

## Type: T, A, DK, & G For Ammonia (R-717) and Halocarbon Refrigerants

### Features

- **Protect compressors from liquid carry-over (slopovert).**
- **Avoid continuous liquid buildup in the suction accumulator.**
- **Available in gas pressure transfer, gravity transfer, or pump transfer versions.**
- **Available as an assembled skid-mounted unit, or as a group of components for field assembly.**

### Description

H. A. Phillips & Co.'s compressor protection systems transfer liquid refrigerant carry-over (slopovert) from the low side of the system back to a vessel of higher pressure in order to protect the mechanical integrity of the compressors. Four basic compressor protection system types are available, all of which economically reclaim the required refrigerating effect and avoid continuous liquid refrigerant buildup in the suction accumulator.

In all systems, the excess liquid is first gravity drained from the suction accumulator into a dump trap. The systems differ in where and how they transfer liquid back to the high side.

#### **Type T:**

If a controlled pressure receiver (or other intermediate pressure vessel such as an intercooler or desuperheater) is available, this is the simplest compressor protection system. Excess entrapped liquid refrigerant is transferred from the dump trap to a controlled pressure receiver using compressor discharge gas. The Type T system only operates with an intermediate pressure vessel because it does not develop enough pressure to transfer liquid to the high pressure receiver.

#### **Type A:**

The Type A system transfers excess entrapped liquid refrigerant to the high pressure receiver using a combination of compressor discharge gas and gravity. It is only applicable when the dump trap is located above the high pressure receiver with enough vertical height to allow gravity drainage of liquid refrigerant.

#### **Type DK:**

The Type DK system transfers excess entrapped liquid refrigerant to the high pressure receiver by pressurizing the dump trap to a pressure higher than the receiver pressure. This is accomplished through operation of an interrupting valve located in the compressor discharge line. During normal system operation, the interrupting valve is fully open. During a transfer cycle the valve operates as a differential pressure regulator to ensure the pressure in the dump trap is higher than the pressure in the high pressure receiver. At the end of the transfer cycle, the interrupting valve returns to its fully-open position.

#### **Type G:**

If your system cannot accommodate an interrupting valve in the discharge line, the Type G system provides an alternative. The Type G system transfers excess entrapped liquid refrigerant to the high pressure receiver using a combination of compressor discharge gas and a mechanical pump. Once the transfer cycle starts and the dump trap pressure rises to discharge pressure, a liquid pump provides the necessary head to transfer liquid refrigerant to the high pressure receiver. This centrifugal liquid refrigerant pump, with a small horsepower motor, is capable of overcoming approximately a forty-foot total dynamic head (TDH).

## Compressor Protection System Components

### **Each system may be factory assembled (including wiring) and comes complete with the following:**

#### **Dump Trap:**

Suitably sized for given design criteria to allow adequate liquid refrigerant transfer and to prevent liquid slopover. Vessels meet ASME code for 300 PSI MAWP and -50°F MDMT, dual stamped and National Board registered.

#### **Three-Way Valve:**

Phillips Series 3000 solenoid-operated 3-way valve, with angle filter.

#### **Check Valves:**

Phillips Series 600 and 700 flanged in-line disc and piston type check valves as indicated in system piping schematics.

#### **Service Valves:**

Hand stop valves (with hand wheels or seal caps) as indicated in system piping schematics.

#### **Level Control:**

Phillips model FSP external float switch.

#### **Accessories:**

Each system is supplied with gauge and gauge valve, relief valve and unions as indicated in piping schematic.

#### **Control Panel:**

Factory pre-wired UL Rated NEMA Type 4 enclosure (for T, A, and DK systems), complete with an adjustable off-delay system timer, manual transfer switch, alarm selector switch, terminal block and pilot light indicators.

