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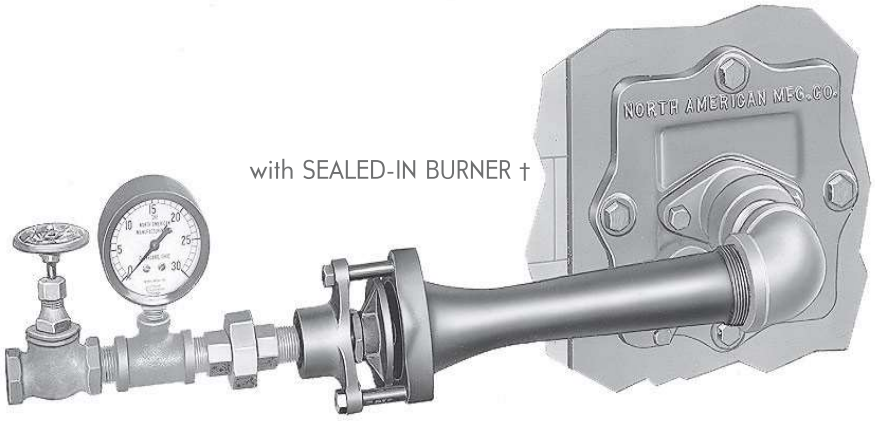
PROCESS TECHNOLOGIES

ENERGY | COMBUSTION

North American
High Pressure Inspirator



with SEALED-IN BURNER †

with OPEN BURNER †

† Greater stability can be obtained by inserting pipe nipples, two pipe diameters long, at each end of the pipe elbow.

3070 High pressure inspirator

- For use with natural gas premix burners
- High pressure gas iduces combustion air without blower
- Built-in air shutter provided
- Gas flow capacities from 17-7,680+ scfh, with 1" to 8" NPT exit sizes
- See sheet 3070-1 for inspirators that can be used to replace main air blowers

Product Overview/Sizing | High Pressure Inspirator

3070 Inspirators supply a fuel / air mixture to open or sealed-in premix burners by using the energy in high pressure natural gas to induce and mix with combustion air. Gas inlet pressures between 10 and 30 psi are most common but gas pressures up to 100 psi gas can be used.

Desired air/gas ratio is set with the air disc at high fire and is maintained reasonably throughout the turndown range, as long as combustion chamber pressure is fairly steady.

A gas orifice in the spud is carefully aligned with the machined throat in the body to ensure proper air inspiration and highest possible mixture pressures.

Inspirator capacity is affected significantly by the type of installation and pressure conditions within the combustion chamber:

Negative pressures (draft) increase inspirator capacity and retard flashback.

Positive pressures reduce capacity, and probability of flashback is greater.

At neutral furnace pressures, flashback normally will not occur at mixture pressures above 0.25"w.c. for natural gas.

Available turndown depends on mixture pressure, which in turn depends on gas and furnace pressures. Inspirators are primarily on-off devices.

INSPIRATORS FOR USE IN OTHER APPLICATIONS

High Pressure Inspirators can also be used for other applications.

— 3070 Inspirator mixers can be used to replace main air blowers in applications where it is difficult to use a traditional blower. See Sheet 3070-1 for details

TABLE 1. NATURAL GAS CAPACITIES AND DEVELOPED MIXTURE PRESSURES

(for 0.6 sp gr, natural gas, 1000 Btu/ft³, 10 ft³ air required/ft³ gas) Gas Flow (cfh)
in Bold Type, Mixture Pressures ("w.c.) in Light Type, see page 4 for burner capacities.

