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NicroSpray® System Operating Manual Model N-5

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NicroSpray® System
OPERATING MANUAL
TABLE OF CONTENTS

Introduction

The **NicroSpray System***, **Model N-5** sprays solid particles and liquid binder simultaneously. It differs from all other spraying devices in that the dry powder and liquid are not mixed before spraying. Each is fed through the system separately and mixed only after leaving the nozzle. The flow rates of both powder and binder are individually controlled, and up to 50 lbs/hour of powder can be sprayed.

The system has two powder hoppers, allowing several options for powder spraying: the same powder can be used in both hoppers to achieve the highest spray rates; or each hopper can be filled with a different powder for blending purposes (different powders will have different flow rates); or one hopper can be used alone.

The system uses compressed plant air for power. No electrical connections are required. It can also be operated at remote locations by using suitably regulated compressed air or nitrogen from portable gas cylinders.

The NicroSpray System was specifically developed for applying Nicrocoat alloys (nickel-chromium alloys that form a stainless coating over carbon and alloy steels, as well as other easily oxidized metal surfaces) and Nicrobraz brazing filler metal powders. (Technical data sheets for these products are included with this manual).

Other free-flowing powders may also be applied with this unit. Spray rate parameters for such powders must be determined experimentally by the user.

The liquid binder most suited for use with the NicroSpray System is Nicrobraz Cement 520. This specialized binder surrounds each powder particle as both the powder and cement are sprayed from the gun, and quickly dries upon contact with a base metal substrate. Tests must be conducted to determine which spray-gun settings are most suited for each customer application.

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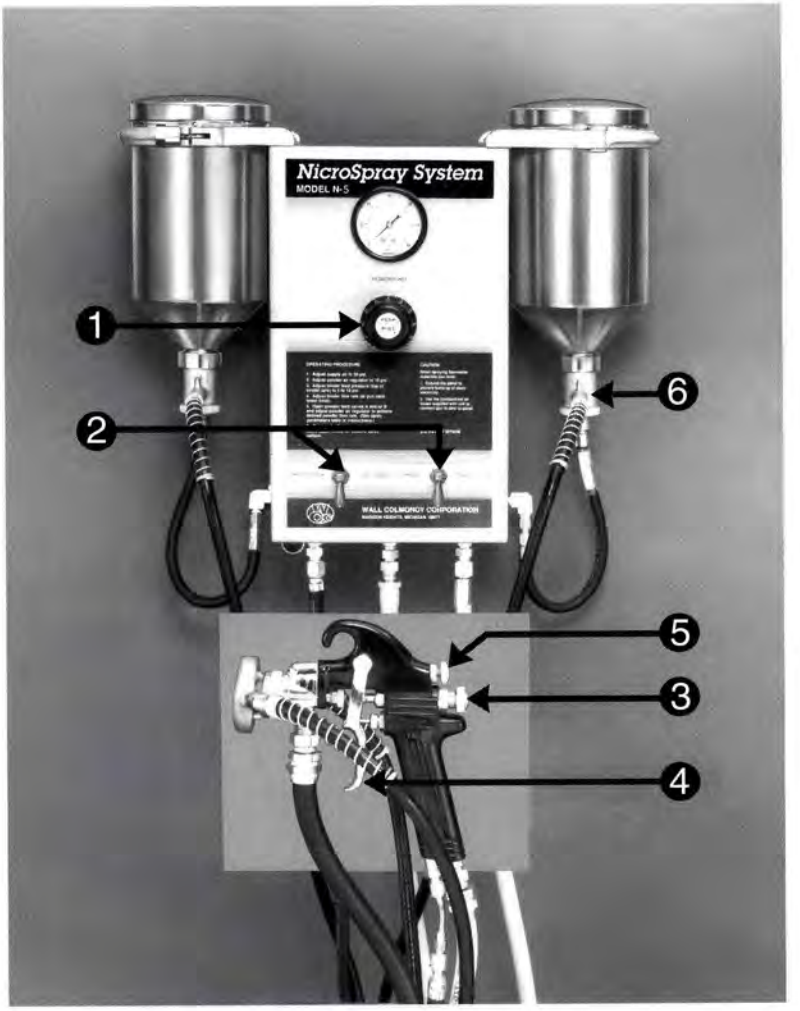
* U.S. Patent Number 3,275,240

The Model N-5 utilizes a high volume, low pressure (HVLP) spray gun, which reduces the amount of volatile organic chemicals (VOCs) released into the atmosphere. (This units conforms to the environmental regulations imposed by the State of California.)