#### **For G systems only:**

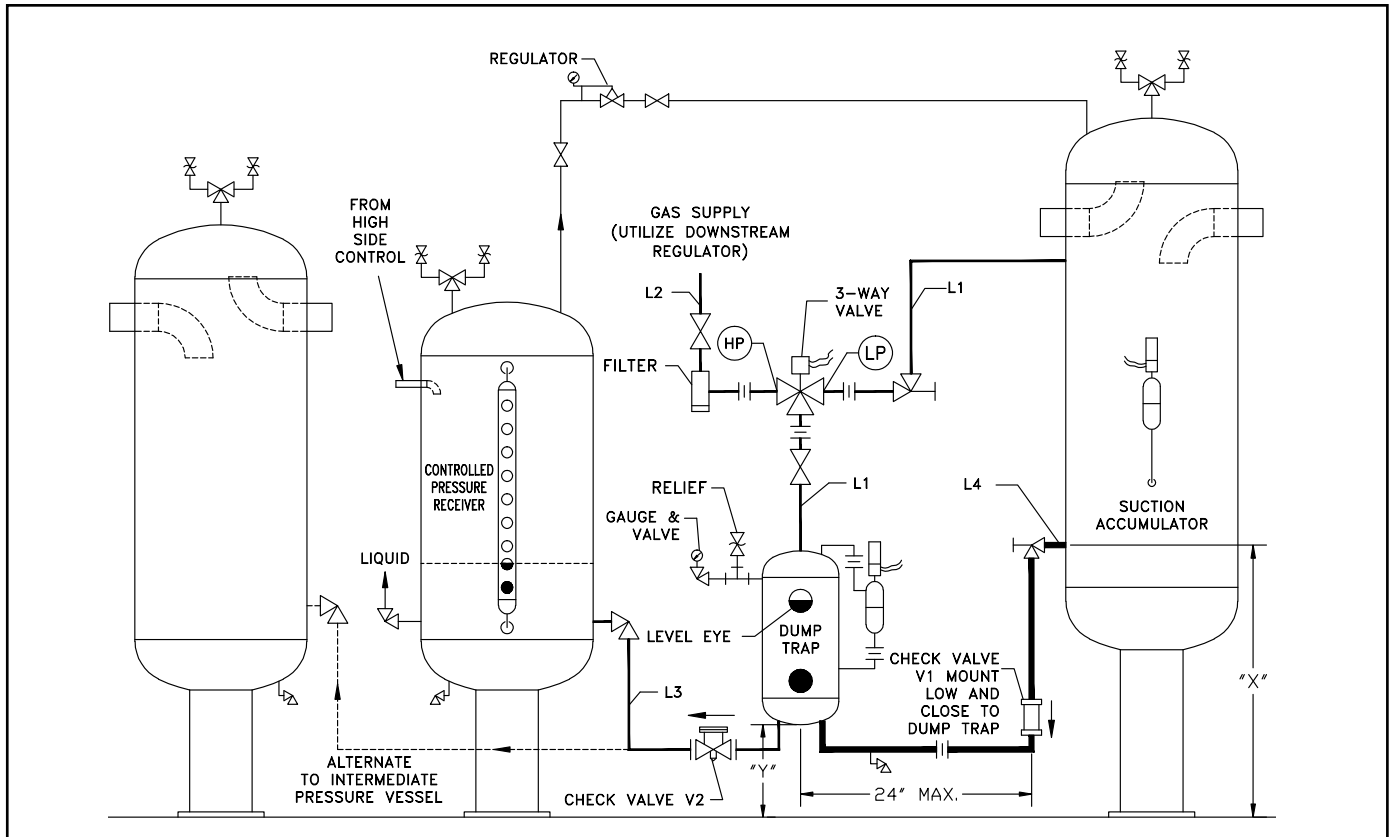
A 230/460 volt (pump power), 120 volt control panel is factory pre-wired in a UL Rated NEMA Type 4 enclosure complete with:

- NEMA rated starter with adjustable solid state OL relay (manual reset)
- Fused disconnect switch with a lockable handle
- OFF time delay relay
- ON time delay relay
- Transfer push button switch
- Control circuit transformer
- Pilot lights
- Terminal strip
- Options:
  - Alarm horn
  - Counter with manual reset

#### **Pump:**

(For Type G systems only) a centrifugal liquid refrigerant pump with a mechanical seal and its own shaft sleeve. The seal may easily be replaced by removing the cover and the impeller without disturbing the piping, or removing the pump from the system. The motor is C-Face mounted (TEFC, 460/230/60/3). Hermetic pumps are available as an option.