Inspirator designation	gas pressure, psi 5	10	15	20	25	30	Burner size
3070-1 68	**17**	**24**	**30**	**34**	**38**	**42**	**-1-A**
w/#68 drill	0.24	0.48	0.72	0.96	1.20	1.44	
3070-1 65	**22**	**32**	**38**	**44**	**49**	**54**	**-1-B**
w/#65 drill	0.25	0.50	0.75	1.00	1.25	1.50	
3070-2 59	**31**	**43**	**53**	**61**	**69**	**75**	**-2-A**
w/#59 drill	0.30	0.60	0.90	1.20	1.50	1.80	
3070-2 57	**36**	**51**	**63**	**72**	**81**	**89**	**-2-B**
w/#57 drill	0.31	0.62	0.93	1.24	1.55	1.86	
3070-2 55	**44**	**62**	**76**	**88**	**99**	**108**	**-2-C**
w/#55 drill	0.32	0.64	0.96	1.28	1.60	1.92	
3070-2 54	**51**	**71**	**88**	**101**	**113**	**124**	**-2-D**
w/#54 drill	0.33	0.66	0.99	1.32	1.65	1.98	
3070-3 53	**60**	**84**	**103**	**119**	**133**	**146**	**-3-A**
w/#53 drill	0.37	0.74	1.11	1.48	1.85	2.22	
3070-3 52	**76**	**108**	**131**	**152**	**170**	**186**	**-3-B**
w/#52 drill	0.40	0.80	1.20	1.60	2.00	2.40	
3070-4 50	**96**	**136**	**166**	**192**	**215**	**235**	**-4-A**
w/#50 drill	0.41	0.82	1.23	1.64	2.05	2.46	
3070-4 46	**125**	**176**	**216**	**249**	**278**	**305**	**-4-B**
w/#46 drill	0.43	0.86	1.29	1.72	2.15	2.58	
3070-4 44	**138**	**195**	**238**	**275**	**308**	**337**	**-4-C**
w/#44 drill	0.45	0.90	1.35	1.80	2.25	2.70	
3070-5 41	**168**	**238**	**291**	**336**	**376**	**412**	**-5-A**
w/#41 drill	0.47	0.94	1.41	1.88	2.35	2.82	

Inspirator designation	gas pressure, psi 5	10	15	20	25	30	Burner size
3070-5 36	**201**	**284**	**348**	**402**	**450**	**492**	**-5-B**
w/#36 drill	0.48	0.96	1.44	1.92	2.40	2.88	
3070-6 34	**226**	**320**	**391**	**451**	**505**	**550**	**-6-A**
w/#34 drill	0.50	1.00	1.50	2.00	2.50	3.00	
3070-6 31	**278**	**393**	**481**	**555**	**621**	**680**	**-6-B**
w/#31 drill	0.52	1.04	1.56	2.08	2.60	3.12	
3070-6 30	**306**	**437**	**536**	**619**	**692**	**757**	**-6-C**
w/#30 drill	0.53	1.06	1.59	2.12	2.65	3.18	
3070-7 29	**352**	**498**	**611**	**705**	**788**	**863**	**-7-A**
w/#29 drill	0.55	1.10	1.65	2.20	2.75	3.30	
3070-7 22	**453**	**640**	**784**	**905**	**1012**	**1100**	**-7-B**
w/#22 drill	0.57	1.14	1.71	2.28	2.85	3.42	
3070-7 11/64	**560**	**766**	**938**	**1082**	**1210**	**1350**	**-7-C**
w/#11/64 drill	0.59	1.18	1.77	2.36	2.95	3.54	
3070-8 3	**826**	**1178**	**1430**	**1663**	**1847**	**2022**	**-8-A**
w/#3 drill	0.62	1.24	1.86	2.48	3.10	3.72	
3070-8 C	**1038**	**1468**	**1800**	**2075**	**2325**	**2550**	**-8-B**
w/#C drill	0.64	1.28	1.92	2.56	3.20	3.84	
3070-8 J	**1462**	**2068**	**2535**	**2935**	**3270**	**3585**	**-8-C**
w/#J drill	0.66	1.32	1.98	2.64	3.30	3.96	
3070-8 5/16	**1788**	**2530**	**3100**	**3575**	**4000**	**4380**	**-8-D**
w/#5/16 drill	0.69	1.38	2.07	2.76	3.45	4.14	
3070-9 27/64	**3250**	**4580**	**5620**	**6480**	**7260**	**7680**	**-9**
w/#27/64 drill	0.74	1.48	2.22	2.96	3.70	4.44	

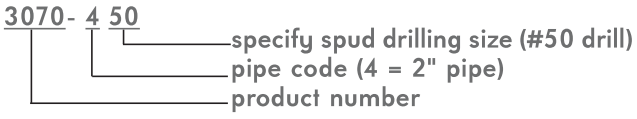
Sizes for Multiple Burners | High Pressure Inspirator

TABLE 2. INSPIRATOR SIZE FOR MULTIPLE PREMIX BURNERS

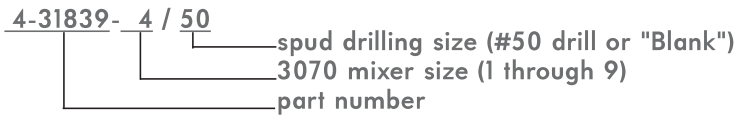
Inspirator Selection. When more than one nozzle is used per inspirator, manifold must be designed for very low pressure drop to obtain listed inspirator ratings. Too much resistance reduces capacity and upsets air/gas ratios.

