 ~ 250
```

RESERVOIR SKIM LEVEL/TIMER -

Selects tank level at which system will remove floating oil from tank's surface and the time duration between skim events.

Default = (LEVEL: 950, TIME: 15 min)

```
SKIM LEVEL : ~ 950  
SKIM TM : 00 : 15 : 00
```


FILTER LIFE ALARM LEVEL -

Sets the minimum level at which a warning alarm will be triggered when filter monitoring is enabled.
Default = (20%)

ALARM AT
~ 0% FILTER LIFE

DEFAULT RESET –

Reset PLC settings to factory defaults.
Code = 1234

DEFAULT RESET
ENTER CODE ~ 0

7.4.3.1. Variable/Adaptive Series PLC Settings (VR2 Series)

3434 [↩] – Setup Menu

RESERVOIR SKIM SETUP -

Enable/disable tank skim function and displays time duration between tank skim events when enabled.
Default = (0)

SKIM ON=1 OFF=0
SELECT~ 25:00:00

ALARM LATCH –

Sets alarm output as a latching signal (which keeps its state constant when triggered) or pulsing signal (which changes state for 5 seconds before reverting).
Default = (0)

ALARM LATCH : ~
ON=1 OFF=0

FILTER ALARM –

Enables alarm to occur if filter condition/performance is reduce below a preset treshhold.
Default = 0

FIL ALARM BIT
OFF=0 ON=1 ~

FILTER ALARM TYPE –

Sets the alarm output as normally open (NO) or normally closed (NC) when filter alarm is triggered
Default = 0

SELECT PRESSURE :
P1+P2=0 , P1=1 < ~ >

PORT PRESSURE ISOLATION –

Allows variable pressure selection to be performed only on one system or on both.
Default = 0

SELECT PRESSURE :
P1+P2=0 , P1=1 < ~ >

BINARY PRESSURE –

Enables variable pressure to be controlled by binary input signal (two inputs, four pressures).
Default = 0

BINARY PRESSURE
ON=1 OFF=0 < < ~ > >

PRESSURE MEMORY –

Starts system up at the last pressure value that was selected before it was previously shut down.

KEEP LAST PRESS .
ON=1 OFF=0 < < ~ > >

Default = 0

6478 [↵] – Mist Collector Menu

HIGH SPEED RUN TIMER -

Sets duration of mist collector high-mode after high pressure system is shut down.

Default = (20 sec)

MC HS RUN ~ 0

RUN SIGNAL TYPE -

Sets run signal as latching input or pulsing input.

Default = (0)

MC PULSE / LATCH
0 = PLS 1 = LAT ~

RUN MODE -

Allows mist collector to auto run whenever a high Pressure system is active.

Default = (1)

MC ON WITH HP
0 = OFF 1 = ON ~

AUTO RUN WEEKDAY SCHEDULE -

Sets automatic weekday run schedule for the mist collector system.

Default = (0:00 - 0:00)

MON - FRI STRT / STP
~ 0 : 00 0 0 : 00

AUTO RUN WEEKEND SCHEDULE -

Sets automatic weekend run schedule for the mist collector system.

Default = (0:00 - 0:00)

SAT - SUN STRT / STP
~ 0 : 00 0 0 : 00

*Note: Availability of menus are subject to change without notice and may not be available on all systems

7.4.4. RA11 Series PLC Settings

MAIN SCREEN

FLO – Current GPM, 3, 8, 11

LVL – Current tank level

FILL – Indicates supply pump fill.

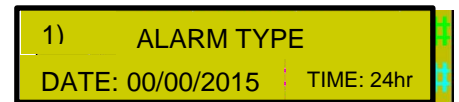
M – Displayed when pump is in manual mode



FLO 0.0 LVL **
FILL 0 M

ALARM HISTORY


Using the down arrow (▼), from PLC main screen control pad, will display 10 most recent alarms.



1) ALARM TYPE
DATE: 00/00/2015 TIME: 24hr

INFO SCREEN

ⓘ key on PLC will display current PLC version.



VR8 2P VFD V1.5

Press [1] & [2] keys simultaneously to access password screen. Use this function to access the following menus.

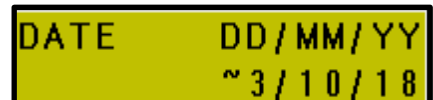
0515 [↵]

SET TIME - 24hr Clock Format



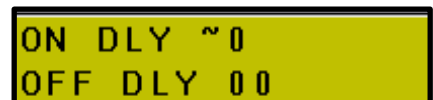
SET TIME
~2:56:03

DATE - DD/MM/YY



DATE DD/MM/YY
~3/10/18

ON/OFF DELAY - High pressure delay on Start/Stop. Set in 01 second increments.



ON DLY ~0
OFF DLY 00

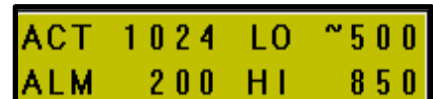
FILL SETTINGS

ACT – Actual tank level.

LO – Level when supply pump begins to fill tank.

ALM – Level when machine will go into alarm.

HIGH – Level when tank is full.



ACT 1024 LO ~500
ALM 200 HI 850

SKIM LEVEL - Fills tank to over flow level, allows film to removed from tank (950 maximum).

SKIM TIMER - Interval between skim function. Minutes:Seconds (MM:SS)



SKIM LEVEL: ~950
SKIM TM: 00:15:00

DEFAULT RESET - Reset PLC to factory defaults.
Code = 1234



DEFAULT RESET
ENTER CODE ~0

7.4.4.1. RA11 Series PLC Settings

3434 [↵]

SKIM ON/OFF – Activate/Deactivate skim function. 1=ON 0=OFF

SKIM ON=1 OFF=0
SELECT ~ 00:15:00

LATCH ON/OFF – Latching or Pulsing alarm signal. 1=ON 0=OFF

LATCH ON=1 OFF=0
SELECT ~

RDP PUL/LAT – Operate Reduced Pressure (RD) option with Pulsing/Latching M-Codes. 0=Pulsing 1=Latching.

RDP PUL/LAT
0=PUL 1=LAT ~

MM FLOW SETTING – Option to choose which high pressure pump(s) to run. 1=ON 0=OFF

- **FLOW SETTING** – Function allows 3gpm, 8gpm, 11gpm to run independently. **M** will display on main screen in bottom right corner when active.
 - 1 = 3 GPM only
 - 2 = 8 GPM only
 - 3 = 11 GPM only

MM ~ On=1 Off=0
FLOW SETTING _

CALIBRATION – Calibrates flow sensor to coolant being used in system. Will run high pressure through dump valve, back to R Series tank for 10-15 seconds.

CALIBRATION
1=YES NO PRESS ~

6478 [↵] MIST COLLECTOR SETTINGS

MC HS RUN – Mist collector will run at high speed for set amount of time after high pressure has stopped. Assists in clearing mist from machine tool cabinet. Set in 1 second increments.

MC HS RUN ~0

MC PULSE/LATCH – Ability to use Mist Collector option with Pulsing/Latching M-Codes. 0=PULSE 1=LATCH

MC PULSE/LATCH
0=PLS 1=LAT ~

MC ON WITH HP – Run Mist Collector option when high pressure is being used. 1=ON 0=OFF

MC ON WITH HP
0=OFF 1=ON ~



MON-FRI STR/STP – Set start and stop times Monday – Friday. 24hr format.

MON-FRI STRT/STP
~0:00 00:00

SAT-SUN STR/STP – Set start and stop times Saturday – Sunday. 24hr format.

SAT-SUN STRT/STP
~0:00 00:00

7.5. Alarms

	The machine uses one alarm output to interface with machine tool. If a fault occurs, a signal is sent to the alarm circuit on machine tool, which, typically, will put machine tool into a feed hold. The units PLC will display fault type.
	Alarm will not clear off PLC display until fault has been rectified. Once fault has been remedied, press [←] to clear alarm.

<u>ALARM DISPLAY</u>	<u>SYMPTOM(S)</u>	<u>CAUSE</u>
Slow Fill/Change Bag or Check Feed Pump	Tank will not fill fast enough to keep up with output.	<ul style="list-style-type: none"> ▪ Improper supply pump rotation. ▪ Clogged filter. ▪ Priming issue. ▪ Machine tool coolant screen clogged. ▪ Obstructed hoses. ▪ Dip tube not fully submerged.
C.B. TRIP RESET ENTER TO CLEAR	Motor overload tripped	<ul style="list-style-type: none"> ▪ Electric motor short cycle. ▪ Electric motor shorting. ▪ Load on motor to great. ▪ Electric motor over load set to low. ▪ Electrical short in system causing overload to trip.
Drive Alarm	<ul style="list-style-type: none"> ▪ Call MP Systems 877-689-1860 	Fault on VFD present in unit

7.6. Slow Fill Alarm

In the event of a Persistent '**Slow Fill**' alarm (Displayed on PLC) please follow the steps below. The following steps will assist in determining the root cause of the issue. If the problem continues please contact *MP SYSTEMS @ (877)-689-1860*.

- Check inlet pressure gauge;
 - If gauge reads below 7 PSI, the systems is most likely ingesting air.
- Check the inlet conditions of machine;
 - Inlet dip tube must be touching the bottom of machine tool tank.
 - Ensure machine tool tank screen is free of debris.
 - Ensure coolant/cutting fluid has not become entrained with air.