## Type "T" Liquid Return System



### ENGINEERING DATA

CATALOG NUMBER*	ACCUM. CAP (TONS)	SYSTEM CAPACITY (GPM)	DUMP TRAP DIA x LNG (IN.)	"X"		"Y" (REF.) (IN.)	IPS LINE SIZES				SHIPPING WEIGHT (LBS.)
				VERT.	HOR.		L1	L2	L3	L4	
							VENT	GAS	TRANSFER	DRAIN	
T187V/H **	140	3.7	12 x 26	30	25	10	3/4	3/4	3/4	1 1/4	270
T287V/H	240	6.1	12 x 26	30	25	10	3/4	3/4	3/4	1 1/2	285
T387V/H	440	10.9	16 x 38	42	27	11	3/4	3/4	1 1/4	2	430
T487V/H	760	19.1	20 x 40	46	33	13	1 1/4	1 1/4	1 1/4	3	670
T587V/H	1480	31.2	24 x 42	50	39	15	1 1/4	1 1/4	2	4	810
T687H	2000	56.5	24 x 72	SP.	42	15	1 1/4	1 1/4	3	4	1180
T787H	3000	73.4	24 x 84	SP.	42	15	2	1 1/4	3	4 (2)	1630

#### Ordering Instructions:

\* When ordering, specify suffix "V" (for vertical dump trap) or suffix "H" (for horizontal dump trap).

\*\* Use next larger size system when accumulator suction temperature is below 0°F.

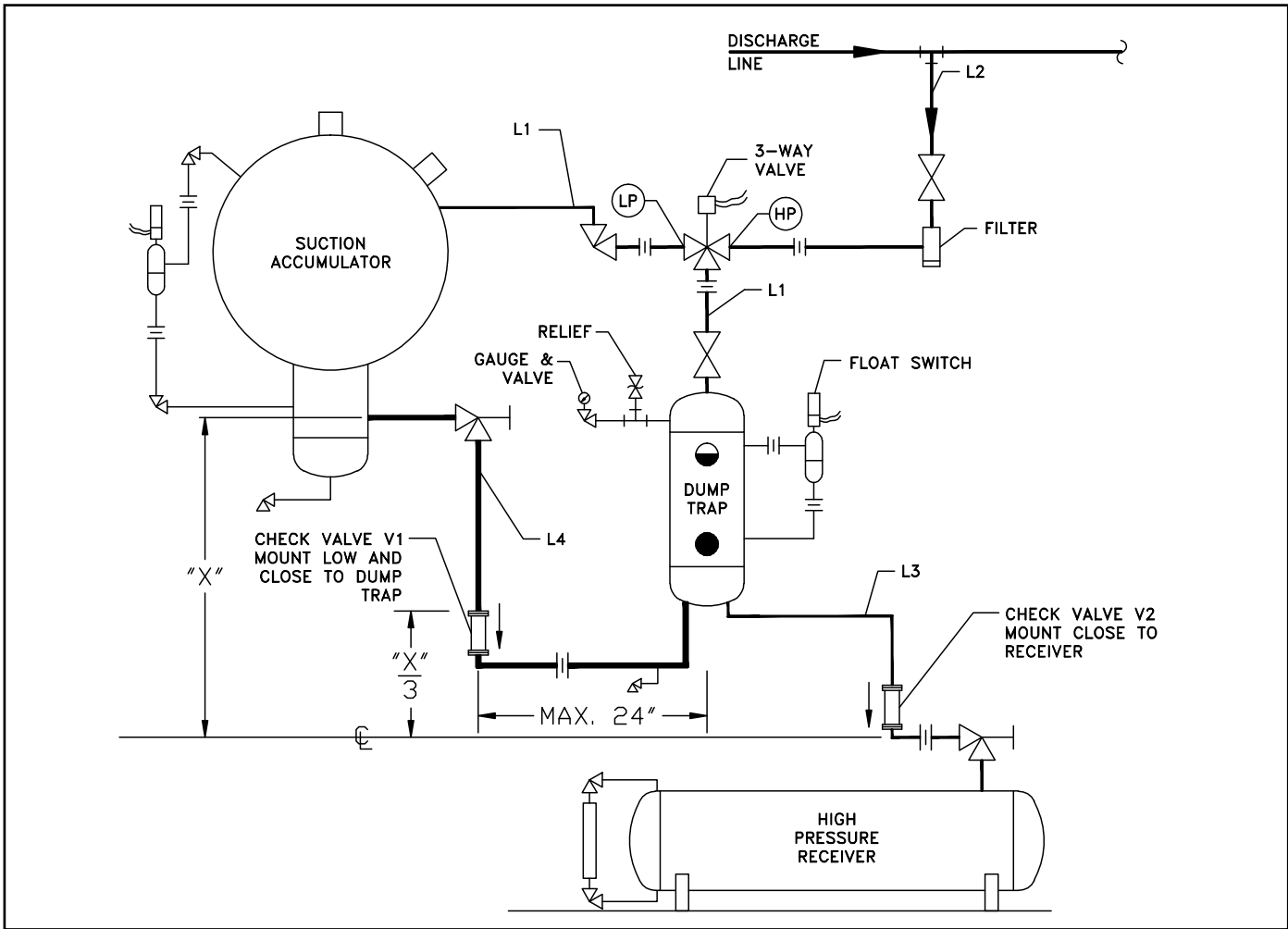
If system is to be used for a Halocarbon refrigerant, use 1/4 of the tonnage ratings shown for R-717.