Burner size	number of burners 1	2	3	4	5	6
-0-A		3070-1 68	3070-1 65	3070-2 57	3070-3 53	3070-3 53
-0-B		3070-1 65	3070-2 57	3070-3 53	3070-3 52	3070-4 50
-0-C		3070-2 57	3070-2 54	3070-3 52	3070-4 50	3070-4 46
-1-A	3070-1 68	3070-2 55	3070-3 53	3070-4 50	3070-4 46	3070-4 44
-1-B	3070-1 65	3070-2 55	3070-3 52	3070-4 46	3070-5 41	3070-5 41
-2-A	3070-2 59	3070-3 53	3070-4 50	3070-4 44	3070-5 36	3070-6 34
-2-B	3070-2 57	3070-3 52	3070-4 44	3070-5 41	3070-6 34	3070-6 31
-2-C	3070-2 55	3070-4 50	3070-5 41	3070-5 36	3070-6 31	3070-6 30
-2-D	3070-2 54	3070-4 46	3070-5 36	3070-6 34	3070-6 30	3070-7 29
-3-A	3070-3 53	3070-4 44	3070-6 34	3070-6 31	3070-7 29	3070-7 22
-3-B	3070-3 52	3070-5 41	3070-6 31	3070-7 29	3070-7 22	3070-7 11/64
-4-A	3070-4 50	3070-6 34	3070-7 29	3070-7 22	3070-7 11/64	
-4-B	3070-4 46	3070-6 31	3070-7 22	3070-7 11/64		
-4-C	3070-4 44	3070-6 31	3070-7 22			
-5-A	3070-5 41	3070-7 29	3070-7 11/64			
-5-B	3070-5 36	3070-7 22				
-6-A	3070-6 34	3070-7 22				
-6-B	3070-6 31	3070-7 11/64				
-6-C	3070-6 30					
-7-A	3070-7 29	Multiple burners are not recommended because of flashback hazard in large manifolds.				
-7-B	3070-7 22					
-7-C	3070-7 11/64					

To order a complete 3070 inspirator, specify:



To order a replacement spud, specify:



Capacities | High Pressure Inspirator

TABLE 3. FACTORS FOR RICH OPERATION AND FOR OTHER GASES

gas specifications			% air thru Inspirator	gas capacity factor	spud area and mixture press. factor
Btu/ft³	sp gr	ft³ air/ft³			
800	0.54	5.8	100	0.68	1.36
			90	0.56	1.65
			80	0.47	2.00
			70	0.38	2.44
1000	0.6	10.0	90	0.83	1.21
			80	0.67	1.50
			70	0.53	1.90
1200	0.7	11.7	100	1.25	0.85
			90	1.03	1.02
			80	0.83	1.28
			70	0.66	1.60

Example: Non-standard selection. Inspirator to supply 80% air for 300 cfh of 20 psi 1000 Btu/ft³ gas.

In Table 1, read a 0.67 capacity factor and a 1.50 spud and mixture pressure factor. The required 300 cfh capacity × 0.67 = 201 cfh equivalent capacity. In the left half of Table 1, look down the 20 psi gas pressure column until you find a gas flow near 201 cfh. 192 cfh corresponds to a 3070-4 50 tentative inspirator size and drill designation and 1.64"w.c. tentative mixture pressure. The last number means #50 spud drill, which has 0.00385 sq. in. area (from any drill size table). Multiply this by the spud area factor, 0.00385 × 1.50 = 0.00578 sq. in. The next larger standard drill is #44 with 0.00581 sq. in. area. Therefore, specify a 3070-4 Inspirator with #44 spud drill. To find actual mixture pressure, multiply 1.64 × 1.50 = 2.46"w.c.

