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TECHNICAL SERVICE BULLETIN

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SUBJECT: KNOW YOUR OIL BURNER NOZZLES
What they are, what they do and how to take care of them.
(Taken from Fuel Oil & Oil Heat)

The nozzle of any high pressure burner seems like a small, insignificant part, but it sure can cause headaches if not pampered and handled with the utmost of respect. The method you employ in handling this piece of equipment, either correctly or abusively, can be the difference between customer satisfaction and dissatisfaction.

Nozzle manufacturing is a precision job, but because of the extremely large number of nozzles used each year, manufacturing must be on a production line basis. There are many nozzle manufacturers, and each strives for the highest quality product possible. Quality control is the password in this business. Testing and packaging are just as important.

Since all manufacturers of high pressure burners do not use the same type of air handling parts, the air patterns of burners vary to the extent that they can be classified as requiring either hollow spray or solid spray nozzles for the best efficiency results. This then requires that each nozzle manufacturer produce both hollow and solid spray nozzles to meet these burner requirements.

In light of the smaller type of equipment being used, higher efficiencies and general dependability of component parts and control systems, it becomes a "must" that all parts be compatible and comply with the burner manufacturer's recommendations.

Nozzles are extremely high on the list of parts that are changed quite regularly, so it becomes very important that the service technician understand the necessity to replace a nozzle with one of the same gallonage, angle of spray, and above all else the correct nozzle to match the air pattern of the burner, which may be either the hollow or solid spray type.

A great deal of time, thought and engineering went into the specifying of the original nozzle on the job. The serviceman must stay with the original "specs" for the nozzle unless something unusual occurs, such as an addition to the home or connection of upper rooms that up to this point had not been finished off for use, all of which adds heating load that must be compensated for.

Any organization providing burner service to any and all types of burners should have a file system to identify each job and list information on the

nozzle capacity, angle of spray and whether the burner requires a solid or hollow cone nozzle.

Until just a few years ago, the burner manufacturer's recommendation as to the type nozzle had to be relied upon or the memory of an old-timer if the manufacturer was no longer around. The only equipment for determining the air pattern of a burner, and therefore the type of nozzle to be used, was not portable and available only for research and laboratory work.

Today we have available two easy-to-operate, portable pieces of equipment that determine the air pattern and dictate the type of nozzle and angle of spray. The capacity still has to be calculated, but that is an entirely different subject.

Your reporter is familiar with the large nozzle manufacturers, and it must be assumed that all such companies follow rigid manufacturing, quality control, testing and packaging procedures. Each manufacturer checks out his nozzles for delivery rate (gph) and angle of spray and then carefully packs the nozzle in a metal, plastic or cardboard container. The nozzle should remain in its original container until it is to be used.

A nozzle consists of an outer shell or body, and the orifice is in the dead center of this body. This orifice is not just a hole but a highly engineered passage for the oil to flow through and form into either a hollow cone or solid cone spray. It is manufactured with great precision to insure its exactness (this is why it is so important not to clean this orifice with anything metallic).

Tangential slots are machined on the face of the valve or disc and lead from the source of oil in the back of the nozzle through the slots into the swirl chamber, which is that space between the tip of the valve and the orifice when the nozzle is completely assembled. This size of these tangential slots, and the number of them, control the flow rate of the nozzle and the swirling action obtained in the swirl chamber.

Some nozzles come in three parts, and the third part locks the valve or disc into place properly. A firm hand-tight position is sufficient to put this valve or disc into place. Extreme pressure may have a tendency to crush the slots and distort flow rate. Finally, a filter is installed to remove any minute particles from the oil as small as 25 to 50 microns.

If the nozzle must be cleaned on the job, it cannot be emphasized too strongly to NEVER use anything of a metal nature such as a needle, pin, wire or penknife. Scratches and distortion will occur and ruin the nozzle. Changes in volume and angle of spray will occur over which you have no control.

The disc that you remove has the tangential slots through which every drop of

oil must pass. These slots are accurately machined and sized; again, NEVER use anything metal when cleaning this part (Figure 3).

A good, cheap cleaning tool for this purpose is available everywhere... a toothpick. Shaved down to a fine point, this little piece of wood does an excellent job of cleaning the tangential slots and orifice. Good hot water under pressure is excellent for flushing. Also, there are several liquid cleaners or solvents available for the purpose. If nothing else is available, clean #2 heating oil will do the job.

