

# Understanding Hot Gas Bypass

Hot gas bypass is recommended when the load on an evaporator varies and operation of the air conditioning system is desired at lower than design conditions. Additionally, hot gas bypass is used when the evaporator coil is designed for comfort cooling (latent and sensible loads) versus precision cooling (all sensible loading). If return air conditions will be 72°F / 50%RH or lower the unit should incorporate the hot gas bypass option.

Hot gas bypass provides an artificial load on the evaporator by introducing a portion of high pressure, high temperature gas to the evaporator / suction side of the system. The use of hot gas bypass can be accomplished in several ways. This Tech Tip covers the Standard (External) Hot Gas Bypass. Please refer to Tech Tip TT-002 for an explanation on Internal Hot Gas Bypass.

### Standard (External) Hot Gas Bypass

Standard (External) Hot Gas Bypass consists of a valve located in the condensing section. The inlet of the hot gas bypass valve is piped from a tee in the discharge line between the outlet of the compressor and inlet

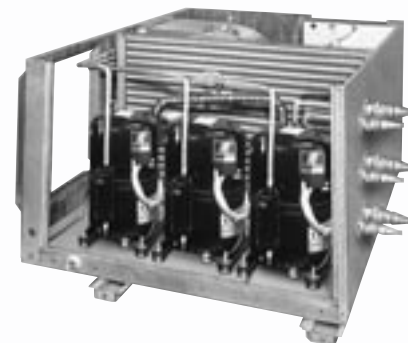
of the condenser. The outlet of the bypass valve is piped to a tee between the expansion valve and the distributor of the evaporator coil. A check valve is installed in the evaporator section in the hot gas line before it enters the suction side. This is to prevent the liquid in the bypass "off cycle" from filling the line and slugging the refrigerant lines on bypass / compressor start cycle. Refer to Figure 1 (see next page) for an illustration of how a single circuit unit is piped. During operation, if the suction pressure falls below 58 psig, the valve will modulate open to introduce a portion of the hot discharge gas to bypass the condenser coil and be injected into the evaporator coil after the expansion valve thus raising the temperature and pressure. This eliminates the coil from freezing and the system from going off on low pressure.

If the system will be split, a third refrigerant line must be installed between the condensing section and the evaporator section. This line must be insulated to prevent heat loss from the discharge line to the ambient.

Line sizing should be calculated to not exceed a 6 to 12 psi pressure drop. To select the correct refrigerant pipe size for the External Hot Gas Bypass reference Table 1 for units of 50 feet of run or less. Refer to Table 2 for piping runs between 50 and up to 100 feet. For anything over 100 feet, contact United CoolAir Corp. After brazing and leak checking, evacuate the hot gas line-set and break the vacuum with a small

amount of refrigerant gas. Refer to the Operation and Maintenance Manual for additional charge recommendations for split units.

Considerations affecting the choice of this hot gas bypass configuration are related to labor and material to install the third refrigerant line as well as architectural restraints.



\*\* Evaporator Same Level, Lower or Higher than Condensing Unit (Max Lift 20')

Compressor Tonnage	Hot Gas Line
1 Ton	3/8
1.5 Ton	1/2
2 Ton	1/2
2.5 Ton	1/2
3 Ton	5/8
4 Ton	5/8
5 Ton	3/4
6 Ton	5/8
7.5 Ton	5/8
8 Ton	5/8
10 Ton	3/4

**Table 1** – Up to 50 Feet of Refrigerant Piping

\*\* Please note the maximum lift when the Evaporator Section sets lower than Condensing section is 20 feet.

# TechTips

## UNDERSTANDING HOT GAS BYPASS

\*\* Evaporator Same Level, Lower or Higher than Condensing Unit (Max Lift 20')

Capacity	Hot Gas
1 Ton	1/2
1.5 Ton	1/2
2 Ton	5/8
3 Ton	5/8
4 Ton	3/4
5 Ton	3/4
5 Ton Dual	5/8
6 Ton	5/8
7.5 Ton	3/4
8 Ton	3/4
10 Ton Dual	3/4

**Table 2** – 50 to 100 Feet of Refrigerant Piping

\*\* Please note the maximum lift when the Evaporator Section sets lower than Condensing section is 20 feet.

Caution: The following procedures should only be performed by a qualified technician.