 - Check coolant/cutting fluid level of machine tool.

If machine tool side, inlet conditions seem to be agreeable and inlet hose appears to be full of coolant/cutting fluid, please follow the steps below;

- Check inlet pressure gauge;
 - If gauge reads high, most likely obstruction of the outlet of supply pump.
- Change filter bags;
- Check hoses that run to filter vessels to ensure there is no obstruction in hoses;

After all listed steps have been taken and there is still no flow from the supply pump please follow steps below;

- Debris may have been sucked into supply pump and restricting flow.
- Remove supply pump, pump head (blue casting with inlet/outlet). Remove debris hindering impeller from properly moving coolant/cutting fluid.

8. Maintenance



Before carrying out any operation on unit or accessing internal components, ensure that the power supply has been switched to the 'OFF' position.

Before working on the unit, carefully read the safety instructions set out in **Section 2. Safety Measures**

It is good practice to carry out periodic checks on machine, in order to ensure it is working properly. Routine maintenance does not require special technical knowledge; however, it should be carried out by trained personnel.

Maintenance operations are essential for keeping the unit at its highest efficiency, from the point of view of both efficiency and energy usage.

8.1. Routine Maintenance

<u>ROUTINE MAINTENANCE</u>		
Group/Component	Operation	Maintenance Interval
Machine Structure	Visually check condition of structure (areas of corrosion and/or dents).	Monthly
Hydraulic Circuit	HOSES – Visual check for leaks in hydraulic circuit.	Weekly
	FILTERS – Replace as needed.	Daily/Weekly/Monthly
	FLUID – Check quality and cleanliness of fluid in tank.	Monthly
	PRESSURE – Check pressure when machine is in use. Pressure must be within range listed on machine.	Monthly
Electrical Components	Check current usage and seating of electrical components.	Yearly

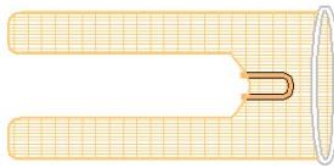
8.1.1. Filter Bag Replacement

1. Switch power to 'OFF' position;
2. Close valve to filter vessel that will be changed;
3. Let system pressure equalize for up to 30 seconds;
4. Remove 4 wing nuts on filter cover;
 - Lift away filter cover.
5. Slowly lift filter bag, using handles on filter bag;
 - Coolant/cutting fluid will gradually drain out of filter bag.
6. Install replacement filter bag;
7. Replace filter cover;
 - Secure 4 wing nuts.
8. Open corresponding valve and continue normal operation.

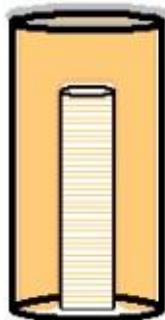
Grab tab, inside filter bag, pull towards embedded O-ring (inside-out). Keep filter bag even all the way around, this will make installing replacement bag much easier.



Filter bag should look similar to the image below.



Be sure filter bag slides over filter cone, center of filter basket.



Do not force filter bag to one side of filter basket cone!



9. Options & Accessories

9.1. Auto Cross

Auto Cross (AC) system automatically switches between the two filter vessels present in unit. Once a filter bag becomes depleted, the AC system senses the lack of flow and will switch to the clean filter. PLC will display depleted filter #. The AC system allows for less down time and makes scheduling filter bag changes far easier. It is recommended that there always be a clean filter present in system, this allows for un-interrupted operation.

If both filter bags are depleted, the unit will go into alarm.



Be sure to leave both valves to filters open.

Only close valve of filter vessel when changing the filter bag in corresponding filter vessel, as to not interrupt operation.

Refer to **Section 8.1.1. Filter Bag Replacement**

9.2. Dual Pressure

2-3 M-Codes are required for a DP system to operate properly. DP option allows for M-Code controlled pressure reduction. Set higher pressure with main regulator, then utilizing a second regulator to set a lower pressure. Activating corresponding M-Code allows for reduced pressure. When lower pressure is no longer needed, 'release' corresponding M-Code to return to initial higher pressure.



DP option useful in machining environments that require small tools that require a lower pressure, such as small drills or burnishing operations.

9.3. Dual Simultaneous Pressure


Dual Simultaneous Pressure (DSP) option provides two different pressures simultaneously. Port 1 dedicated to higher pressure and Port 2 dedicated to reduced pressure. DSP allows the option of having high pressure active on tools that require higher pressure while still allowing other parts of machine tool, such as sub-spindle, to still utilize the reduced coolant flow.



DSP allows both ports/pressures to run independently of one another.

9.4. Variable Pressure

Adaptive Variable Option	
Standard Installation (Recommended)	Advanced Installation
<p>No programming necessary. The unit automatically adapts to ensure the correct pressure is always present at the tool. Set it and forget it. It Just Works!</p> <p>The pump will increase or decrease speed to maintain set pressure. This ensures the pump only works as hard as needed, greatly reducing unnecessary heat input while also decreasing wear of pump components.</p> <p><i>MP SYSTEMS</i> standard installation is simple and straight forward. User only needs to install 2 wires onto stock coolant contactor, and 2 wires onto the stock coolant overload for alarm. THAT'S IT, the system is ready to run. Refer to <u>Section:6.3.3.1.1.</u></p>	<p>Installation becomes more complicated, requiring at least 3 extra spare M-Codes and additional programming. Only used in special applications that utilize fine engraving, coolant driven, and other specialty tools.</p> <p>Allows for 3 programmable pressures & 1 default pressure to be used in applications that require finer control.</p> <p>The pump will increase or decrease speed to maintain set pressure. This ensures the pump only works as hard as needed, greatly reducing unnecessary heat input & decreasing wear of pump components</p>

	<p>Variable Pressure factory default pressures: 1000psi, 750psi, 500psi, 250psi.</p> <p><u>Required M-Codes</u></p> <p>4 sets for pressures</p> <p>1 set per port</p>
--	--

9.4.1. How to Program Variable Pressure

- For programmable pressure, wires 12, 13, 14, and 15 will need to be wired to M-codes. The port AND the desired pressure will need to be fired for the lower pressure to work.

Example: Port 1 ON= M101. Pressure 2 =M103

- M101 AND M103 will need to be active for the pressure 2 setting on port 1.
- For pulsing M-codes, a finish signal may be needed. Wires 16 and 17 from the MP unit will provide a dry contact for the finish signal.

9.5. MP 1200 Mist Collector (MC)

The MP 1200 Mist Collector is used to remove unwanted mist and vapors created by spraying fluid at high velocity in the machine tool cabinet. The MP 1200 aids in keeping unwanted mist/vapor from entering the work environment around the machine tool. Not only does the MP 1200 keep the air in the work place much cleaner, it has the potential to save money by recycling wasted fluid that would have ended up in the air, back to the machine tool reservoir.

The MP 1200 consists of 3 filtering components and 1 optional post HEPA filter add-on that can be mounted to the top of the MP 1200. The first component in the MP 1200 is the impinger (re-usable), this component allows the unit to separate out the heavier liquid particles. The second component, a 2" thick wire mesh screen (re-usable) that aids in removing the residual heavy liquid particles. The final and most important component of the MP 1200 is the 19" x 23" x 12" high capacity, high efficiency filter (expendable) that brings its efficiency up to 95%.

The optional post HEPA filter (expendable) can bring efficiency to 99.7%.

9.5.1. Control Signal Options (MC)

Please refer to MP 1200 Mist Collector installation guide, supplied with MP 1200, for mounting & power installation instructions.


<u>MP 1200 Control Options</u>	<u>Instructions</u>
Standard Control	MP 1200 will run at set speed (dial on unit) when high pressure is active. Once high pressure becomes de-activated MP 1200 will run at full speed for 20 seconds, to clear remaining mist/vapor from machine tool cabinet. MP 1200 settings can be modified through R Series PLC, please refer to <u>Section 7.4: Settings</u> .
M-Code Control	<ul style="list-style-type: none">▪ Latching M-Codes<ul style="list-style-type: none">○ MP wire #12 (ON/OFF)○ MP wire #9 (+24VDC) common▪ Pulsing M-Codes<ul style="list-style-type: none">○ MP wire #12 (ON)○ MP wire #13 (OFF)
Flood Coolant Control	<ul style="list-style-type: none">▪ MP wire #9 (+24VDC) common▪ MP wire #12 (ON/OFF) <p>A dry contactor must be used, no other machine tool wires may be present.</p> <ul style="list-style-type: none">▪ MP wire #9 on Terminal 13▪ MP wire #12 on Terminal 14
Refer to <u>Section 7.4. Settings</u> to modify PLC to allow for M-Code Control or Flood Coolant control.	