The **Control Panel** holds two powder hoppers with carburetors, a regulator and gauge for controlling powder feed, and two powder on/off valves.

Binder Tanks of either a two-quart or five-gallon capacity can be used. Both are pressurized, with integral regulators and gauges. The two-quart size can hang under the panel.

The regulator (**1**) controls the powder-air pressure and the rate of powder flow. The on/off valves (**2**) start and stop powder from entering the air flow. The rate of binder flow is controlled by a valve (**3**) on the back of the gun.

The two-position gun trigger (**4**) first starts the air flow (with, or without powder for air drying work), and then the binder flow. (**5**) Fan control valve adjusts width of spray pattern. (**6**) Carburetor.

Plant Air

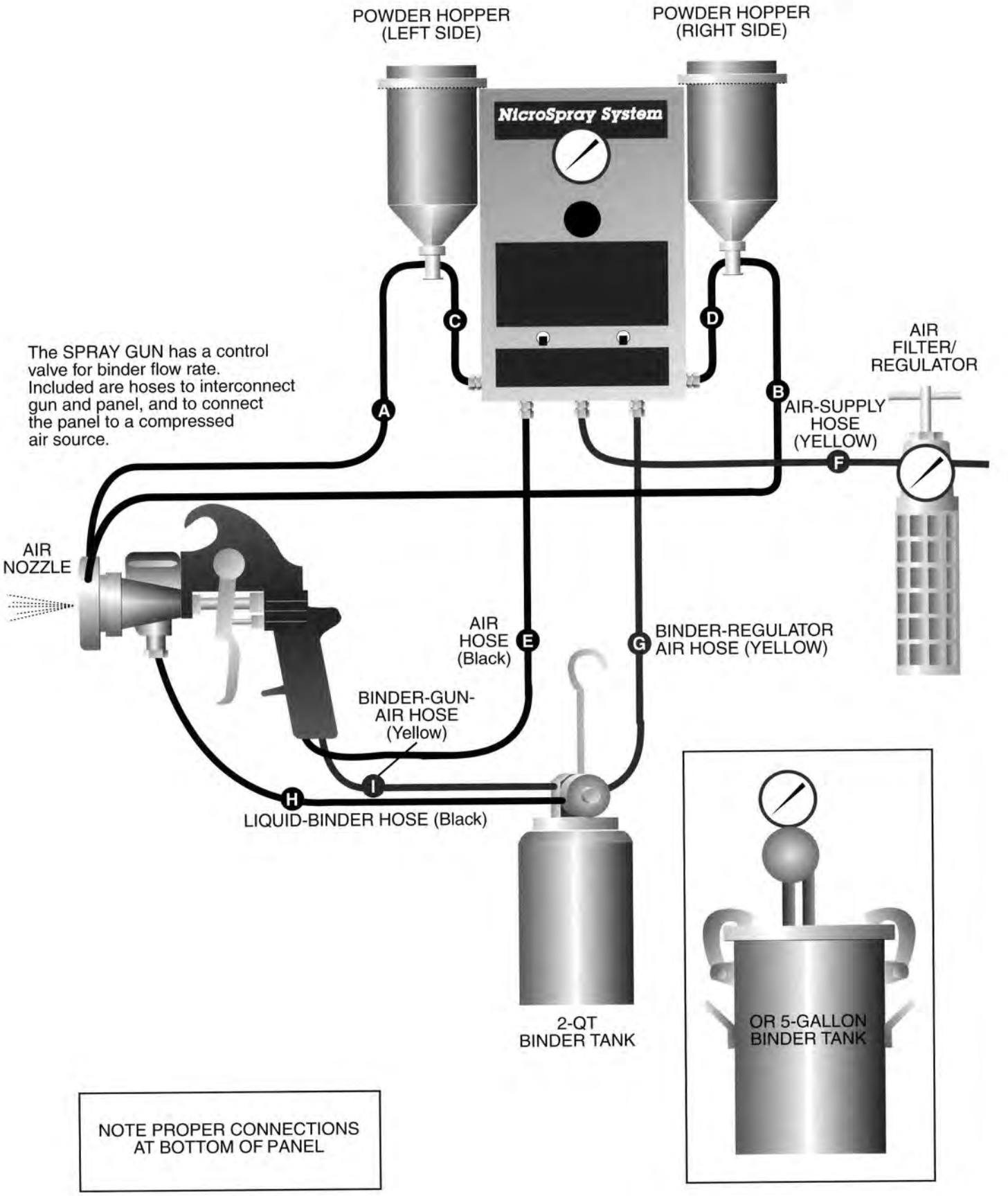
AIR FILTER/REGULATOR (supplied as standard). The air filter/regulator unit filters, regulates and indicates the pressure of the plant air supply. An adjustable balanced piston valve maintains selected pressure, including shut-off. The unit offers instant response to supply or demand fluctuations. The rugged filter contains a 2-micron filter cartridge made of borosilicate glass microfibers, bonded into a cylinder.