Propane and butane does not inspirate as much air in a 3070 mixer as high pressure natural gas. To use propane, butane, or low-pressure gases in an open-air torch, see Bulletin 4696 "Gas-Compressed Air Torches"

TABLE 4. COMBUSTION AIR CAPACITIES, CFH FOR NORTH AMERICAN PREMIX BURNERS (sold separately see Bulletin 4682)

For nozzle capacity in Btu/h HHV, assuming 100% air through the nozzle, multiply figures below by 100. Nozzle can be run rich at air rates below, using secondary air to complete combustion of the exess fuels.

Burner Size	Burner Air Flow scfh Mixture Pressure in inches of water 1	2	3	4
-0-A	200	280	340	390
-0-B	250	350	430	500
-0-C	280	400	490	570
-1-A	350	490	600	700
-1-B	440	620	760	880
-2-A	560	790	960	1120
-2-B	650	920	1120	1300
-2-C	780	1100	1340	1560
-2-D	880	1240	1510	1760
-3-A	980	1380	1690	1960
-3-B	1200	1690	2060	2400
-4-A	1500	2120	2580	3000
-4-B	1900	2680	3280	3800
-4-C	2050	2890	3530	4100

Burner Size	Burner Air Flow scfh Mixture Pressure in inches of water 1	2	3	4
-5-A	2450	3450	4220	4900
-5-B	2900	4100	5000	5800
-6-A	3200	4510	5500	6400
-6-B	3850	5450	6600	7700
-6-C	4250	6000	7300	8500
-7-A	4750	6700	8500	9500
-7-B	6000	8450	10300	12000
-7-C	7050	9950	12100	14100
-8-A	10500	14800	18200	21000
-8-B	13000	18400	22500	26000
-8-C	18000	25500	31200	36000
-8-D	21500	30200	37200	43000
-9	37700	53000	65000	75500
4651-01	130	183	225	260
4651-0	250	350	433	500

Standrar Spud Sizes | High Pressure Inspirator

TABLE 5. STANDARD AVAILABLE 3070 SPUD DRILL SIZES

Many spud sizes are available to order as standard sizes. The table shows drill sizes/names and the hole diameter in inches. "BLANK" spud nozzles are also available without a hole which can be custom drilled in the field.

3070-1	3070-2	3070-3	3070-4	3070-5
Drill Name and (DIA. inches)				
Spud sizes for use with standard North American natural gas premix gas burners				
#68 (.031) #65 (.035)	#59 (.041) #57 (.043) #55 (.052) #54 (.055)	#53 (.060) #52 (.064)	#50 (.070) #46 (.081) #44 (.086)	#41 (.096) #36 (.107)
Spud sizes for standard 3070 compressed air reducers				
#47 (.079) #44 (.086)	#37 (.104) 7/64 (.109) #33 (.113) #32 (.116)	#29 (.136) 9/64 (.141)	#19 (.166) #16 (.177) #15 (.180)	#9 (.196) #5 (.206)
Other available standard spud sizes				
#69 (.029)	#70 (.028) #52 (.064) #47 (.079)	#55 (.052) #54 (.055) #31 (.120) #26 (.147)	#65 (.035) #52 (.064) #40 (.098) #34 (.111) #22 (.157)	#50 (.070) #46 (.081) #44 (.086) #22 (.157) #12 (.189)
Maximum diameter hole that fits spud				
(.313)	(.313)	(.313)	(.313)	(.437)

3070-6	3070-7	3070-8	3070-9
Drill Name and (DIA. inches)			
Spud sizes for use with standard North American natural gas premix gas burners			
#34 (.111) #31 (.120) #30 (.129)	#29 (.136) #22 (.157) 11/64 (.172)	#3 (.213) C (.242) J (.277) 5/16 (.313)	27/64 (.422)
Spud sizes for standard 3070 compress air reducers			
B (.238) F (.257) G (.261)	N (.302) O (.316) Q (.332)	7/16 (.438) 15/32 (.469) 1/2 (.500) 17/32 (.531)	23/32 (.719)
Other available standard spud sizes			
#41 (.096) #36 (.107) #29 (.136) 13/64 (.203)	1/8 (.125) 9/64 (.141) #26 (.147) 3/16 (.188) 15/64 (.234) 1/4 (.250) P (.323) U (.368)	3/16 (.188) #11 (.191) #2 (.221) F (.257)	21/64 (.328)
Maximum diameter hole that fits spud			
(.437)	(.547)	(.547)	(.813)