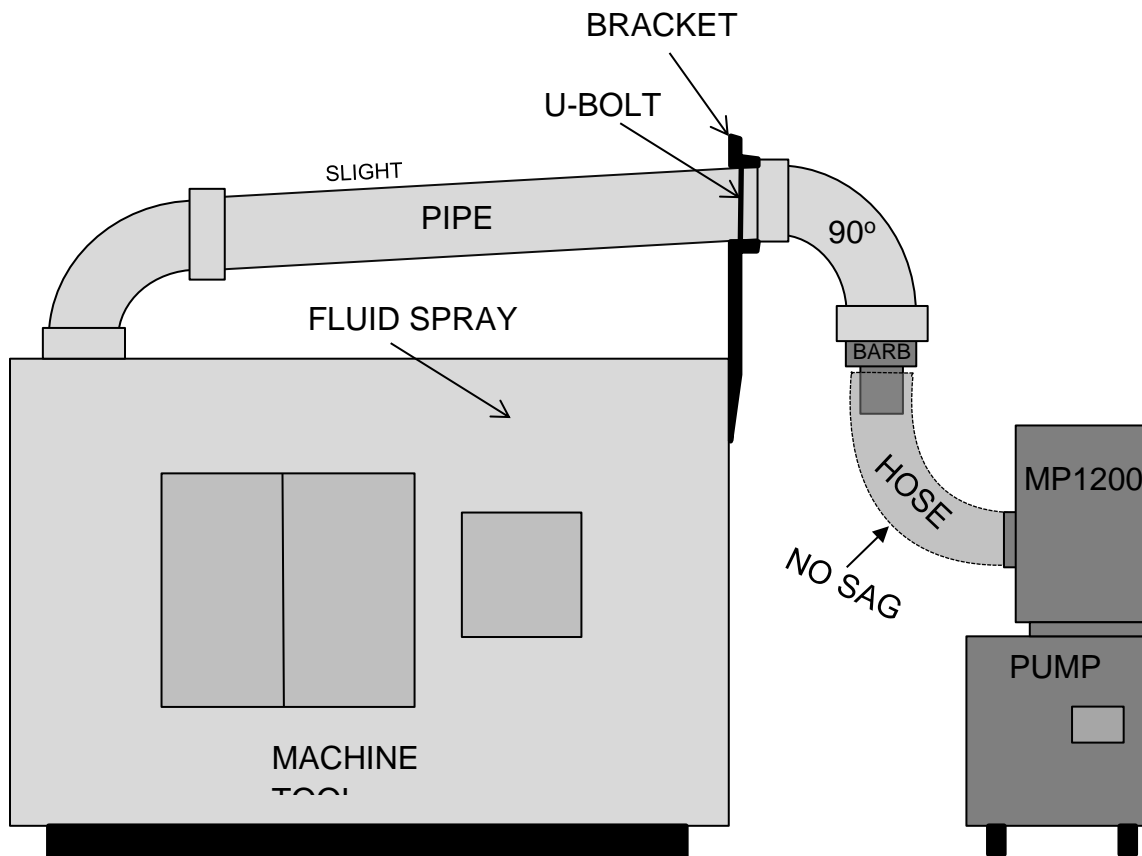


Wire numbers are subject to change. Please refer to AE GEN SGNL, attached to signal harness supplied in installation kit.

9.5.2. Plumbing Instructions (MC)

- Ensure 1/2" black push lock hose from drain of MP1200, bottom of unit, connects to the 1/2" hose barb on top of return of the R Series. Refer to **B MP1200 INSTALL** manual supplied with MP 1200 mist collector;
- Install supplied 6" flange on top of machine tool working cabinet;
 - Install away from direct coolant spray to avoid heavy fluid particles entering MP 1200 filter system.
 - Heavy liquid particles will greatly reduce filter life and performance.
- With 6" flange installed on machine tool, it may be necessary to use hard piping to allow for a slight slope. The slope will allow the remaining liquid to return to machine tool cabinet;
 - If using supplied 6" polywire hose, a rigied support bracket may need to be constructed to allow the hose to have a slope and stay in place.
- Avoid sagging of 6" polywire hose leading to MP 1200;
 - Less sag will help prevent fluid from collecting and potentially become ingested by MP 1200.

	<p>This information does not represent all installations. Machine tools and installation setups may vary depending on available space and materials.</p>
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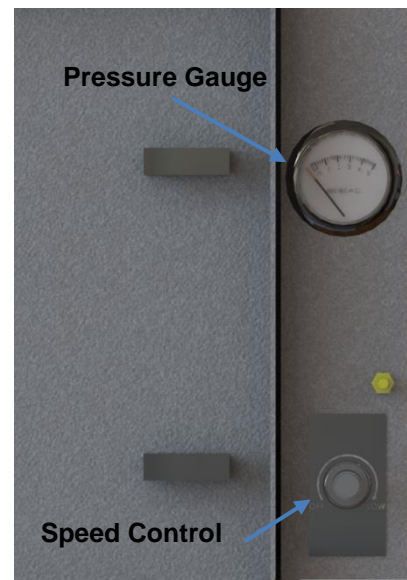
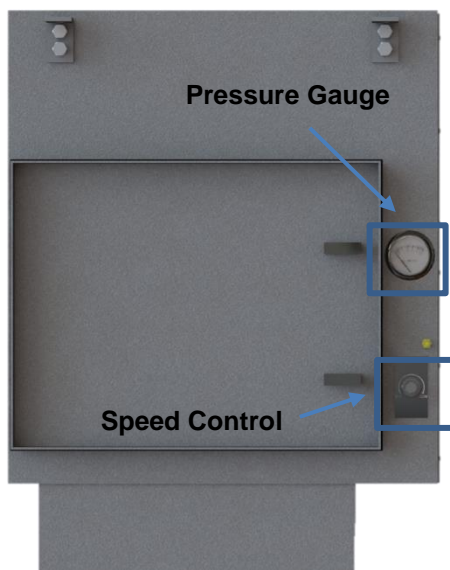
9.5.3. Understanding Gauge & Speed Control (MC)

Pressure Gauge

The MP 1200 gauge measures pressure in, Inch Water Column (Inch W.C.). The units are by convention and due to the historical measurement of certain pressure differentials. It is used for measuring small pressure differences across an orifice.

Normal operating pressure will vary per application. It is always best to make note of pressure gauge reading after initial installation or after filter(s) have been replaced.

Typically when the gauge indicates higher pressures, one of the filters has become too dirty and will need to be replaced or cleaned. Another indication of dirty filter will be machine tool cabinet not being cleared of residual mist.



Speed Control

The speed control dial on the MP 1200 allows for greater control of the amount of suction provided by the MP 1200 mist collector. When this dial is set, the MP 1200 will run at set speed while high pressure is running, when high pressure is shut off the speed dial is by-passed and the blower speed switches to maximum to clear the remaining mist in machine tool cabinet.

The MP 1200 speed may need to be adjusted per application.



Set blower speed to lowest speed setting that keeps machine tool under negative air pressure. As the filters load it will be necessary to increase the blower speed to maintain adequate airflow.

9.6. RC Mountable Chiller (RC)

RC mountable chillers are built specifically for the harsh environment of the CNC machining industry. The intended purpose of the RC unit is to maintain ambient fluid temperatures of 70°F–90°F. Maintaining these temperatures greatly increases the user's ability to hold the tight tolerances that many customers demand. RC unit utilizes an open-loop system, pulling fluid to and from the machine tool tank. The open-loop systems allows the RC unit to run continuously and independently of the high pressure system.



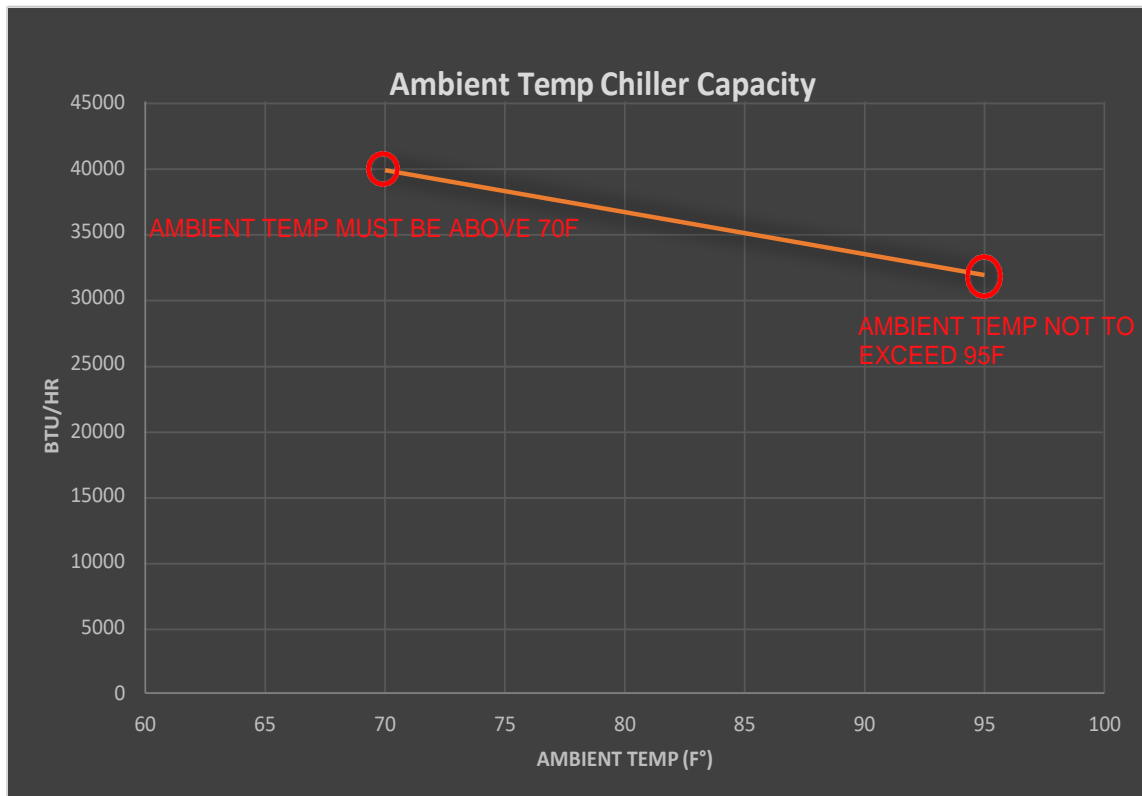
Oil viscosities must be between 90 and 140 SUS @ 100°F.
Pour point must **NOT** be **HIGHER** than 5°F as fluids will not separate.