As you look through the nozzle orifice toward a strong light after cleaning, you might see a cobweb film across the opening. This is normal and usual and will do no harm.

Most nozzle manufacturers recommend that you do not take a new nozzle apart before installing. This is good advice; however, we do suggest that you remove the strainer and check to see if the locknut is firmly seated. You do not have to force it; just be certain it is snug.

The same manufacturers also recommend that you install a new nozzle rather than clean the old one. This might seem like a sales pitch to sell more nozzles, but it really is good advice. It actually costs more to clean a nozzle than to install a new one. Be certain, however, that you replace it with one of the same type, (hollow or solid) gallonage and angle of spray. Changing any of these specifications may very well cause future difficulty. If you do not have the exact replacement, it then becomes necessary to clean the original nozzle and reinstall it.

These nozzles are designed to deliver the specified gallonage at an oil pressure of 100 lbs. per square inch. Variation in this pressure causes variation in the flow rate. It is permissible to vary this pressure within small limits such as 85 lbs. on the low side and 115 lbs. on the high side. Any changes beyond these limits should be taken care of by changing the nozzle to the next smaller or larger size, as required, and maintained as close to the 100 lbs. per square inch pressure as possible.

The all-important nozzle takes a lot of punishment. It is in the hottest spot on the burner and exposed to high combustion chamber temperatures. It performs three functions:

1. It breaks up the heating oil into fine droplets, normally called atomization. These finely-divided particles of oil mixing with the air delivered by the burner fan and ignited by the hot electric spark permit rapid combustion within the combustion chamber area.

2. The heating oil is supplied to the nozzle under 100 lbs. per square inch pressure, and the nozzle orifice delivers on the correct amount to be burned.

3. The type and size of nozzle selected determines the final results for a particular burner to perform satisfactorily in any given furnace or boiler.

To summarize briefly, we list a few do's and don'ts:

1. Do NOT carry loose nozzles in your pocket, tool box or service truck.

2. Do NOT use anything metal when cleaning a nozzle.

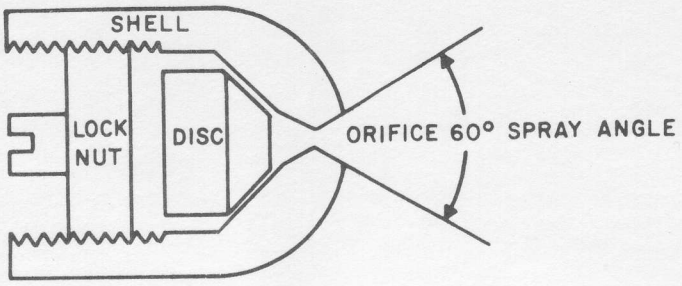
3. Do NOT have dirty hands when handling nozzles.

4. Do NOT try to clean a nozzle if you have the exact replacement.

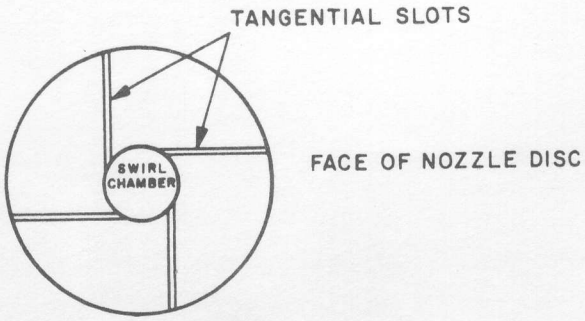
5. DO keep your nozzles protected until you are ready to install.