### Hot Gas Bypass Operation

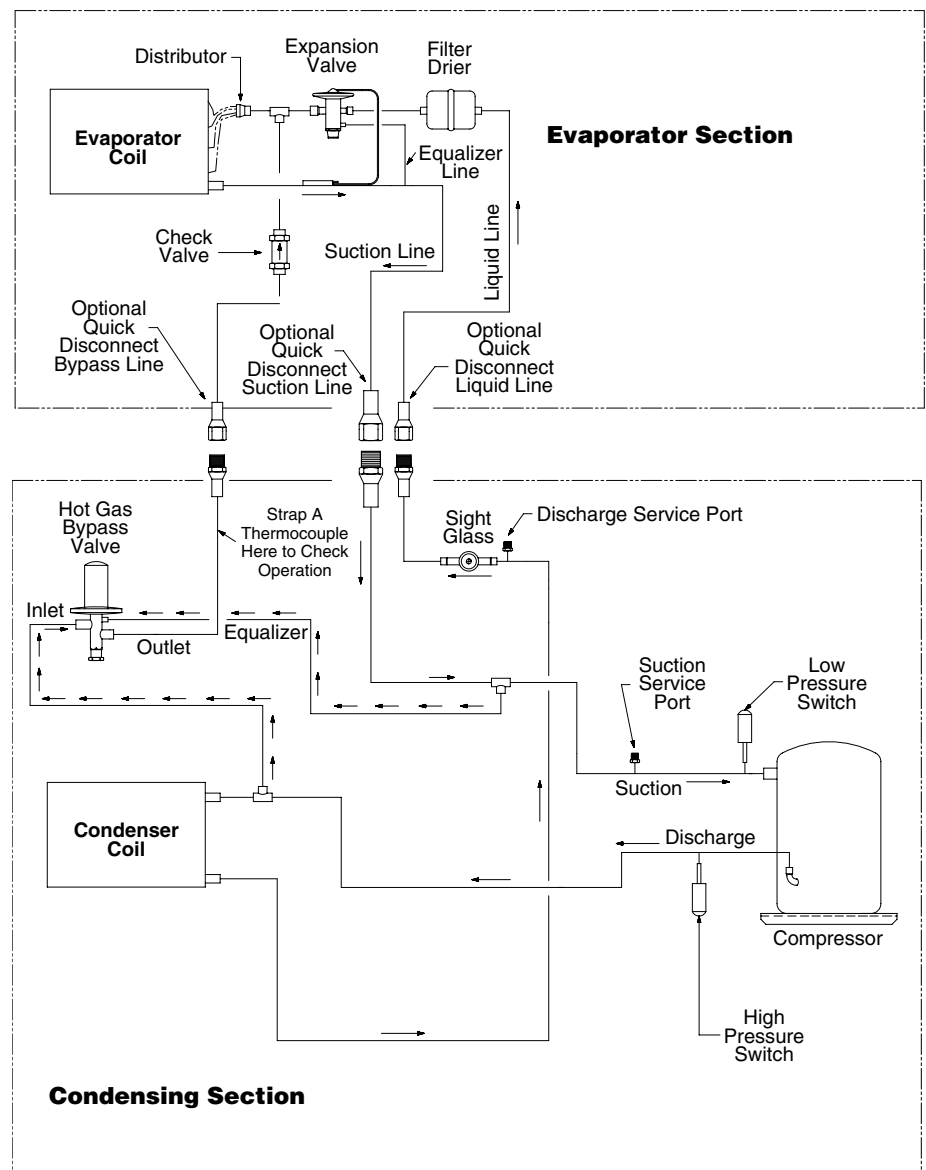
Strap a thermocouple to the refrigerant line outlet of the hot gas bypass valve as illustrated in Figure 1. Connect a set of refrigerant gauges to the suction and discharge service ports of the compressor system. The suction pressure will be used to monitor the bypass activation point which is 58 psig. The discharge pressure will be for reference only during this procedure. Discharge pressure should remain stable throughout the checking and adjustment. Operate the unit in cooling mode long enough to allow the system to stabilize.

If the present load in the space does not allow the suction pressure to drop to 58 psig or

below, partially blocking off the evaporator coil may be required to decrease the load on the coil. As the suction pressure starts to fall below 58 psig, the hot gas bypass should start to modulate open to help stabilize the suction pressure at or just above 58 psig. At this point, the temperature reading

at the thermocouple should start to increase. A reading of 120°F or higher should be observed. If the suction pressure continues to fall below 58 psig and the hot gas bypass outlet temperature does not rise, the valve requires adjustment.