9.6.1. Chiller Ambient Temperature Chart

Ambient Temperature Chart

Ambient temperature is not to exceed 95°F or go below 70°F. Loss in capacity results when ambient temps are outside the operating range. If set point temperature is greater than 2° below ambient temperature a loss of capacity is possible.



Pump Model	RF8/VR8	RT/VRT/RF16/VR16
HP PUMP	15264	30528
Circulation Pump	2544	2544
Feed Pump	2544	2544
Total BTU Load	20352	35616

To calculate heat load on machine add total kilowatt or horsepower rating of coolant pumps in machine tank. 1kW=3412 BTU total kW X 3412 = total BTU's 1HP=2544 BTU total HP X 2544 = total BTU's

If you have any questions, comments, or concerns, please call us at (877) 689-1860 to speak to a Service Technician

MPSYSTEMS-I-001/01 (Ambient Temperature Chart)

9.6.2. Mounting Instructions (RC)

- Lift RC unit with properly rated straps or chains (300lbs);
 - Use (4) eye bolts to lift units.
 - Orientate as shown.
 - Run 1" Inlet hose through lid of R Series.



- Use the (3) mounting points shown, to align RC unit in the correct position;
 - A person(s) should be present to assist in alignment.




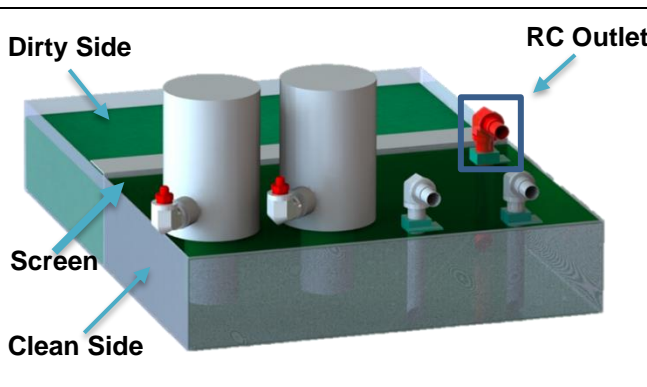


- Use supplied 1/4–20 x 3/4" bolts to fasten RC unit to R Series;
- RC unit mounted.



9.6.3. Plumbing Instructions (RC)

Once the RC chiller unit has been mounted and securely fastened, the following steps will need to be taken to ensure the RC unit functions correctly:

<ul style="list-style-type: none"> ▪ Connect 1" RC unit inlet hose to circulation pump located in R Series; 	
<ul style="list-style-type: none"> ▪ Connect 1/2" hose from RC unit return to R Series tank; 	
<ul style="list-style-type: none"> ▪ Connect supplied 3/4" polywire hose to RC unit return hose barb; <ul style="list-style-type: none"> ○ Open gate valve all the way. 	
<ul style="list-style-type: none"> ▪ Install supplied 1" dip tube in clean side of machine tool tank; <ul style="list-style-type: none"> ○ Mount dip tube with supplied mounting bracket. ○ Install dip tube away from pumps and R Series dip tubes. This will allow the 'chilled' fluid to better circulate in machine tool tank. 	

9.6.4. Electrical Installation

Once RC unit has been mounted and all plumbing has been completed, the electrical connections will need to be made. *MP SYSTEMS* has designed the RC mountable chiller to be plug and play, this allows for a simpler installation.

(2) power/control harnesses will need to be connected to ensure RC unit can properly communicate with the R Series;

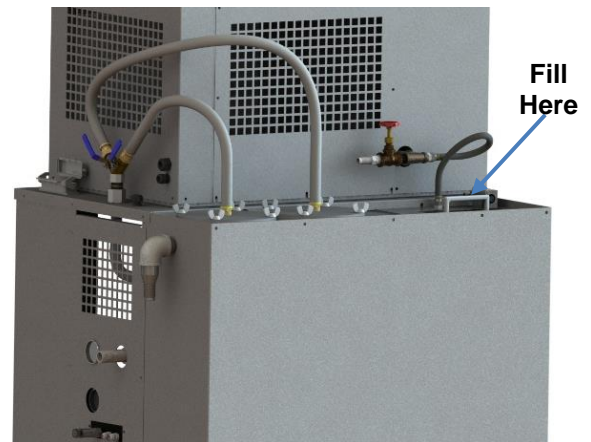
- (1) – 4/8 pin Harting connector;
 - 3 phase power.
 - Control signals for RC unit.
- (1) – 4 pin round connector;
 - Control signals for supply pump located in R Series.



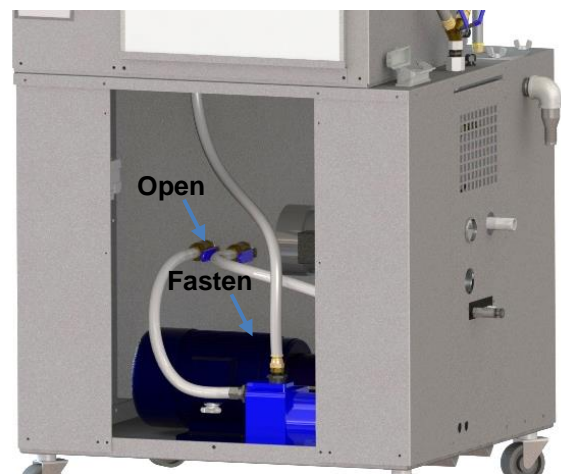
Refer to **Section 6.3.2.1. Control Signal Explanation** to ensure the correct control signals were installed when R Series control harness was installed.

9.6.5. Priming & Start-Up

- R Series vertical reservoir must be filled before RC unit can be primed;



- Ensure outlet hose for circulation pump has been firmly fastened;
- Open 1" ball valve leading from R Series reservoir to 1HP circulation pump;
 - Gravity will force fluid into circulation pump.



- Priming is complete;
- Re-attach side panel;
- RC mountable chiller is ready to run.



9.6.6. Settings (RC)

MAIN SCREEN

- ### - Control Mode (Setpoint/Ambient Tracking)
- ### ~ F- Ambient/Setpoint Temperature
- ### ~ F- On/Off
- ### ~ F- Inlet Temperature
- # - Compressor Status
- # - Circulation Pump Status
- ## - Operating Mode [HI, LO, HT, SL]



###>###~F ###
I>###~F # # ##

INFO SCREEN

① (Information) Button on PLC control pad will display current PLC version.

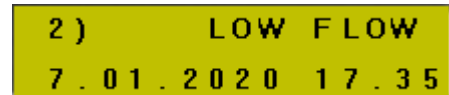
- ### - Run Signal Source [SIG, SHD, OVR]
- ### ~ F- Ambient Temperature



EPP RC V2.19
AMB>###~F

ALARM SCREEN

▲▼ (Up, Down) Button on PLC control pad will Display the last 10 alarms along with the date and time of occurrence.



2) LOW FLOW
7 . 0 1 . 2 0 2 0 1 7 . 3 5

Press [1] & [2] keys simultaneously to access password screen. Use this function to access the following menu options.

0515 [↶] – User Menu

SET TIME -

Sets system time. 24hr Clock Format
(for scheduling and logging events)

TIME : HH : MM : SS
< < ~ 2 : 46 : 44 > >

DATE – DD/MM/YY

Sets system date
(for scheduling and logging events)

DATE : DD / MM / YY
< < ~ 1 / 08 / 20 > >

TRACKING TEMPERATURE

ABOVE AMBIENT –

Provides an offset (above ambient) when
chiller is set to tracking mode.

Default = 0°F

TRACK ~F> AMBIENT
< < ~ 0 ~F > >

TEMPERATURE CONTROL MODE –

Determines if chiller's target temperature will
be fixed (static) or allowed to match ambient
temperature (tracking).

Default = Tracking

MODE : TRACKING = 1
STATIC = 0 < < ~ > >

STATIC TEMPERATURE –

Set static/constant temperature.

Default = 72°F

STATIC SETPOINT :
< < ~ 2 ~F > >

AUTOMATIC SCHEDULE ON/OFF -

Chiller runs automatically based
on day and time of the week.

Default = off

SCHEDULED RUN :
ON - 1 OFF - 0 < < ~ > >

MON-FRI AUTOMATIC START/STOP –

Sets chiller start and stop times
Monday – Friday. 24hr format

WEEKDAY TIME
< < ~ 0 : 00 - 00 : 00 > >

SAT-SUN AUTOMATIC START/STOP –

Sets chiller start and stop times
Saturday – Sunday. 24hr format

WEEKEND TIME
< < ~ 0 : 00 - 00 : 00 > >

DEFAULT RESET –

Reset PLC settings to factory defaults.

Code = 1234

DEFAULTS : RESET
< < ~ ~ ~ ~ > >

9.6.6.1. Settings (RC)

3434 [↵] – Setup Menu

CHILLER SLEEP MODE –

Determines if chiller will hibernate when inlet temperature is equal to target temperature for a specified time.

Chiller will restart automatically if inlet temperature is no longer equal to or below target temperature, or on startup of high pressure pump.

Default = on

```
SLEEP MODE :  
ON - 1  OFF - 0  < < ~ > >
```



SLEEP MODE DELAY–

Elapsed time before chiller will hibernate when inlet temperature is equal to target temperature for a specified time.

Default = 5 min

```
SLEEP MODE : DELAY  
MM : SS  < < ~ 5 : 0 0 > >
```

9.6.7. Alarms 'RC'

	RC unit uses one alarm output to interface with R Series. If a fault occurs, a signal is sent to the alarm circuit on R Series, which, typically, will put machine tool into a feed hold. The units PLC will display fault type.