Add an "F" in front of the Catalog Number. Seal cap valves and accessories will be furnished.

"T" Systems under a different nomenclature can be used for various other applications:

- For transferring excess refrigerant from a pumped liquid recirculation suction accumulator to another vessel, or to a liquid transfer unit that will return it to the high pressure receiver. The dump trap is modified to accept the liquid from the pump discharge header.
- For lifting slopover refrigerant from the vertical outlet header of a plate freezer back to the suction accumulator, greatly reducing pressure drop.
- For lifting liquid in trapped suction lines and transferring to a higher level of suction line, or directly back to the suction accumulator, or to a liquid transfer unit that will return it to the high pressure receiver.

# Type "A" Liquid Return System



## ENGINEERING DATA

CATALOG NUMBER*	ACCUM. CAP (TONS)	SYSTEM CAPACITY (GPM)	DUMP TRAP DIA x LNG (IN.)	"X" (MIN REQ'D, IN.)		IPS LINE SIZES				SHIPPING WEIGHT (LBS.)
				VERT.	HOR.	L1	L2	L3	L4	
						VENT	GAS SUPPLY	TRANSFER	DRAIN	
A187V/H**	100	2.7	12 x 26	38	28	3/4	3/4	1 1/4	1 1/4	270
A287V/H	200	6.7	12 x 26	40	30	3/4	3/4	1 1/2	1 1/2	285
A387V/H	300	7.5	16 x 38	55	36	3/4	3/4	2	2	450
A487V/H	800	20.2	20 x 40	62	45	1 1/4	1 1/4	3	3	700
A587V/H	1320	33.3	24 x 42	70	55	1 1/4	1 1/4	4	4	850

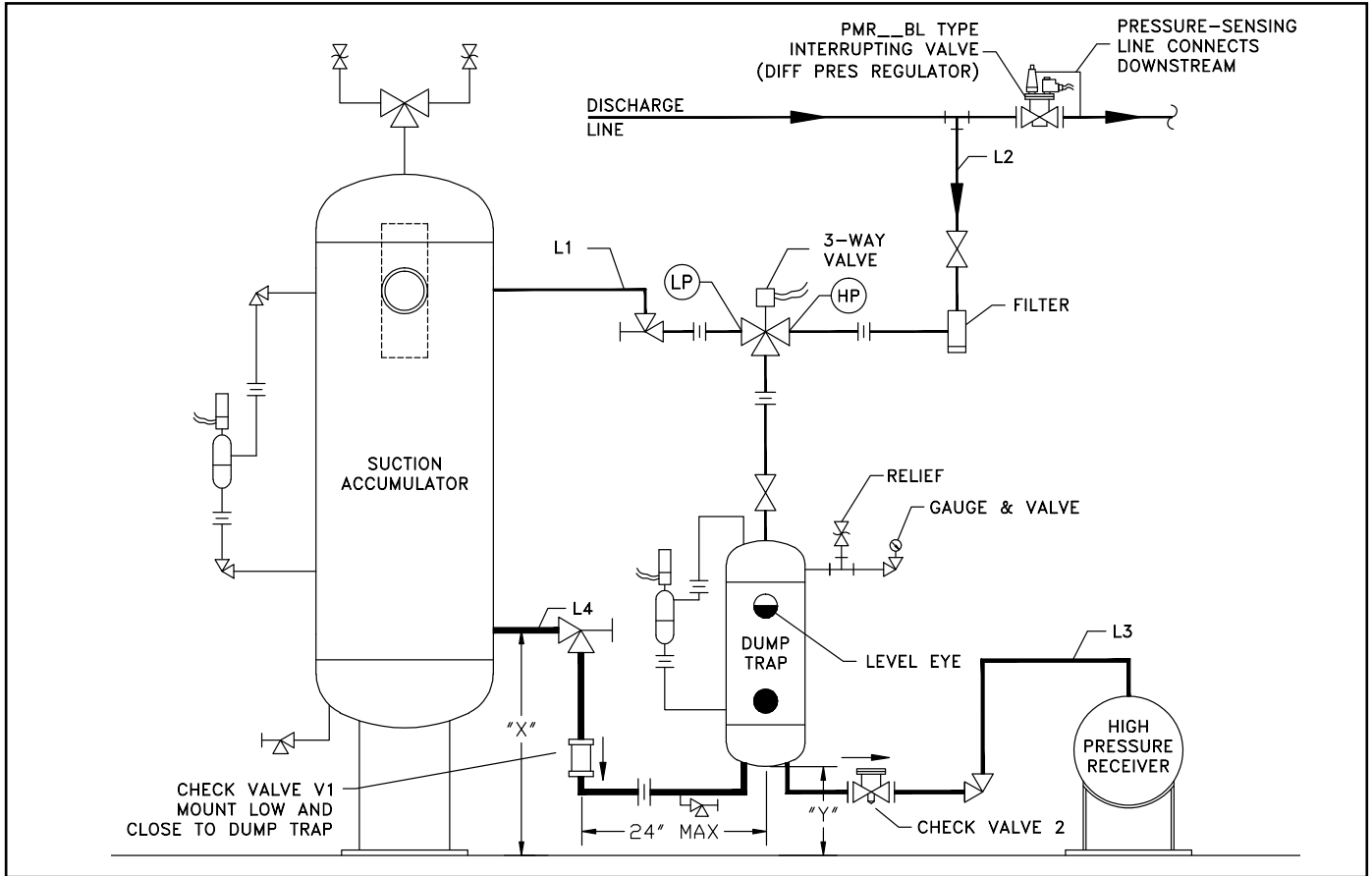
### Ordering Instructions:

