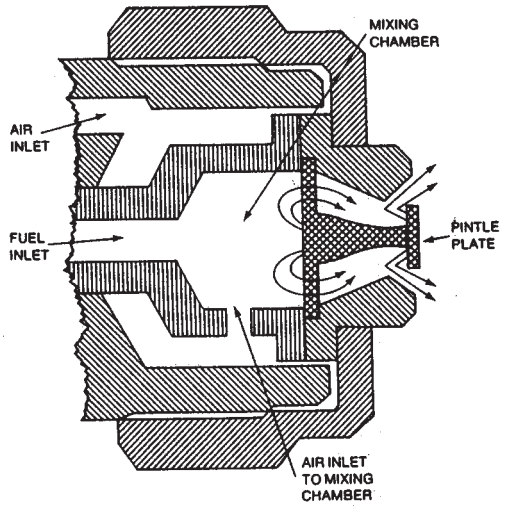
SWIRL-AIR™ Combustion Air Atomizing Nozzles

for maximum use of input hydraulic and pneumatic energy to atomize fuels at low pressure

Delavan's two-fluid Swirl-Air is designed to make maximum use of input hydraulic and pneumatic energy to atomize fuels at low pressures. In combustion applications it can produce fine atomization at flow rates up to 300 gph.

Fuel enters the mixing chamber axially coming in contact with tangentially introduced streams of air (or steam). Interaction of the two creates extreme turbulence and mixing. Finally the fuel-air mixture impinges against a circular deflector ring, or pintle plate, before leaving the nozzle as a finely atomized spray.

Design of the pintle plate support eliminates the need for external struts that could interfere with the spray pattern. The progressive application of shear and inertial forces within the nozzle helps to provide high nozzle efficiencies.



SWIRL-AIR ADVANTAGES

Large fuel passages and lack of torturous paths reduce chances for clogging.

Air consumption (SCFM) and power requirements are relatively low, permitting the use of smaller, more economical, air compressors and blowers.

Good atomization ratios.

Nozzle configuration provides vortex mixing of two fluids.

Can handle fuels up to Type C Bunker oil...also combustible waste liquids. (The use of Swirl-Air nozzles in burning Bunker oils often reduces the accumulation of ashes caused by the high concentrations of impurities such as vanadium and sulphur).

Various spray angles and capacities are available through a selection of metering sets and swirl chambers.

No external struts that interfere with the spray.

APPLICATIONS

The list of industrial combustion applications for the Swirl-Air nozzle continues to grow. Here are some of the more common ones:

- As igniter nozzles in both coal-fired and oil-fired electric power stations.
- As main atomizers in large burners, especially where heavier fuels are used. Advantages include one or more of the following: Fewer flue deposits (ashes), lower smoke reading (0 Bacharach not uncommon), higher CO_2 and lower pre-heat temperatures.
- As an incineration atomizer: Products such as waste water, mustard gas, chemical wastes, eggs etc. have been handled successfully.

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SPRAY CHARACTERISTICS:

Air, steam, or even a process gas, is introduced tangentially into the nozzle chamber in the low pressure region of the swirling mixture, creating extreme turbulence and primary atomization. As the fuel leaves the orifice, it impinges against the deflector ring which serves a dual purpose: close control of spray angle and breakup of the spray into even finer droplets (secondary atomization). Upon leaving the nozzle, the mixture swirls in a clockwise direction, looking downstream.

The nozzle has demonstrated the capability of achieving mean droplet diameters in the 50 to 100 micron range at modest air pressures and air volumes (SCFM). When using steam instead of air, the steam pressure should be approximately four times greater to achieve the same spray characteristics. Comparable atomization in a hydraulic nozzle would usually require very high fuel pressures. The degree of atomization is also fuel pressures. The degree of atomization is also variable by controlling the ratio of air to fuel flows.