	Alarm will not clear off PLC display until fault has been rectified. Once fault has been remedied, press [1] to clear alarm.

<u>ALARM DISPLAY</u>	<u>SYMPTOM(S)</u>	<u>CAUSE</u>
LOW FLOW	Less than 5GPM through heat exchanger	<ul style="list-style-type: none"> ▪ Heat exchanger clogged. ▪ Circulation pump rotation reversed.
OVERLOAD	Motor overload tripped	<ul style="list-style-type: none"> ▪ Electric motor short cycle. ▪ Electric motor shorting. ▪ Load on motor too great. ▪ Electric motor overload set too low. ▪ Electrical short in system causing overload to trip.
INLET OUT OF RANGE	Sensor fault	<ul style="list-style-type: none"> ▪ Inlet temperature out of range.
OUTLET OUT OF RANGE	Sensor fault	<ul style="list-style-type: none"> ▪ Outlet temperature out of range.
HP PUMP FAULT	R Series high pressure system fault	<ul style="list-style-type: none"> ▪ R Series Fault.

9.6.8. Maintenance (RC)



Before carrying out any operation on the unit, ensure that the power supply has been switched to the 'OFF' position.
Before working on the unit, carefully read the safety instructions set out in **Section 2. Safety Measures**

It is good practice to carry out periodic checks on machine, in order to ensure it is working properly. Routine maintenance does not require special technical knowledge; however, it should be carried out by trained personnel.

Maintenance operations are essential for keeping the unit at its highest efficiency, from the point of view of both efficiency and energy usage.

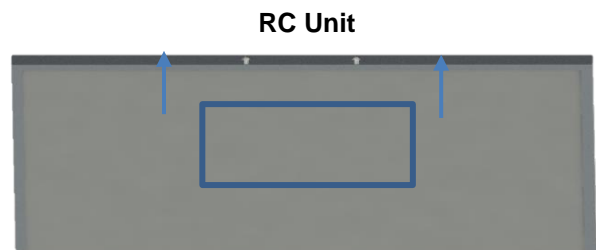
<u>ROUTINE MAINTENANCE</u>		
Group/Component	Operation	Maintenance Interval
Machine Structure	Visually check condition of structure (areas of corrosion and/or dents).	Yearly
Hydraulic Circuit	HOSES – Visual check for leaks in hydraulic circuit.	Monthly
Electrical Components	Check current usage and seating of electrical components.	Yearly
Media Filter	Visually check for debris build up.	Monthly

9.6.8.1. Media Filter

- Shut down R Series before any maintenance is performed.
- Loosen brackets (top/bottom).
- Slide media filter out.



- Clean with mild detergent or soapy water.
- Media filter can be dried using compressed air, if needed.
 - **DO NOT** re-install wet.
- When re-installing media filter, ensure flow arrows point up towards heat exchanger in RC unit.



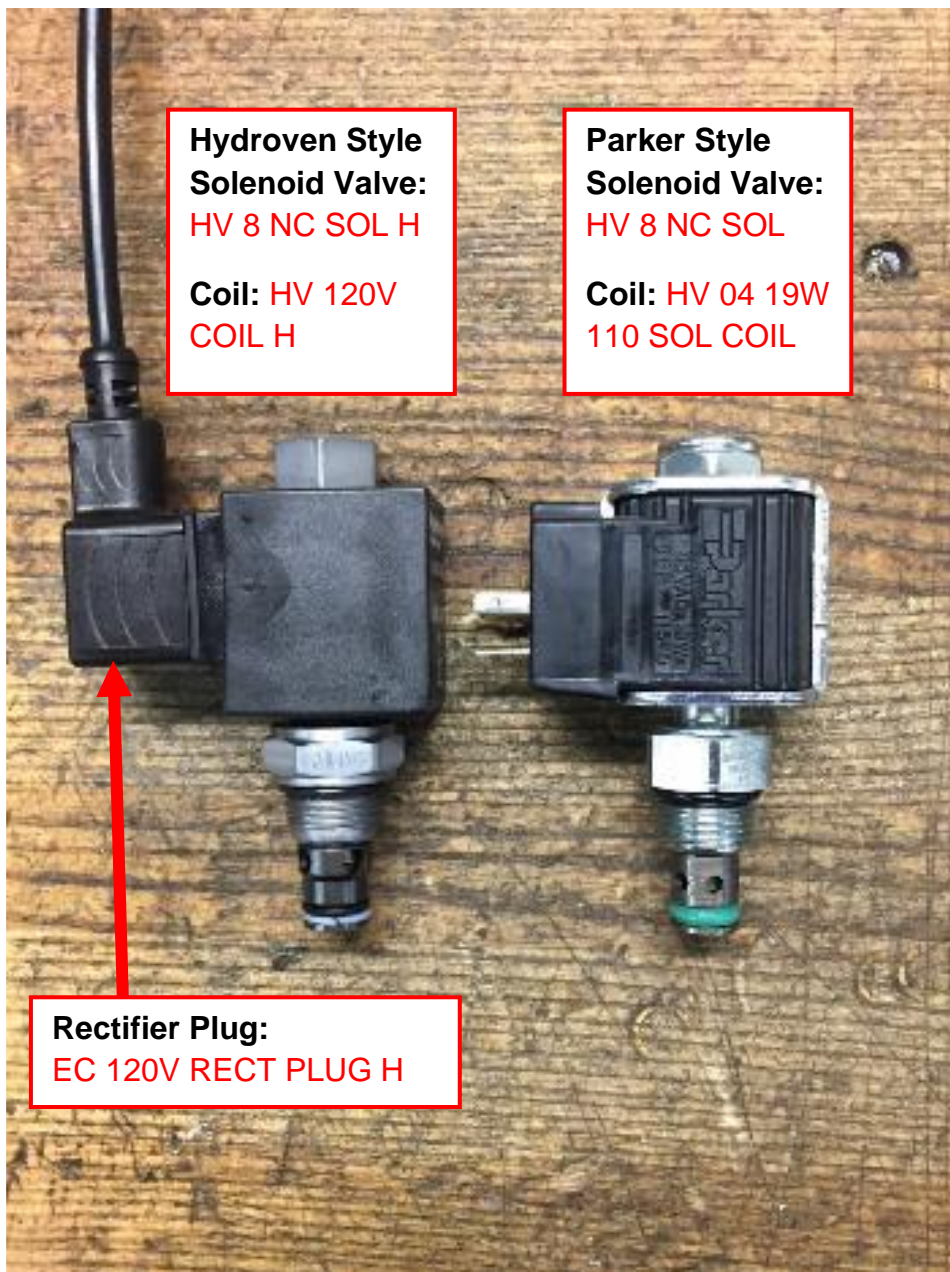
10. Spare Parts

11. <u>SPARE PARTS</u>		
Part Name	Part #	
<u>R Series</u>		
Filter Vessel O-Ring	M ORING	
Clear Tank Cover	M COVER RF	
Filter Bag (5 Micron)	HB BAG ORING #2 5MC 7X32	
High Pressure Motor Contactor	ED CA7 30 00 120	
Supply Pump Motor Contactor	ED CA8 9 10120	
7.5HP Motor Overload	208-230VAC	460VAC
	ED KTA7 25H 25A	ED KTA7 25H 16
1HP Feed/Supply Pump Overload	208-230VAC	460VAC
	ED KTA7 25S 4A	ED KTA7 25S 2.5
Feed/Supply Pump	AHP FP 1 HP SCO	
Feed/Supply Pump Shaft Seal	AK SHAFT SEAL KIT	
High Pressure Pump (Water/Oil)	P D10 8@1750	
High Pressure Pump Valve Rebuild Kit (Abrasive)	P D 10 KIT AD	
Tank Level Sensor	AM FLOAT ASSEMBLY R03	
Solenoid Valves	See 10.1 Solenoid Identifier	
Solenoid Coils	See 10.1 Solenoid Identifier	
<u>MP1200 (MC)</u>		
Stage 1: Baffle (Washable)	MC 806MP18232B	
Stage 2: Mesh (Washable)	MC 806MP182321	
Stage 3: Micro-Cell (Disposable)	MC HE MAIN 18.5X23X11.5	
Fan Motor	MC FAN MOTOR ASSY	
Capacitor	EE CAP 370/440V 15UF	
HEPA-Filter (Add-On)		
HEPA Post Filter (Replacement)	MCF HEPA 24X24X11.5	
HEPA Post Filter (New Install)	MCF HEPA W/BRKT 24X24X11.5	
Other		
6" Poly Wire Hose	HH 6" POLYWIRE	
6" Mounting Collar (Flange)	HC 6" COLLAR	
Please contact <i>MP SYSTEMS</i> for spare parts not listed, (877) 689-1860		



MP SYSTEMS recommends stocking (10) spare filter bags.

10.1 Solenoid Identifier



10.2 Relief Valve Identifier



11. Hose Identification



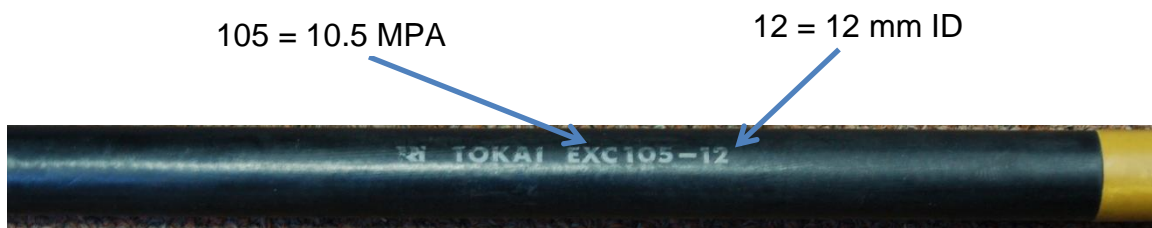
Following information used to determine hose rating, hose size, fitting size, and fitting style.