\* When ordering, specify suffix "V" (for vertical dump trap) or suffix "H" (for horizontal dump trap).

\*\* Use next larger size system when accumulator suction temperature is below 0°F.

If system is to be used for a Halocarbon refrigerant, use 1/4 of the tonnage ratings shown for R-717. Add an "F" in front of the Catalog Number. Seal cap valves and accessories will be furnished.

# Type "DK" Liquid Return System



## ENGINEERING DATA

CATALOG NUMBER*	ACCUM. CAP (TONS)	SYSTEM CAPACITY (GPM)	DUMP TRAP DIA x LNG (IN.)	"X" (MIN REQ'D, IN.)		"Y" (REF.) (IN.)	IPS LINE SIZES				SHIPPING WEIGHT (LBS.)
				VERT.	HOR.		L1	L2	L3	L4	
						VENT	GAS	TRANSFER	DRAIN		
DK187V/H**	120	3	12 x 26	30	25	10	3/4	3/4	3/4	1 1/4	270
DK287V/H	200	5.1	12 x 26	30	25	10	3/4	3/4	3/4	1 1/2	285
DK387V/H	360	9.1	16 x 38	42	27	11	3/4	3/4	1 1/4	2	430
DK487V/H	560	14.2	20 x 40	46	33	13	1 1/4	1 1/4	1 1/4	3	670
DK587V/H	1160	29.2	24 x 42	50	39	15	1 1/4	1 1/4	2	4	810

### Ordering Instructions:

Order "DK" system based on accumulator tonnage.

\* When ordering, specify the suffix "V" (for vertical dump trap) or suffix "H" (for horizontal dump trap).

\*\* Use next larger size system when accumulator suction temperature is below 0°F.

If system is to be used for a Halocarbon refrigerant, use 1/4 of the tonnage ratings shown for R-717.

Add an "F" in front of the Catalog Number.