Unpacking Your NicroSpray System

Checklist

Check shipping carton(s) for the following standard items (see diagram on next page). If additional items were ordered and included, they will be noted on the packing list.

- ❑ Control panel
- ❑ Spray gun
- ❑ 2-qt pressure container, or 5-gallon pressure tank
- ❑ Two powder hoppers with carburetors
- ❑ Hose sets (described on page 5) consisting of:
  - ❑ two white powder hose assemblies (Ⓐ and Ⓑ)
  - ❑ two short black carburetor air hoses (Ⓒ and Ⓓ)
  - ❑ one black valve-activating air hose assembly (Ⓔ)
  - ❑ one yellow air-supply hose assembly (Ⓕ)
  - ❑ one yellow binder-regulator air hose (Ⓖ)
  - ❑ one black liquid-binder hose assembly (Ⓗ)
  - ❑ one yellow binder-gun-air hose assembly (Ⓘ)
- ❑ Air filter/regulator
- ❑ 6-inch adjustable wrench
- ❑ Nozzle brush
- ❑ Protective hose-sleeve
- ❑ "Y" connector (to allow powder to feed from only one hopper through both powder hoses)
- ❑ Operating Manual


POWDER HOPPER
(LEFT SIDE)
POWDER HOPPER
(RIGHT SIDE)
NicroSpray System
The SPRAY GUN has a control valve for binder flow rate. Included are hoses to interconnect gun and panel, and to connect the panel to a compressed air source.
A
B
C
D
AIR
FILTER/
REGULATOR
AIR-SUPPLY
HOSE
(YELLOW)
F
AIR
NOZZLE
AIR
HOSE
(Black)
E
G
BINDER-REGULATOR
AIR HOSE (YELLOW)
BINDER-GUN-
AIR HOSE
(Yellow)
I
H
LIQUID-BINDER HOSE (Black)
2-QT
BINDER TANK
OR 5-GALLON
BINDER TANK
NOTE PROPER CONNECTIONS
AT BOTTOM OF PANEL

Instructions for Hose Connections

Connect the hoses to air filter/regulator, panel, spray gun, and either the 2-qt pressurized fluid cup or the 5-gallon binder tank, as shown in the sketches on pages 4, 7 and 8.

A - Powder hose (white, "Accubraid" 1/4" I.D. x 13-feet long): from left-hopper carburetor powder outlet fitting No. 1 to No. 6 fitting on the gun nozzle (see p. 7). The hose end at the panel powder outlet has a 9/16"-18 right-hand nut and the spray gun nozzle hose end has 3/8"-24 right-hand nut.

B - Powder hose: from right-hopper carburetor powder outlet No. 2 to No. 7 fitting on the nozzle of the gun. Same type of hose as in "A" above.

C - Carburetor air hose (black "Thoroflo", 1/4" I.D. x 11" long): from left side panel elbow-fitting No. 22 to quick-disconnect fitting No. 47 on back of carburetor. Panel end of hose has 3/8"-24 right-hand nut. Carburetor end is a B1-T12 male disconnect plug.

D - Carburetor air hose: from right-side panel elbow-fitting No. 22 to carburetor quick-disconnect fitting No. 47. Identical to hose "C".