**Figure 1 – Standard (External) Hot Gas Bypass Non-Active Mode**



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## UNDERSTANDING HOT GAS BYPASS

### Hot Gas Bypass Adjustment

If the hot gas bypass opens below 58 psig, the valve must be adjusted to bring the activation point to 58 psig. By turning the adjustment stem one complete turn clockwise, the pressure setting will increase approximately 4 psig. By turning the adjustment stem counterclockwise one complete turn, the pressure setting will decrease approximately 4 psig.

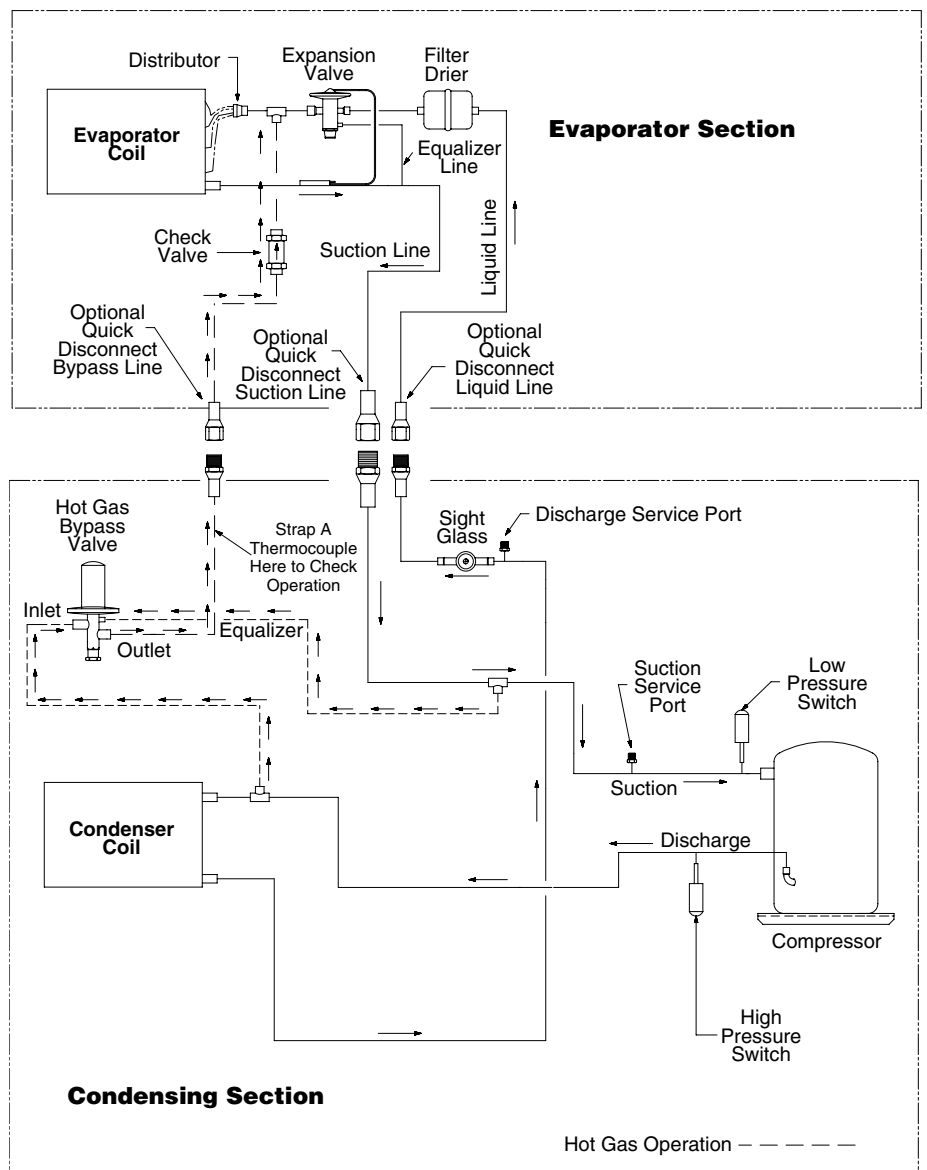
Using an adjustable wrench, remove the cap that covers the adjustment stem of the valve. Make sure to adjust in small increments allowing the system to stabilize between adjustments. Recheck the setting after each adjustment.

Change the thermostat settings a few times and allow the system to cycle through. Vary the load a bit and recheck after the system stabilizes to ensure the suction does not fall below 58 psig. Replace the cap when adjustments are complete.

Field installation of the Hot Gas Bypass Option is not recommended because of having to open the refrigerant system. If there are any questions about the application, we are here as your equipment provider to help with your decision to utilize this option.



**Figure 2 – Standard (External) Hot Gas Bypass Active Mode**



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Notes



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