### INTERRUPTING VALVES FOR DK SYSTEMS

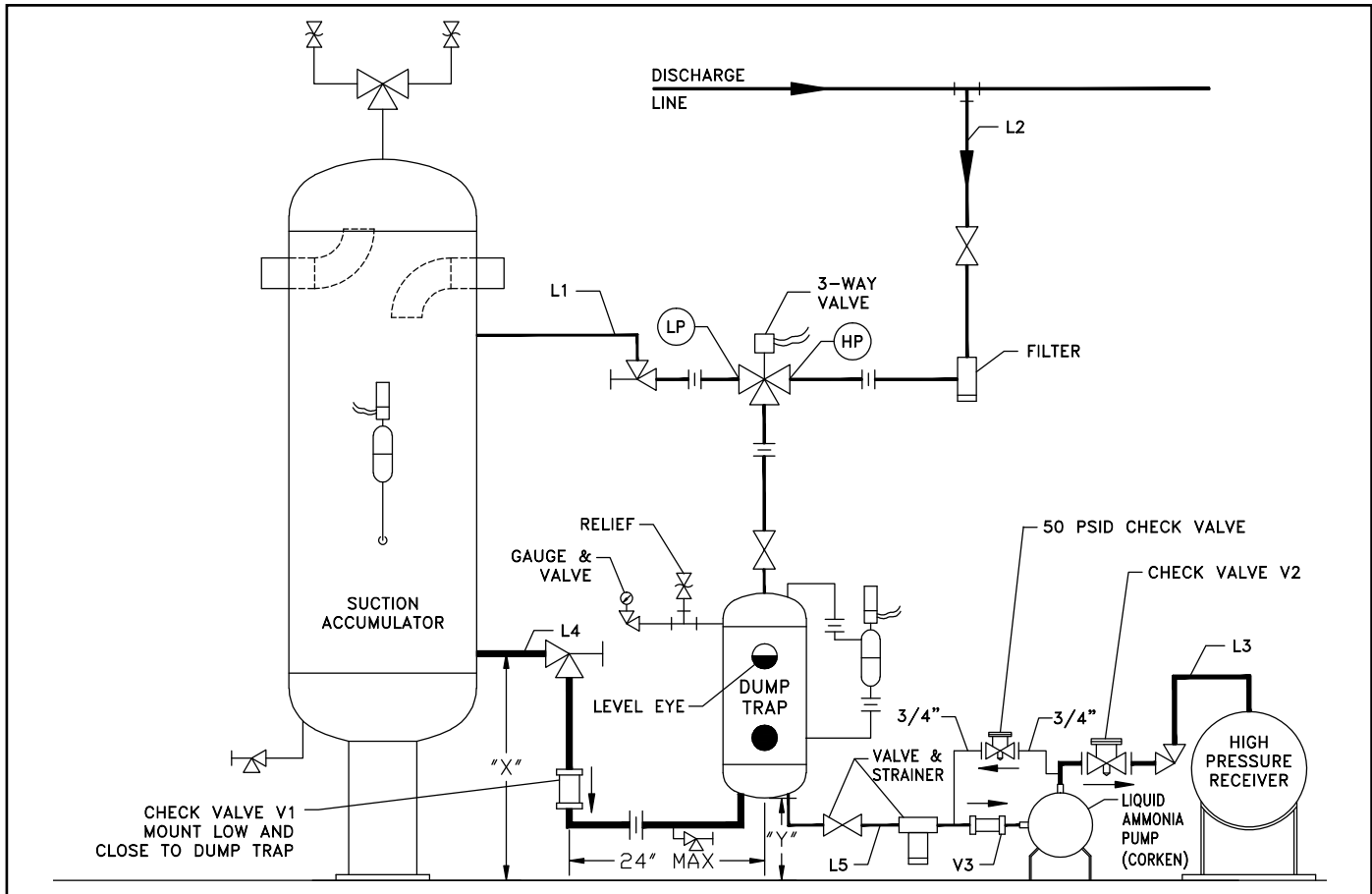
VALVE CATALOG NUMBER	PLANT TONS (R717)	PIPE SIZE (IPS)	SHIPPING WEIGHT (LBS.)
PMR40BL	80	1 1/2 ; 2	40
PMR50BL	140	2	55
PMR65BL	320	3	175
PMR80BL	640	4	265
PMR100BL	1160	5	380
PMR125BL	1800	6	400

### Ordering Instructions:

Order the interrupting valve based on tonnage of the discharge line to be used for its installation.

Never use an interrupting valve that is more than one pipe size smaller than the usable discharge line.