Identifying High Pressure Hose & Fittings

High pressure hoses are typically labeled with size and rating of the hose (MPA/PSI/BAR). This appendix will assist in, interrupting the hose labels.

<u>MINIMUM HOSE RATING</u>		
MPA	PSI	BAR
7	1015	70
17	2030	140

Tokai High Pressure Hose



The picture above is labeled EXC105-12.

105 = Hose rating.	12 = ID of hose (Metric).
105 = 10.5 MPA	12 = 12 mm

Bridgestone High Pressure Hose



The picture above is labeled PA1004.

10 = Hose rating.	04 = ID of hose (Imperial).
10 = 10 MPA	04 = 1/4" ID

11.1. Fitting Identification

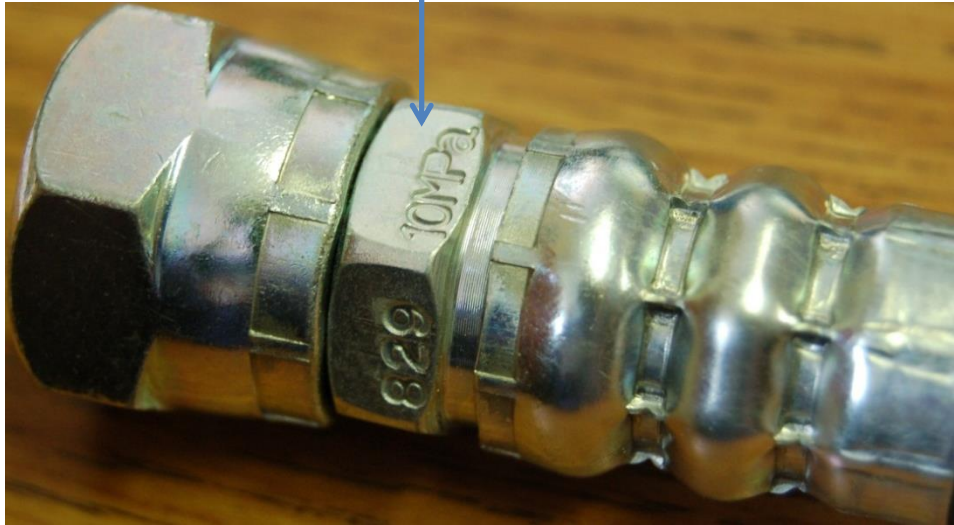


Typically hose fittings will be marked with pressure rating.

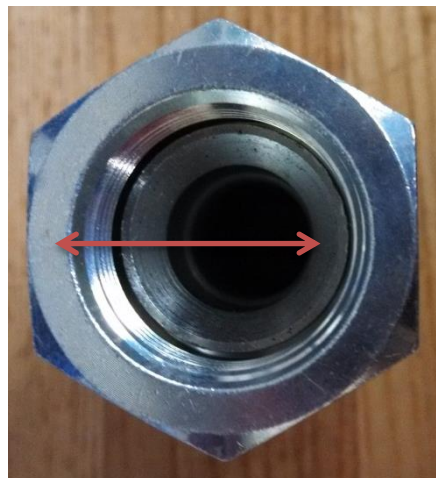


Caution: Be sure that fittings are also rated for correct MPA.

10 MPA



ID (Inner Dimension)



Determining Hose Fittings

JIC Fitting Identification

Fitting Size Inch (mm)	Nominal Size	No. Thread Per Inch	Male Thread OD (Outer Dimension)	Female thread ID (Inner Dimension)
-4 (6)	1/4"	20	11.0 mm	9.9 mm
-6 (9)	3/8"	18	14.1 mm	12.9 mm
-8 (12)	1/2"	16	18.9 mm	17.5 mm
-12 (19)	3/4"	12	26.9 mm	25.0 mm

JIS Fitting Identification

Fitting Size Inch (mm)	Fitting Nominal Size	No. Thread Per Inch	Male Thread OD (Outer Dimension)	Female thread ID (Inner Dimension)
-4 (6)	1/4"	19	13.5 mm	11.7 mm
-6 (9)	3/8"	19	16.7 mm	15.2 mm
-8 (12)	1/2"	14	20.5 mm	18.9 mm
-12 (19)	3/4"	14	26.3 mm	24.4 mm

Komatsu Fitting Identification

Fitting Dash Size	Fitting Nominal Size	Metric Thread Size	Male Thread OD (Outer Dimension)	Female thread ID (Inner Dimension)
-4	1/4"	M14 x 1.5	14 mm	12.5 mm
-6	3/8"	M18 x 1.5	18 mm	16.5 mm
-8	1/2"	M22 x 1.5	22 mm	20.5 mm
-12	3/4"	M30 x 1.5	30 mm	28.5 mm

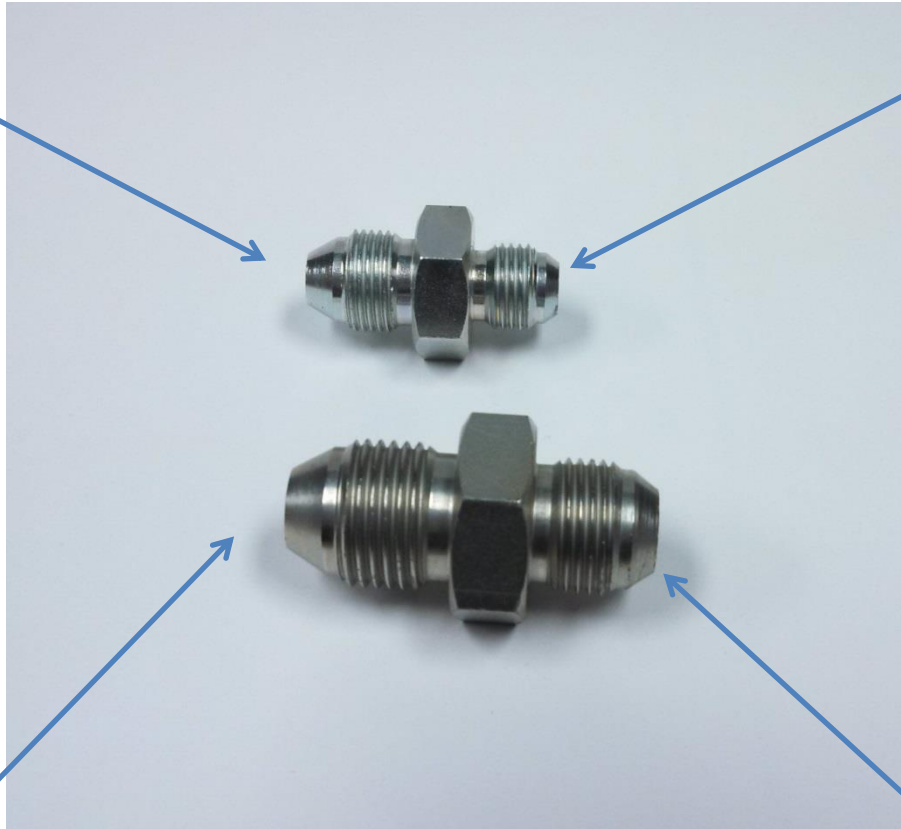


JIC fittings have 37° flare with straight thread.
JIS fittings have a 30° flare with BSP thread (British Standard Pipe Thread).
Komatsu fittings have 30° with metric thread, 19.6 threads per inch.