CONSTRUCTION & MATERIALS:

Four-Piece construction (see below): (1) nozzle body (adapter), (2) swirl chamber, (3) metering set (integral nut and pintle) and (4) nozzle cap.

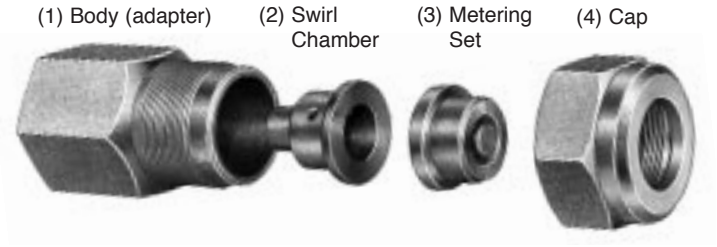
Parallel and concentric bodies (adapters) are available. Both are shown in the dimensional drawings.

Standard nozzle material is mild steel for all four basic parts. Other materials available on special request.

CONSIDERATIONS BEFORE ORDERING:

With the wide variety of combustion applications, there is no way to cover all possibilities in one piece of literature. There are, for example, the problems of nozzle fixtures, the adaptations necessary for existing fireheads, and the needs for special adapters. So if yours is such an application, send us the details and we will give you our recommendation. Use the following list of questions as your guideline:

(1) What type of fuel? (#2, #4, #6 oil etc.)
(2) Required flow rate in gallons per hour?
(3) What atomizing fluid...air, steam or other?
(4) What atomizing fluid pressure...(psig) is available?
(5) What atomizing fluid volume (scfm) is available?
(6) What fuel pressure (psig) is available?
(7) What is the method of attaching both fuel and atomizing fluid lines to the nozzle? Parallel pipes? Pipe within a pipe? Or Other?
(8) Fuel pipe size?
(9) Atomizing fluid pipe size?
(10) Approximate spray angle required?
(11) If possible, also furnish prints of existing installation, or a free-hand sketch.



Nozzle Size (GPH)	Nozzle Assy. Number		Component Part Numbers				
			(1) Body		(2) Swirl	(3) Metering	
	Parallel	Concentric	Parallel	Concentric	Chamber	Set	(4) Cap
50	34429-*	34460-*	34426	34516**	34427#	34431-*	1165-5
60	33240-*	34890-*	33517	33287	33233	33373-*	33516-1
100	33515-*	34892-*	33517	33287	33518	33521-*	33516-1
150	33522-*	34894-*	33517	33287	33523	33526-*	33516-1
200	33527-*	34896-*	33528	33907	33529	33532-*	33516-2
250	33533-*	34898-*	33528	33907	33534	33537-*	33516-2
300	33538-*	34900-*	33528	33907	33539	33542-*	33516-2

* When ordering either a complete nozzle assembly or just a metering set, be sure to specify one of the dash numbers below to designate spray angle.
** Body subassembly 34516 includes swirl chamber for concentric model.
\# Swirl Chamber 34427 is for parallel model only.

Dash No.	Spray Angle	
	50 GPH Size	All Other Sizes
-1	50°	50°
-2	70°	70°
-3	90°	90°
-4	110°	120°

SWIRL-AIR NOZZLE CAPACITIES

(Based on #2 fuel oil)

The capacities shown in the following charts will (1) serve as a guide to nozzle selection and (2) rate each nozzle according to minimum atomization energy expended per gallon of #2 oil burned. For example, both the 150 gph and 200 gph nozzles are flow rated at 150 gph, but the 200 gph nozzle has a higher air/fuel ratio. The wide turn-down capability of this nozzle also permits each nozzle to be operated at capacities less than shown. However, very low flows would require installation of a fuel metering pre-orifice or valve to prevent oscillation or "chugging" in the fuel line or system. Ideally, a nozzle should be selected for minimum energy used for atomization and for optimum burner performance. For some applications this may require customer testing.