## Type "G" Liquid Return System



### ENGINEERING DATA

CATALOG NUMBER*	ACCUM. CAP (TONS)	SYSTEM CAPACITY (GPM)	DUMP TRAP DIA x LNG (IN.)	"X" (MIN REQ'D) (IN.)		"Y" (REF.) (IN.)	IPS LINE SIZES					PUMP MOTOR (HP)	SHIPPING WEIGHT (LBS.)
				VERT.	HOR.		L1 VENT	L2 GAS SUPPLY	L3 TRANSFER	L4 DRAIN	L5 PUMP SUCTION		
G187V/H**	120	3	12 x 26	30	25	10	3/4	3/4	1	1 1/4	1 1/4	3/4	415
G287V/H	170	4.3	12 x 26	30	25	10	3/4	3/4	1	1 1/2	1 1/4	3/4	435
G387V/H	360	9	16 x 38	40	30	11	3/4	3/4	1 1/4	2	1 1/2	2	650
G487V/H	560	14	20 x 40	46	35	13	1 1/4	1 1/4	1 1/4	3	1 1/2	2	960
G587V/H	1040	26	24 x 42	56	45	19	1 1/4	1 1/4	2	4	2	3	1595
G687H	1200	30	30 x 48	SP.	47	21	1 1/4	1 1/4	3	4	3	3	1900
G787H	2000	50	24 x 84	SP.	47	21	2	1 1/4	3	4 (2)	3	5	2500

#### Ordering Instructions:

\* When ordering, specify suffix "V" (for vertical dump trap) or suffix "H" (for horizontal dump trap).

\*\* Use next size system when accumulator suction temperature is below 0°F.

If system is to be used for a Halocarbon refrigerant, use 1/4 of the tonnage ratings shown for R-717. Add an "F" in front of the Catalog Number. Seal cap valves and 'Freon' accessories will be furnished.

The standard wired control panel is 120 Volt control; motors are dual 230/460/3/60 voltage.

The Corken standard pump furnished with the systems above is centrifugal type with a mechanical seal. Hermetic pumps are optional. Optional pumps may require changes to piping schematic.

## Filling Dump Trap from Suction Accumulator

### All System Types

Liquid refrigerant is first separated and entrapped in a suction accumulator. It then drains by gravity through a check valve into the dump trap and accumulates until its level reaches the upper Level Eye®. A float switch operates the three-way valve through the off-delay relay, closing the vent line and allowing discharge pressures into the dump trap. This immediately causes the inlet check valve to close. Liquid is then transferred according to system type.

## Transfer of Liquid to High Side

### Type T

The supply gas pressurizes the dump trap beyond the pressure of the intermediate pressure vessel (controlled pressure receiver, intercooler or desuperheater), and liquid transfer begins. After the liquid level in the dump trap falls about two inches, the off-delay timer starts to time out and maintains the dump cycle until the dump trap is emptied. When the transfer cycle times out, the three-way valve is de-energized and the dump trap is vented to the suction accumulator. The inlet check valve opens and draining resumes.

**Setting the timer:** The timer should be set to drain the dump trap completely past the outlet check valve.

### Type A

The supply gas pressurizes the dump trap to discharge pressure, and with the assistance of gravity, the liquid starts to drain into the high pressure receiver. After the liquid level in the dump trap falls about two inches, the off-delay timer starts to time out and maintains the dump cycle until the dump trap is emptied. When the transfer cycle times out, the three-way valve is de-energized and the dump trap is vented to the suction accumulator. The inlet check valve opens and draining resumes.

**Setting the timer:** The timer should be set so that all liquid in the outlet drain line is completely emptied past the hand valve at the receiver.

### Type DK

The solenoid on the interrupting valve is de-energized, and the valve switches from fully-open to differential pressure regulation. This ensures that the pressure in the dump trap is 20 psi higher than that in the high pressure receiver. High pressure gas flowing through the three-way valve into the dump trap transfers liquid to the high pressure receiver. When the transfer cycle times out, the interrupting valve solenoid is re-energized and the three-way valve is de-energized. The interrupting valve opens fully, and the dump trap is vented to the suction accumulator. The inlet check valve opens and draining resumes.