JIS & JIC Fittings Example

-6 (3/8")
JIS

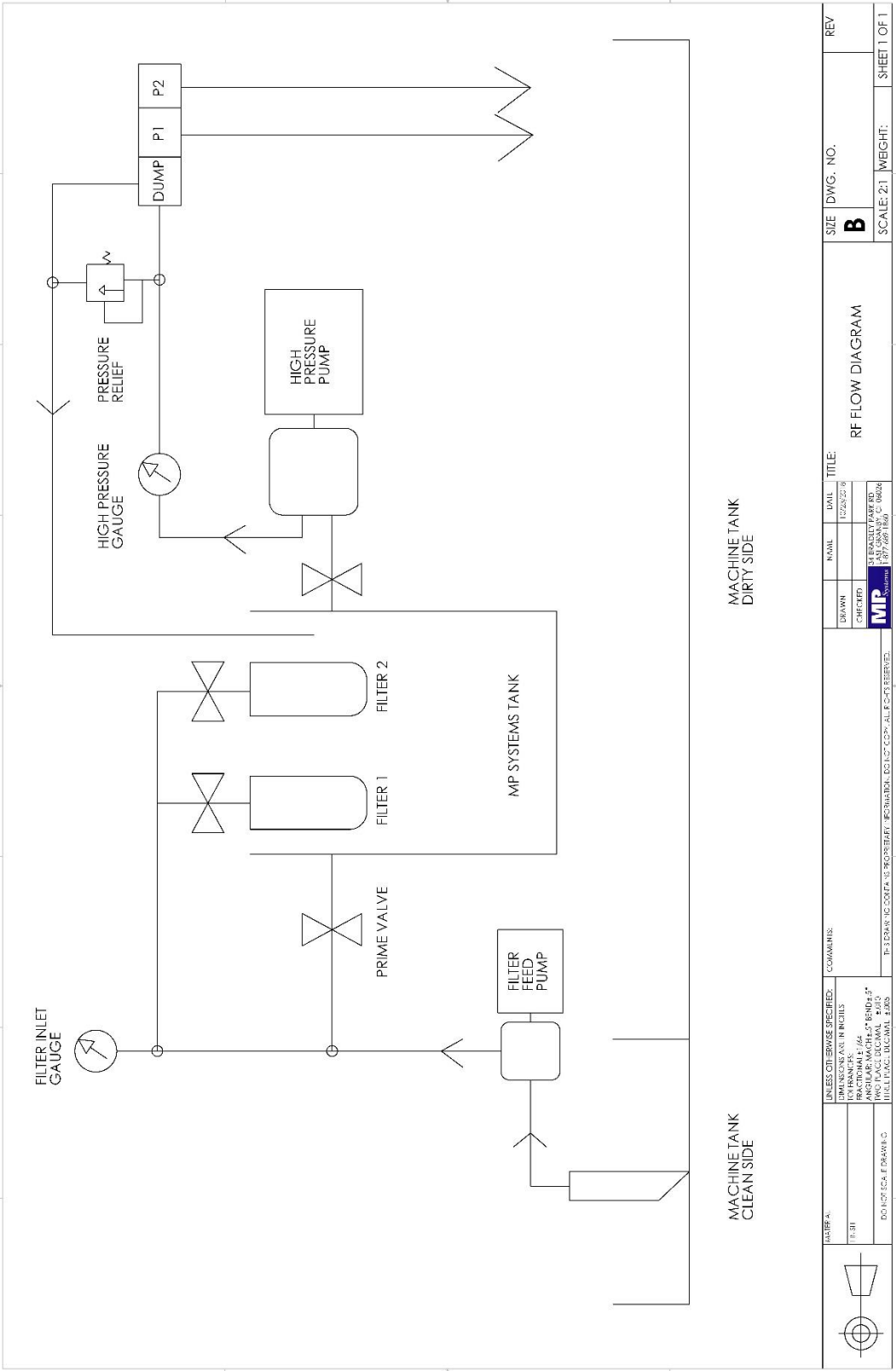
-6 (3/8")
JIC



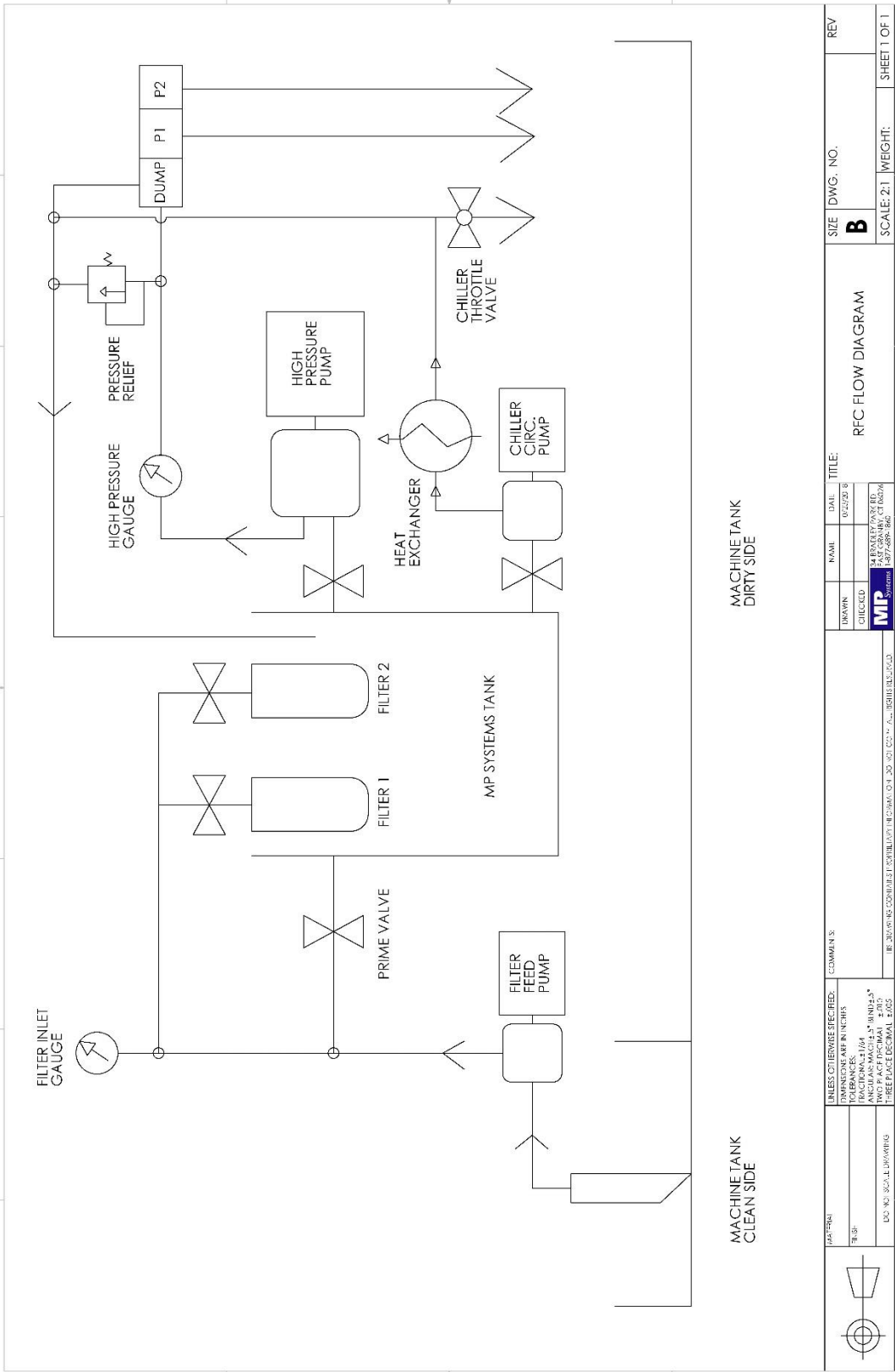
-8 (1/2")
JIS

-8 (1/2")
JIC

RF8 Series Flow Diagram

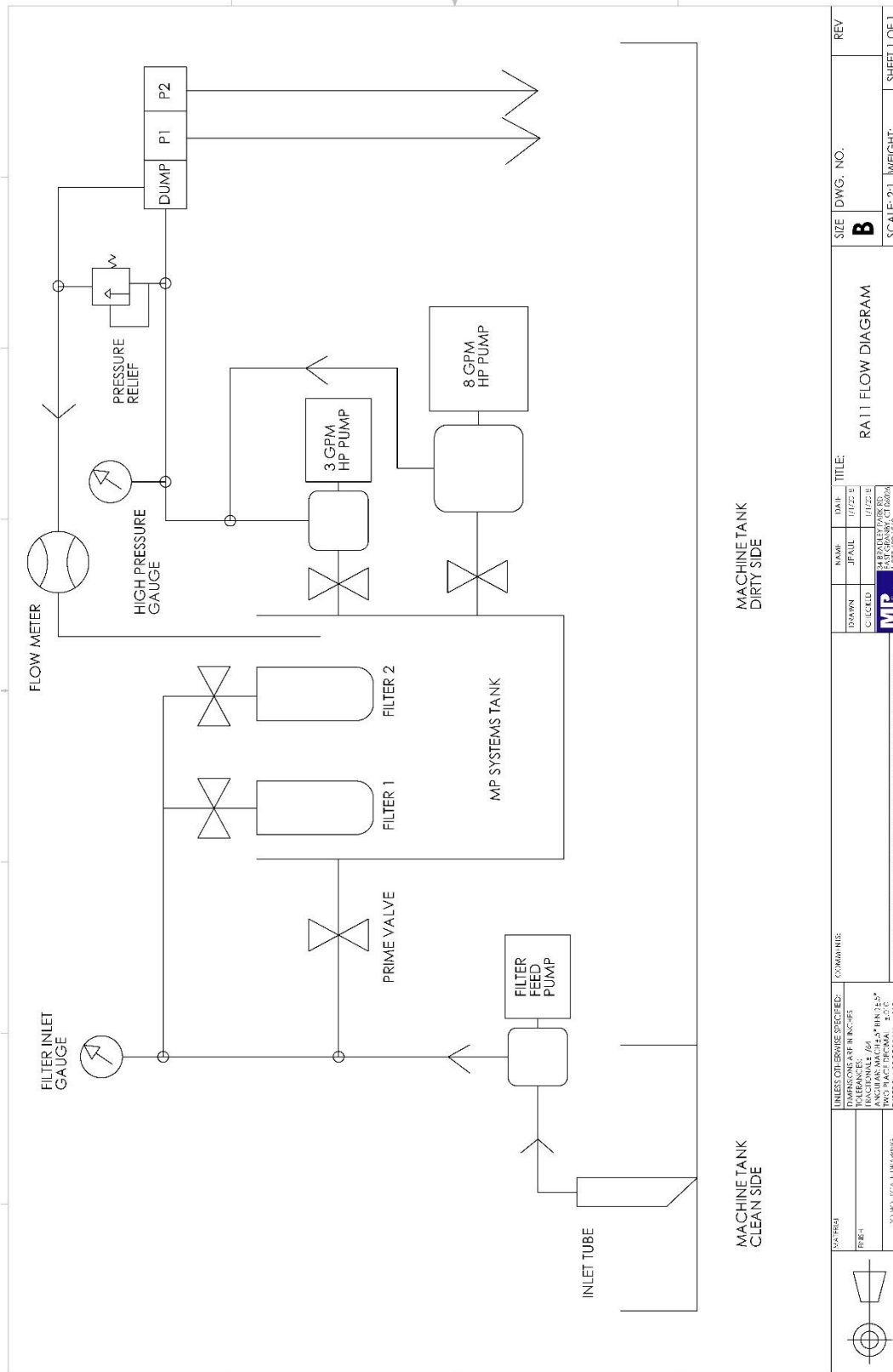


RFC Series Flow Diagram



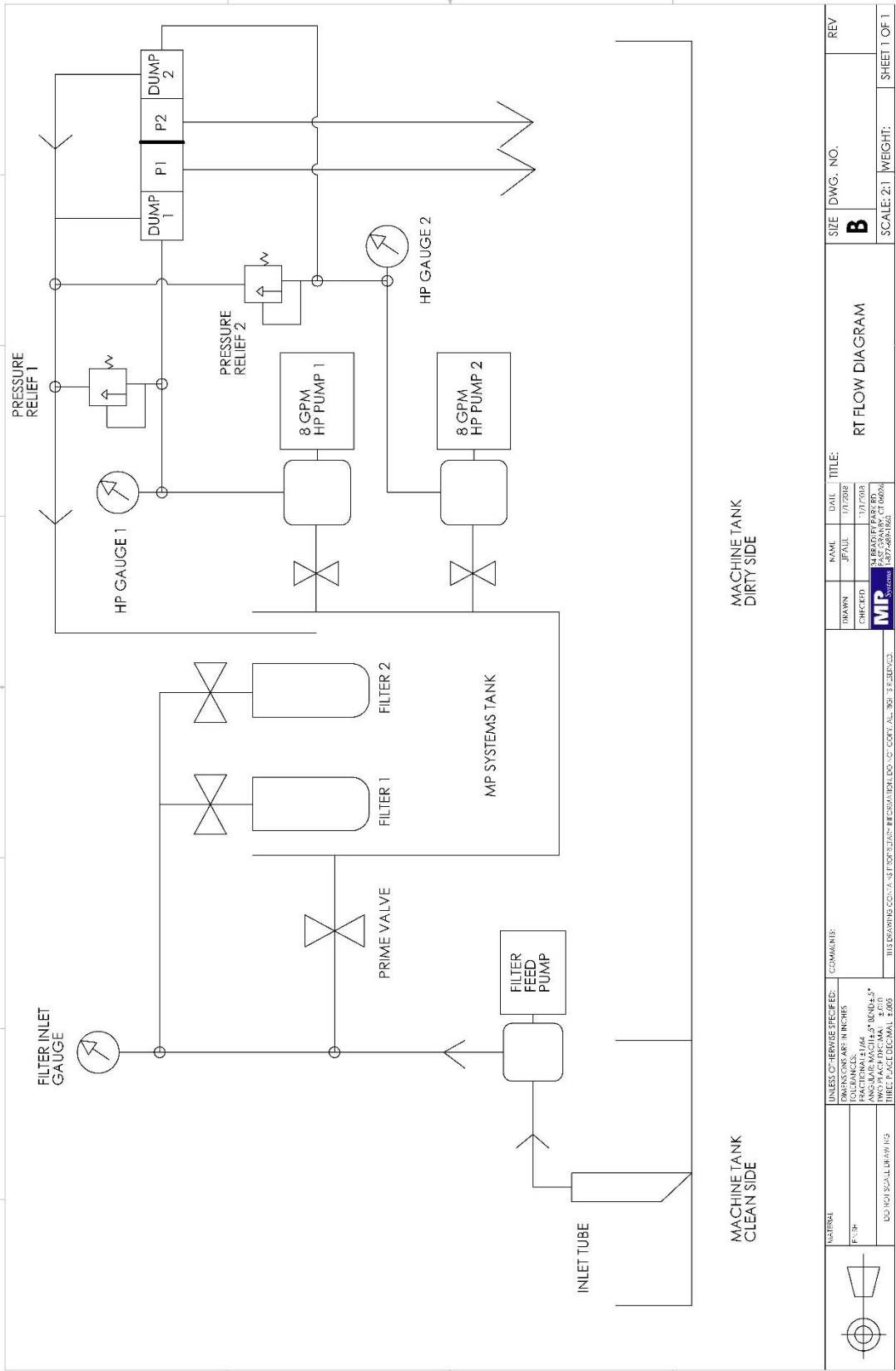
	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONS ± 1/64 DECIMALS ± 0.005 HOLE POSITION ± 0.010 H-REE PLACE DECIMAL ± 0.005	COMMON'S	DRAWN	CHECKED	DATE 01/21/2016	TITLE: RFC FLOW DIAGRAM	SIZE B	DWG. NO.	REV
SCALE: 2:1 WEIGHT: 1387.6880 - 866							SHEET 1 OF 1		

RA11 Series Flow Diagram

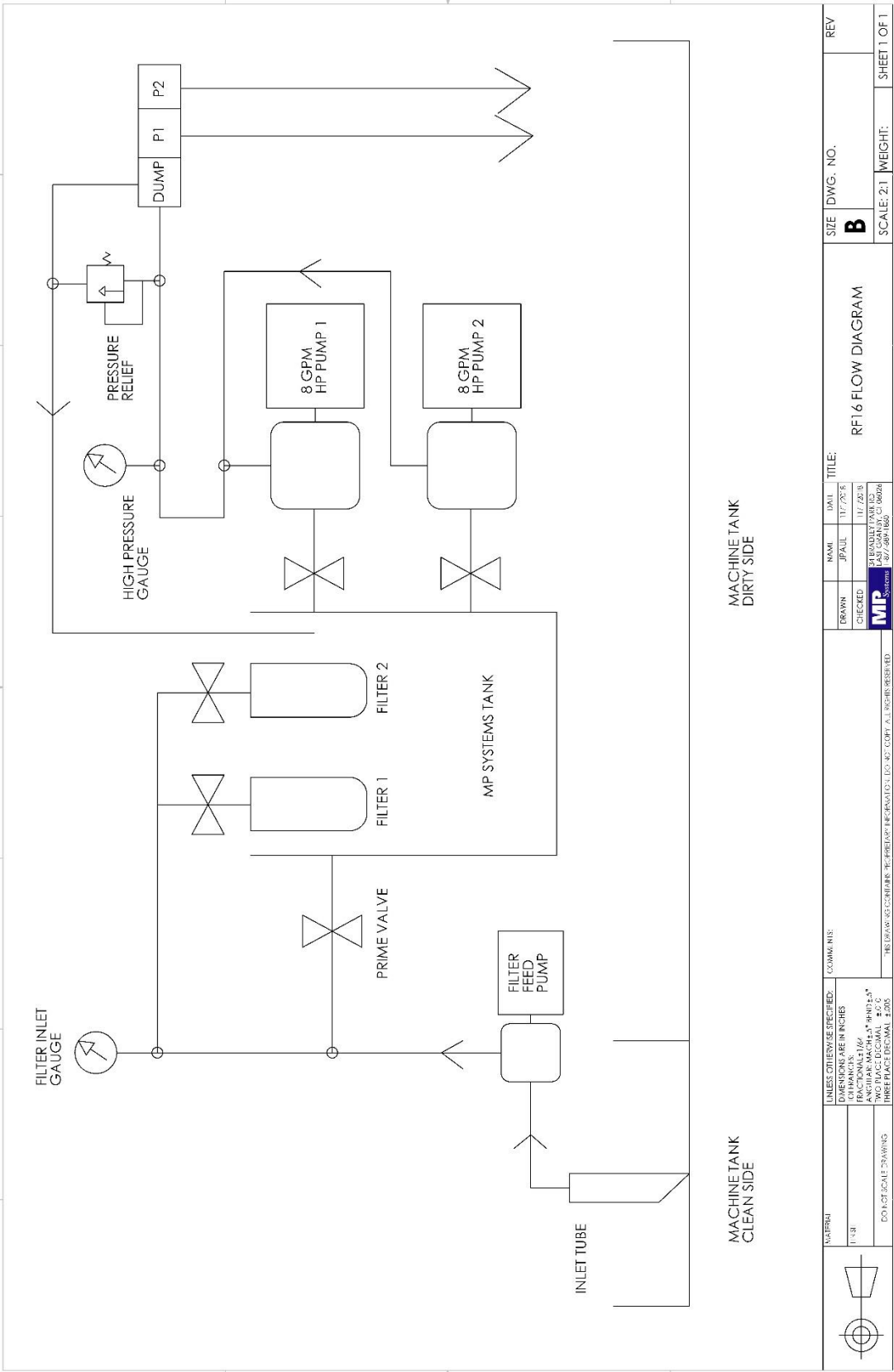


DATE	1/1/22	REV	1
DESIGNED BY	MP	SIZE	DWG. NO.
DRAWN BY	MP	SCALE	2:1
CHECKED BY	MP	WEIGHT	SHEET 1 OF 1
RA11 FLOW DIAGRAM			
TITLE:			
THIS DRAWING IS THE PROPERTY OF MP SYSTEMS. IT IS TO BE USED ONLY FOR THE PURPOSES SPECIFIED. IT IS NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, WITHOUT PERMISSION IN WRITING FROM MP SYSTEMS.			

RT Series Flow Diagram



RF16 Series Flow Diagram



	MATERIALS 1" SAE	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES ANGLES ARE IN DEGREES TWO PLACE DECIMAL THREE PLACE DECIMAL	CROSSING THIS DRAWING IS THE PROPERTY OF MP SYSTEMS, INC. NO PART OF IT MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, WITHOUT PERMISSION IN WRITING FROM MP SYSTEMS, INC.	DRAWN JFAUL	NAME JFAUL	DATE 11/7/2018	TITLE RF16 FLOW DIAGRAM	SIZE B	DWG. NO.	REV
DO NOT SCALE DRAWING										
SCALE: 2:1 WEIGHT: SHEET 1 OF 1										