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Application Recommendations With Baffle Plates

Baffle plates have been used for many years in refrigeration applications to help reduce gas pulsation in discharge line assemblies, this helps to minimize the potential for line failures and refrigerant loss. These baffle plates are orifices that are sized for the refrigerant and application and are used to create a pressure drop to reduce discharge gas pulsation amplitude. The baffle plates are typically installed between the discharge service valve and the compressor body or center cylinder head. They can be effective at the low pulsation frequencies that are common to reciprocating compressors now being produced. Mufflers are typically more effective at higher frequencies but have very low pressure drops. These lower pressure drops result in slightly lower compressor discharge temperatures and slightly higher operating efficiencies. Carlyle has noted several compressor issues recently with our refrigeration compressors when applied with baffle plates with newer HFC refrigerants and POE lubricants. Based on these application issues, this bulletin will review the application limitations of these baffle plates.

Shown are some of the advantages and limitations in applying baffle plates.

Baffle Plate Advantages:

1. Easy to apply on compressor or system. Especially easy on retrofits of existing system that exhibit piping vibration concerns.
2. Effectively reduces pulsation at certain range of operating conditions. Carlyle recommends 6 to 10 psi pressure drop to obtain effective discharge pulsation reductions. This requires different baffle plate sizes for different compressor displacements. A list of our current recommendations is shown in Chart A.
3. The least expensive method of reducing gas pulsation.

Baffle Plate Limitations

1. Baffle plates are effective within certain operating envelopes. Changes in refrigerant can dramatically change refrigerant mass flow and pressure drop. Carlyle has published application recommendations for low, medium and high temperature applications. These should be followed to avoid excessive pressure drops. See Chart A.
2. Baffle plates are typically sized for the refrigerant and application at full design load conditions. When the compressor is unloaded and operated at part load, the mass flow through the compressor is reduced by 1/3, 1/2 or 2/3. This reduction in flow reduces the pressure drop through the baffle plate and its effectiveness in reducing discharge gas pulsation. Mufflers and good piping practices should be considered on compressors with unloaders.

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Baffle Plate Limitations

3. Conversely, system changes that increase the mass flow of the compressor will increase the pressure drop through the baffle plates. Dramatically increasing the suction pressure (in many refrigeration systems, this occurs at the termination of defrost cycles) will result in a large increase of mass flow. This results in very high pressure drops and values as high as 40 to 50 psi have been reported. This is not a problem unless the compressor motor protection limit is reached. In this case, the maximum suction pressure that the compressor is allowed to operate at must be limited.
4. Another operating condition that significantly increases the mass flow is a dramatic decrease in the compressor's discharge pressure. This can occur on systems with floating head pressures. In the wintertime, the discharge pressure may be half or less than what it would be during hot periods in the summer. With reciprocating compressors, this dramatic reduction in discharge pressure increases the volumetric (or pumping) efficiency of the compressor while lowering the discharge temperature of the refrigerant. The combination can result in the same large pressure drops noted in item 3 above. If this occurs, the minimum allowable discharge pressure may have to be limited, or a baffle plate with more holes should be used. This avoids the high pressure drops but compromises the reduction in pressure pulsation at summer time conditions.
5. Finally, compressor start-up can also result in even higher discharge pressure drops across the baffle plate. At start-up, the combination of high suction pressures and low discharge pressures occur. This results in pressure drops of over 100 psi at start-up until the suction pressure drops to design conditions and the discharge pressure rises.

Conclusions and Recommendations

Baffle plates are an effective way to easily reduce gas pulsation but they have several limitations. They can result in too large a pressure drop when the suction pressure is too far above design or the discharge pressure is too far below the design condition. Carlyle, therefore, recommends applying these baffle plates in a manner that avoids the high-pressure drops.

To help avoid some of these high-pressure drops, Carlyle is also implementing several changes in our recommendations. We will now be standardizing on the medium temperature baffle plate recommendation for our 06ER(1/4)150 and 06ER(0/3)099 refrigeration compressors. The new recommended baffle plates are now shown in Chart A.

Where the compressors operate at higher suctions, such as air conditioning applications, baffle plate recommendations are shown in Chart B. Systems designers should use baffle plates built to these specifications in these higher flow applications.

Finally, our best advice would be to only use baffle plates as a service tool on installations where piping vibration has been a problem and it is difficult to correct using mufflers and line clamping. (Mufflers should be first choice in OEM design phase.) Baffle plates are best applied in systems already running. In this environment, the application operating envelope is also better understood and the correct baffle plate can more easily be selected.

CHART A

Carlyle Baffle Plate Recommendations

For Low and Medium Temperature Applications

Compressor Model	Low Temp. R-22/R-404A/R-507			Medium Temp. R-22/R-404A/R-507		
	Part No.	Orifice Dia.	# Orifice holes	Part No.	Orifice Dia.	# Orifice holes
06DR109	Not set-up	3/16"	2	N/A		
06DR013	Not set-up	3/16"	2	N/A		
06DR316	06DA660103	3/16"	3	N/A		
06DR718	06DA660103	3/16"	3	N/A		
06DR820	06DA660103	3/16"	3	06DA660103	3/16"	3
06DR724	06DA660104	3/16"	4	06DA660105	3/16"	6
06DR228	06DA660104	3/16"	4	06DA660105	3/16"	6
06DR337	06DA660104	3/16"	4	06DA660105	3/16"	6
06ER*50	06DA660105**	3/16"	6	N/A		
06ER*65	06EA660145	3/16"	9	N/A		
06ER*75	06EA660145	3/16"	9	N/A		
06ER*99	06EA660145**	3/16"	9	N/A		

* - Can be 0 or 3, 1 or 4, 2 or 5

Note: ** indicates where selections have changed.

CHART B

Carlyle Baffle Plate Recommendations

For Medium & High Temperature Applications

Compressor Model	Medium Temp. R-22/R-404A/R-507			High Temp. R-22/R-404A/R-507		
	Part No.	Orifice Dia.	# Orifice holes	Part No.	Orifice Dia.	# Orifice holes
06DM808	Not set-up	3/16"	2	Not set-up	3/16"	2
06DM313	Not set-up	3/16"	2	Not set-up	3/16"	2
06DM316	06DA660103	3/16"	3	06DA660103	3/16"	3
06DA818	06DA660103	3/16"	3	06DA660103	3/16"	3
06DR820	06DA660103	3/16"	3	06DA660103	3/16"	3
06DR724	06DA660105	3/16"	6	06DA660105	3/16"	6
06DA824	06DA660105	3/16"	6	06DA660105	3/16"	6
06DR228	06DA660105	3/16"	6	06DA660105	3/16"	6
06DA328	06DA660105	3/16"	6	06DA660105	3/16"	6
06DM337	06DA660105	3/16"	6	06DA660105	3/16"	6
06DA537	06DA660105	3/16"	6	06DA660105	3/16"	6
06EM*50	06DA660105	3/16"	6	Not set-up	7/16"	3
06EA*50	06DA660105	3/16"	6	Not set-up	7/16"	3
06EA*65	06EA660145	3/16"	9	Not set-up	3/8"	7
06EM*75	06EA660145	3/16"	9	Not set-up	3/8"	7
06EA*75	06EA660145	3/16"	9	Not set-up	3/8"	7
06EM*99	06EA660145	3/16"	9	Not set-up	3/8"	7
06EA*99	06EA660145	3/16"	9	Not set-up	3/8"	7

* - Can be 0 or 3, 1 or 4, 2 or 5