Dimensions and Part List | High Pressure Inspirator

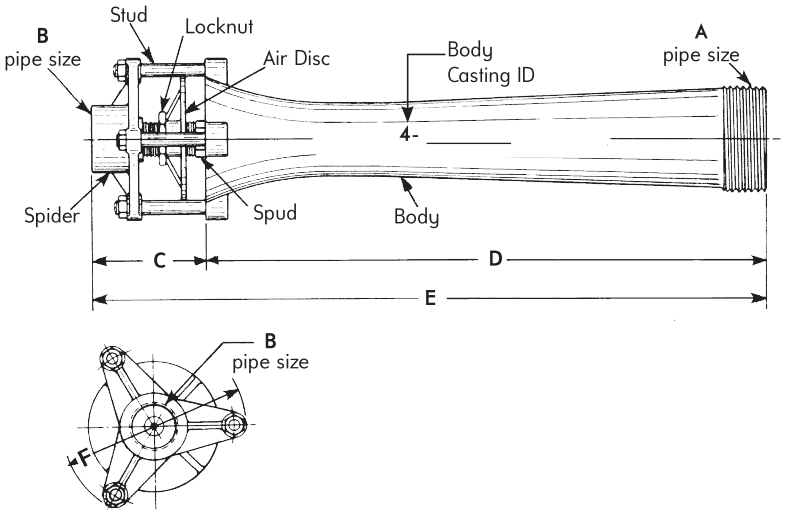


TABLE 6. INSPIRATOR DIMENSIONS & CASTING ID

Inspirator designation	dimensions in inches						Body Casting ID	wt, lb
	A	B	C	D	E	F		
3070-1	1	3/8	2 7/16	7	9 7/16	3 3/16	4-276	2 1/4
3070-2	1 1/4	1/2	2 7/16	8 7/16	10 7/8	3 3/16	4-161	3
3070-3	1 1/2	1/2	2 9/16	10	12 9/16	3 7/8	4-162	5 1/2
3070-4	2	1/2	2 3/4	12	14 3/4	4 5/8	4-160	8
3070-5	2 1/2	3/4	2 3/4	14 13/16	17 9/16	4 7/8	4-1515	11
3070-6	3	3/4	3 5/16	18 3/4	22 1/16	5 7/16	4-1511	14 1/2
3070-7	4	1	3 9/16	21 7/16	25	6 5/16	4-1518	23
3070-8	6	1	4 1/4	30	34 1/4	8 5/8	4-1509	57
3070-9	8	1 1/2	6 3/16	36	42 3/16	11 1/4	4-1728	110

TABLE 7. INSPIRATOR PARTS LIST

Inspirator designation	part numbers					
	Body	Disc	Lock Nut	Spider	Spud	Stud & Nut
3070-1	4-0276-1	4-2192-1	4-0285-1	4-1425-3	4-31839-1	4-0287-6
3070-2	4-0161-1	4-2192-1	4-0285-1	4-1425-2	4-31839-2	4-0287-6
3070-3	4-0162-1	4-0284-2	4-0285-1	4-0080-1	4-31839-3	4-0287-6
3070-4	4-0160-1	4-0284-3	4-0285-1	4-0049-1	4-31839-4	4-0287-2
3070-5	4-1515-1	4-0284-4	4-0285-2	4-1522-1	4-31839-5	4-0287-2
3070-6	4-1511-1	4-0284-5	4-0285-2	4-1523-1	4-31839-6	4-0287-3
3070-7	4-1518-1	4-0284-6	4-0285-3	4-0128-1	4-31839-7	4-0287-3
3070-8	4-1509-2	4-0284-7	4-0285-3	4-1524-1	4-31839-8	4-0287-4
3070-9	4-1728-2	4-55795-1	4-0285-4	4-0165-1	4-31839-9	4-0287-5

DIMENSIONS SHOWN ARE SUBJECT TO CHANGE. PLEASE OBTAIN CERTIFIED PRINTS FROM FIVES NORTH AMERICAN COMBUSTION, INC. IF SPACE LIMITATIONS OR OTHER CONSIDERATIONS MAKE EXACT DIMENSION(S) CRITICAL.

WARNING: Situations dangerous to personnel and property may exist with the operation and maintenance of any combustion equipment. The presence of fuels, oxidants, hot and cold combustion products, hot surfaces, electrical power in control and ignition circuits, etc., are inherent with any combustion application. Components in combustion systems may exceed 160°F (71°C) surface temperatures and present hot surface contact hazard. Fives North American Combustion, Inc. suggests the use of combustion systems that are in compliance with all Safety Codes, Standards, Regulations and Directives; and care in operation.