50 GPH
#34429
and
#34460

FLOW RATE (GPH)	AIR PRESSURE (PSIG) 20 Liquid ΔP	20 Air Flow (SCFM)	30 Liquid ΔP	30 Air Flow (SCFM)	40 Liquid ΔP	40 Air Flow (SCFM)	50 Liquid ΔP	50 Air Flow (SCFM)	60 Liquid ΔP	60 Air Flow (SCFM)	70 Liquid ΔP	70 Air Flow SCFM)	80 Liquid ΔP	80 Air Flow (SCFM)
5	6	2.2	8	2.8	10	3.5	14	4.2	17	5.2	20	5.7	23	6.2
10	11	2.1	15	2.7	18	3.3	21	4.1	26	4.8	30	5.5	33	6.1
15	16	1.9	22	2.5	25	3.2	30	3.9	34	4.6	38	5.4	43	6.1
20	23	1.8	28	2.3	33	3.0	39	3.8	43	4.5	48	5.1	51	6.0
25	30	1.6	36	2.2	42	2.8	47	3.6	52	4.4	57	5.0	62	5.9
30	38	1.4	44	2.1	50	2.7	56	3.5	62	4.2	67	4.9	72	5.8
40	56	1.3	63	2.0	69	2.6	77	3.4	83	4.1	88	4.8	93	5.7
50	78	1.2	87	1.9	92	2.5	100	3.3	107	4.0	112	4.7	120	5.4

60 GPH
#33240
and
#34890

30	19	5.7	27	7.8	35	10.5	43	13.0	51	15.5	59	18.5	68	21.0
40	20	4.8	28	6.8	37	9.0	46	11.5	54	14.0	61	17.0	70	19.0
50	21	4.0	30	6.0	39	8.0	48	10.5	56	12.5	65	15.0	73	17.5
60	22	3.5	31	5.3	40	7.1	49	9.4	58	11.5	67	13.5	76	16.0

100 GPH
#33515
and
#34892

60	20	6.2	27	9.0	35	12.0	42	15.0	49	18.5	57	21.5	64	24.5
70	21	5.7	29	8.1	37	11.0	44	14.0	52	17.0	59	20.5	67	23.0
80	23	5.2	31	7.5	39	10.5	47	13.5	55	16.5	62	19.0	70	22.0
90	25	4.6	33	6.8	41	9.5	49	12.0	57	15.0	64	18.0	72	21.0
100	26	4.2	35	6.2	43	9.0	51	11.5	59	14.5	67	17.0	75	20.0

150 GPH
#33522
and
#34894

100	21	7.2	28	10.5	34	14.5	41	18.0	47	22.0	53	25.5	59	29.0
110	23	6.6	30	10.0	37	14.0	43	17.5	49	21.5	56	24.5	62	28.5
120	25	6.3	32	9.6	39	13.5	45	17.0	52	20.5	59	24.0	65	28.0
130	26	5.9	34	9.1	41	12.5	48	16.5	55	20.0	61	23.5	67	27.5
140	28	5.4	36	8.6	43	12.0	50	15.5	57	19.5	64	23.0	71	26.5
150	30	5.3	38	8.2	46	11.5	53	15.0	60	18.5	67	22.5	73	26.0