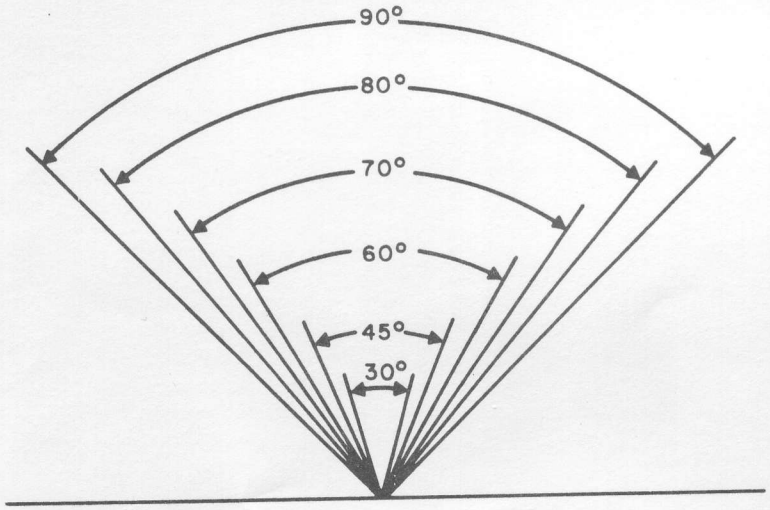
6. DO handle the nozzles carefully.

7. DO use a patented nozzle wrench or the correct sized box wrenches for removal and reinstallation of this delicate piece of equipment.



CUTAWAY OF TYPICAL OIL BURNER NOZZLE





NOZZLE ANGLE OF SPRAY-SOLID OR HOLLOW

Boiler Model	Burner Model	Motor HP (3450 RPM)	Motor Voltage	Firing Rate-GPH	*Nozzle Supplied		Oil Pump Press-PSI	Combustion Safeguard	**Firing Sequence
					Size	Angle			
80 SERIES BOILER									
80-04	GC-534	1/3	115/60/1	5.0	5.0	60	100	R8184	Fixed
80-05	GC-434	1/3	115/60/1	6.2	6.0	60	110	R8184	Fixed
80-06	HC-34	1/3	115/60/1	7.4	5.0	60	220	R8184	Fixed
80-07	HC-34	1/3	115/60/1	8.6	6.0	60	205	R8184	Fixed
80-08	HC-34	1/3	115/60/1	9.8	7.0	60	200	R8184	Fixed
80-09	HC-34	1/3	115/60/1	11.0	8.0	60	190	R8184	Fixed
80-10	HC-34	1/3	115/60/1	12.2	8.0	60	235	R8184	Fixed
80-11	PR-863	3/4	115/60/1	13.4	9.0	45	225	R8184	LFS
80-12	PR-863	3/4	115/60/1	14.6	9.0	45	270	R8184	LFS
80-13	PR-863	3/4	115/60/1	15.8	10.0	45	255	R8184	LFS
80-14	PR-585-1	2	240/60/1	17.0	11.0	45	240	R8184	LFS
80-15	PR-585-1	2	240/60/1	18.2	12.0	45	235	R8184	LFS
80-16	PR-585-1	2	240/60/1	19.4	13.0	45	225	R8184	LFS

*All sizes are Hago Type P

**Fixed fire models have one delay solenoid oil valve. Low fire start models have nozzle line solenoid oil valve; bypass solenoid oil valve and adjustable oil pressure regulating valve; LFS models with R8184 combustion safeguard provide prepurge only, models with R4150A provide prepurge and postpurge.

Boiler Size	Burner Model	Nozzle*			Fuel Pump Pressure-PSI	Oil Input (GPH)
		Manufacturer	GPH	Angle Type		
78-105	100871031	Monarch	1.00	60°R	110	1.05
78-120	100871031	Monarch	1.20	60°R	100	1.20
78-155	100871031	Monarch	1.50	60°R	105	1.55
78-175	100871111	Monarch	1.75	60°R	100	1.75
78-225	100871111	Monarch	2.25	45°R	100	2.25
78-280	100871111	Monarch	2.75	45°R	100	2.80
78-330	780001591	Monarch	3.00	45°R	120	3.30
78-385	780001591	Monarch	3.50	45°R	120	3.85
78-440	780001591	Hago	4.00	45°R	120	4.40

*Hago Type "ES" or Type "P" nozzles of the same spray angle as shown above may also be used.

NOZZLES			
Sizes Recommended for Malibu Boilers			
Model	**Capacity (GPH)**	**Spray Pattern**	**Angle**
M-100	1.00	Solid	60°-80°
M-120	1.20	Solid	60°-80°
M-150	1.50	Solid	60°
M-200	2.00	Solid	60°
M-250	2.50	Semi-Solid	60°

Set draft over fire at —.01 to —.02 inches w.c.
Set smoke at 0 to 1.