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PROCESS TECHNOLOGIES

ENERGY | COMBUSITION

North American Compressed Air Reducers
3070 Inspirator Capacities

Inspirators as High Pressure Air Reducers

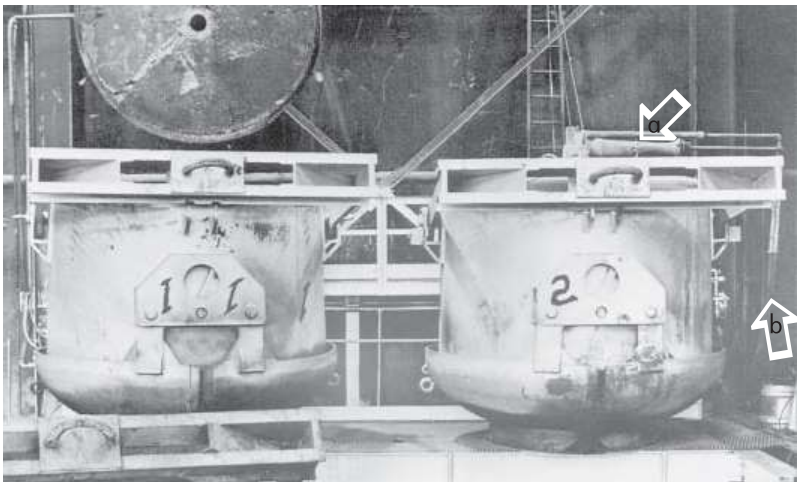
Where installation space is limited and the greater cost of compressed air can be tolerated 3070 Inspirators can be used to reduce compressed air to low pressure air. For burners requiring low pressure air this serves as a substitute for a blower but sacrifices the economy of a blower. Approximately 21% of the total air discharged is compressed air; inlet pressure must be at least 40 times the desired outlet pressure.

Inspirator designation	Spud drill size	Corresponding burner size*	Low pressure air discharged in cfh			
			at 8 osi (20 psi inlet)	at 16 osi (40 psi inlet)	at 24 osi (60 psi inlet)	at 32 osi (80 psi inlet)
3070-1	47 44	A B	700 880	990 1 240	1 210 1 520	1 400 1 760
3070-2	37 7/64 33 32	A B C D	1 120 1 300 1 560 1 760	1 580 1 840 2 210 2 490	1 940 2 250 2 700 3 050	2 240 2 600 3 120 3 520
3070-3	29 9/64	A B	1 960 2 400	2 770 3 400	3 400 4 160	3 920 4 800
3070-4	19 16 15	A B C	3 000 3 800 4 100	4 240 5 350 5 800	5 200 6 600 7 100	6 000 7 600 8 200
3070-5	9 5	A B	4 900 5 800	6 900 8 200	8 450 10 000	9 800 11 600
3070-6	B F G	A B C	6 400 7 700 8 500	9 050 10 900 12 000	11 100 13 300 14 700	12 800 15 400 17 000
3070-7	N O Q	A B C	9 500 12 000 14 100	13 400 17 000 19 900	16 500 20 800 24 400	19 000 24 000 28 200
3070-8	7/16 15/32 1/2 17/32	A B C D	21 000 26 000 36 000 43 000	29 700 36 800 51 000 61 000	36 400 45 000 62 500 74 500	42 000 52 000 72 000 86 000
3070-9	23/32	—	74 000	105 000	128 000	148 000

*Spud drills shown were chosen to correspond to these burner sizes, one burner per inspirator.

In the photo at right, a North American 3070-8 Inspirator used as an air reducer (arrow a) supplies combustion air to a 4422-8-A Burner in the cover of a charging bucket preheating 20 tons of scrap for an electric melting furnace.

The compressed air reducer permits use of a small flexible air supply line (arrow b) – a great convenience in a case such as this, where the burner must move with the cover.



To order Inspirator, specify: 3070-(pipe size code)-(spud drill size) (pipe size) Inspirator.
Example: 3070-5-9 2½" Inspirator.

DIMENSIONS SHOWN ARE SUBJECT TO CHANGE. PLEASE OBTAIN CERTIFIED PRINTS FROM FIVES NORTH AMERICAN COMBUSTION, INC.
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