200 GPH
#33527
and
#34896

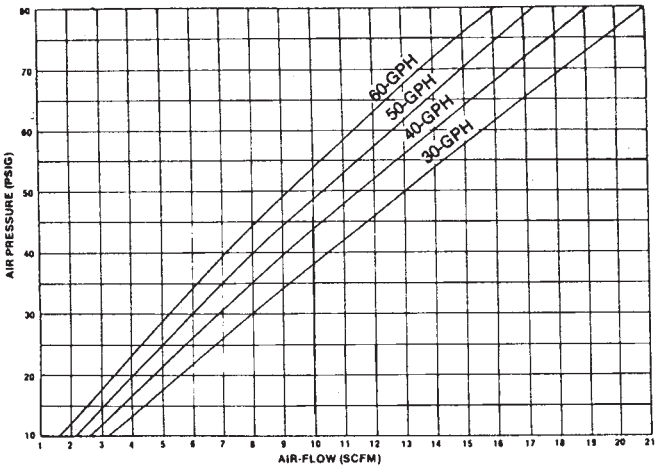
150	23	6.6	31	10.5	38	14.5	46	18.5	53	22.5	60	26.5	66	31.5
160	24	6.4	32	9.9	40	13.5	47	18.0	54	22.0	62	26.0	68	30.5
170	25	6.1	33	9.4	41	13.0	49	17.0	56	21.0	63	25.5	70	29.5
180	26	5.7	35	9.1	42	12.5	50	16.0	58	20.0	65	24.5	72	28.5
190	28	5.5	36	8.6	44	12.0	51	15.5	59	19.5	67	23.5	74	28.0
200	29	5.2	37	8.1	45	11.5	53	15.0	61	19.0	68	23.0	76	27.0

250 GPH
#33533
and
#34898

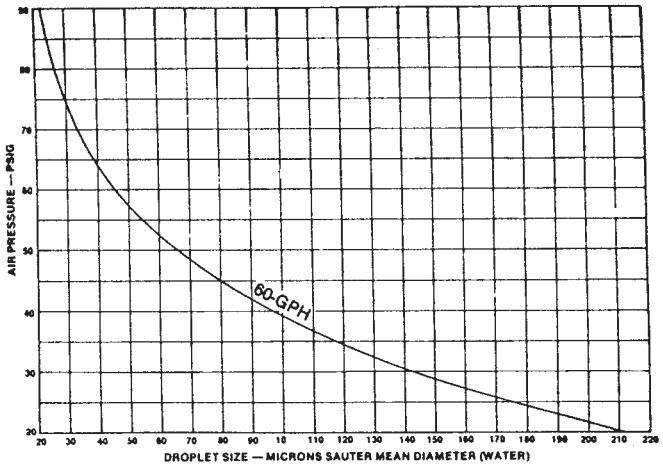
200	24	7.5	32	11.5	38	16.0	46	20.5	52	24.5	59	29.5	65	34.5
210	25	7.2	33	11.0	40	15.5	47	20.0	54	24.0	60	29.0	67	33.5
220	26	6.9	34	10.5	41	15.0	48	19.5	55	23.5	61	28.5	68	33.0
230	27	6.4	35	10.0	42	14.5	49	18.5	56	23.0	63	27.5	70	32.0
240	28	6.2	36	9.8	43	14.0	51	18.0	58	22.5	64	27.0	71	31.5
250	29	5.9	37	9.4	44	13.5	52	17.5	59	22.0	66	26.5	73	31.0

300 GPH
#33538
and
#34900

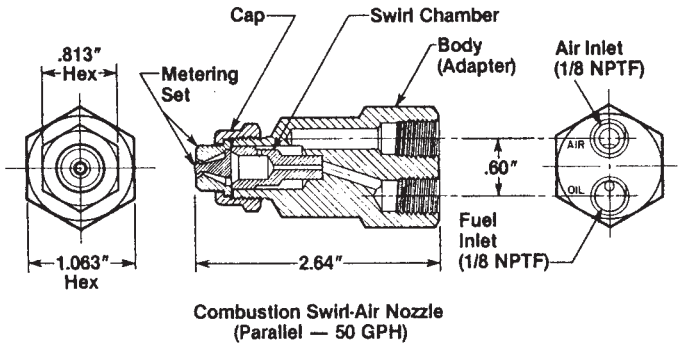
250	23	8.8	31	13.5	38	19.0	45	24.0	52	29.5	58	35.0	64	40.0
260	24	8.6	32	13.0	39	18.5	46	23.5	53	28.5	59	34.0	65	39.5
270	25	8.3	33	13.0	40	18.0	47	23.0	54	28.0	60	33.5	67	39.0
280	26	7.9	34	12.5	41	17.5	48	22.5	55	27.5	62	33.0	68	38.5
290	27	7.5	35	12.0	42	17.0	49	22.0	56	27.0	63	32.5	70	38.0
300	28	7.2	36	11.5	43	16.5	50	21.5	57	26.5	64	32.0	71	37.5