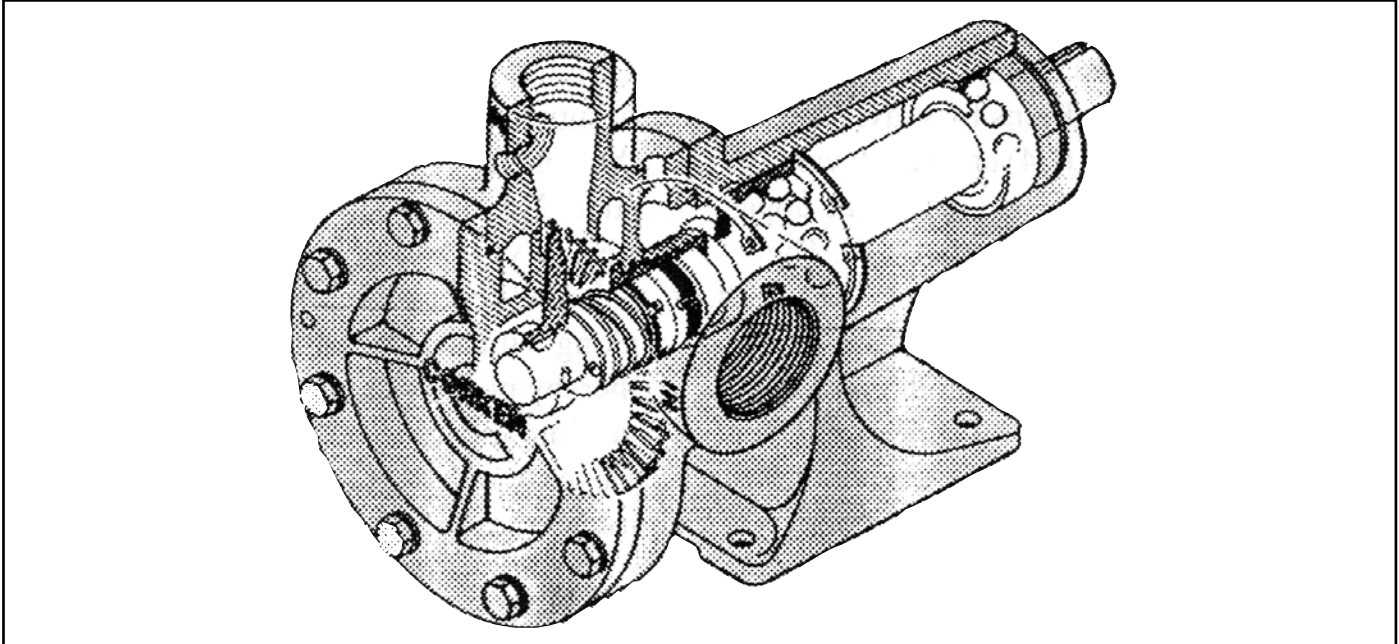
**Setting the timer:** The timer should be set to drain the dump trap completely past the outlet check valve. At the end of the transfer cycle, the interrupting valve is energized to open wide for normal flow of discharge gas to the condenser.

### Type G

The supply gas pressurizes the dump trap to discharge pressure and, after a time delay set by the on-delay timer in the wired control panel, the liquid pump motor starts and liquid refrigerant is transferred to the high pressure receiver. When the transfer cycle times out, the pump is stopped, the three-way valve is de-energized, and the dump trap is vented to the suction accumulator. The inlet check valve opens and draining resumes.

**Setting the timer:** It is imperative that the off-delay timer that controls the total timing of the transfer cycle be set so that the cycle is terminated when the liquid level in the dump trap drops to the middle of the lower Level Eye® on the dump trap. Never let the pump run to a point where the liquid seal on the pump is lost. If this occurs, the life of the mechanical seal will be greatly compromised.

## Refrigerant Transfer Pump



- NPSH is of no concern in the type “G” system.
- The 3/4-hp and 2-hp Corken liquid ammonia pumps used in the “G” systems are fitted with a special sleeve-mounted balanced mechanical seal. The 3-hp and 5-hp pumps are fitted with a standard mechanical seal.
- Heavy duty ball bearings provide precision operation and long service life. There are no shaft sleeve bearings operating in the liquid.
- The one moving part, the impeller, floats on the shaft with no rubbing, grinding, or metal-to-metal contact.
- The Corken pump is easily serviced from the front cover. There is no need to remove the pump from the system. Special operating clearance adjustments are not required.
- C-Face mount TEFC motor.
- The 3/4 horsepower pump on the smaller “G” systems are available for 120/60/1 power.

## General Installation Hints

- On all systems, always mount the inlet gravity check valve in a vertical position as low and as close to the dump trap as possible. If necessary, slant the drain line towards the dump trap if the dump trap is somewhat remote from the drain outlet of the suction accumulator.
- On Type A systems, mount the outlet check valve in a vertical position as close to the receiver as possible. Only on an installation where the mounting parameters are extremely restrictive should the gravity type check valves be mounted in a horizontal position. On all other systems mount the piston type outlet check valve below the lower Level Eye® of the dump trap, generally in a horizontal line.
- Insulate the dump trap; do not insulate the check valves.
- It is **very important** to take special care in setting the off-delay timer that controls the cycle operation, as described in the “Sequence of Operation” section.

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