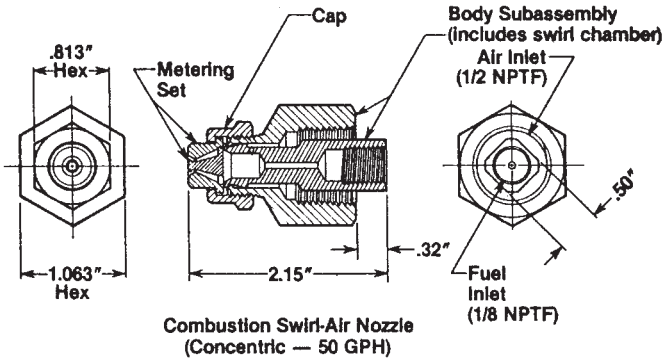
Air Flow vs. Air Pressure (60 GPH Nozzle)



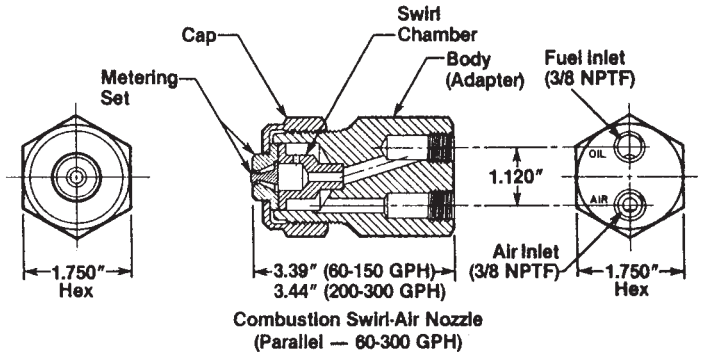
Droplet Size vs. Air Pressure (60 GPH Nozzle)



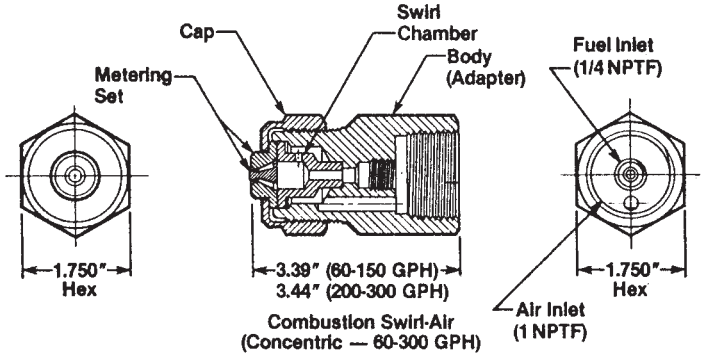
Combustion Swirl-Air Nozzle
(Parallel — 50 GPH)



Combustion Swirl-Air Nozzle
(Concentric — 50 GPH)



Combustion Swirl-Air Nozzle
(Parallel — 60-300 GPH)



Combustion Swirl-Air
(Concentric — 60-300 GPH)

ORDERING INSTRUCTIONS

Refer to "Considerations Before Ordering" section (page 25) if your specific requirements are not met by the information shown in this catalog.

WHEN ORDERING SWIRL-AIR NOZZLES, be sure to include both part number and description. Specify the complete assembly number, including the dash number that corresponds to the spray angle you need. To order individual parts, use the part numbers shown, but make sure you add the proper dash number on metering sets to designate spray angle.

EXAMPLE: P/N 33240-3 is a 60 gph 90^0 parallel inlet nozzle.