E - Valve-activating air hose (black, 1/4" I.D. x 12 1/2 feet long, 200# W.P.): from No. 9 fitting on bottom of gun to No. 5 "valve-activating air" fitting on bottom left-side of panel. The panel end of hose has 9/16"-18 right-hand threaded nut and the gun end has a 3/8"-24 right-hand threaded nut.

F - Air-supply hose (yellow "Airflex", 3/8" I.D. x 15-feet long): One end connected to plant air supply at fitting on air filter/regulator, and other end connected to No. 4 "Air Supply-In" fitting on bottom center of panel. Both ends of hose have 3/8" J.I.C. right-hand threaded nuts. This hose contains a grounding wire inside.

G - Conductive air hose to binder-tank regulator (yellow "Airflex", 3/8" I.D. x 9-feet long): from No. 3 "Binder-tank Air Out" fitting on bottom right-side of panel to No.11 "in" fitting on 2-qt fluid cup or 5-gallon binder-tank regulator. Panel end of hose has 9/16"-18 right-hand threaded nut and binder tank or fluid cup end of hose has a No. 72-1325 connection fitting.

H - Liquid-binder hose (black, 71-280 "Fluidall" hose, 14" I.D. x 10-feet long): from No. 13 fluid outlet fitting on 2-qt fluid cup or 5-gallon binder tank to No. 8 fitting on lower side of the front of the gun. Both ends of hose have No. 72-1306 right-hand connection fittings.

I - Conductive binder-gun-air hose (yellow "Airflex", 3/8" I.D. x 10-feet long, 300# W.P.): from No. 12 "out" fitting on 2-qt fluid cup or on the 5-gallon binder tank regulator to No. 10 fitting on bottom of the spray gun. Both ends of hose have No. 72-1325 right-hand connection fittings.

Note: Use only the special hoses supplied. For best results, order replacements parts from Wall Colmonoy Corporation.

Part Nos.	Hose Sets
712863-01-00	Powder hose (A & B)
712863-03-00	Valve activating air hose (E)
712863-04-00	Air supply hose (F)
712863-05-00	Binder-regulator air hose (G)
712863-06-00	Liquid-binder hose (H)
712863-07-00	Binder-gun-air hose (I)

Procedure for Installing and Operating The Model N-5 NicroSpray System

1. Install panel on wall or vertical upright (perpendicular to the floor). Panel should be at least as high as the gun working height.
2. Connect air filter/regulator to plant air supply.
3. Hang two quart pressure container in hanger on bottom of panel or place five gallon binder tank on floor near unit.
4. See instructions for hose connections to air filter/regulator, panel, gun and either two quart pressure container or five gallon binder tank. (See sketches for hose connections).
5. Remove cover, of either two quart pressure container or five gallon binder tank, and pour in liquid binder.
6. Replace cover on container or tank. Be sure cover is secure.
7. Remove hopper covers and pour powder into hoppers.
8. Replace both hopper covers.
9. Adjust air filter/regulator, at supply, to 60-70 psi.
10. Adjust powder air regulator, on panel, to air psi for desired powder output. See parameter chart.
11. Adjust regulator on two quart pressure container or five gallon binder tank to 7-10 psi.
12. Open powder feed toggle valves "A" & "B" on panel.
13. Pull back gun trigger all the way and readjust powder air regulator to parameter chart. Release trigger.
14. Close fan control valve on gun (upper knob at rear of gun).
15. Open fan control valve approx. 1/4-turn.
16. Close binder feed control valve on gun (lower knob at rear of gun).
17. Open binder feed control valve approximately 1 full-turn.
18. Pull back gun trigger all the way.
19. Readjust fan control valve and binder feed control valve to desired spray pattern.

- Unit is now properly set up for spraying -

NOTE: Grounded Hoses and Panel
Under certain conditions, static electricity can be generated by dry powder moving through the hoses. The gun is grounded to the panel through the special yellow electrically conductive hose. The yellow air hoses are similarly grounded. Therefore, the NicroSpray System will be adequately grounded as long as the piping for the plant air supply is grounded. Consult your plant engineering or safety director to confirm that your air supply line is indeed grounded.

Spray Parameters

Supply air from air filter/regulator should be between 60 psi and 70 psi. Do not increase air pressure beyond 70 psi or go below 60 psi.

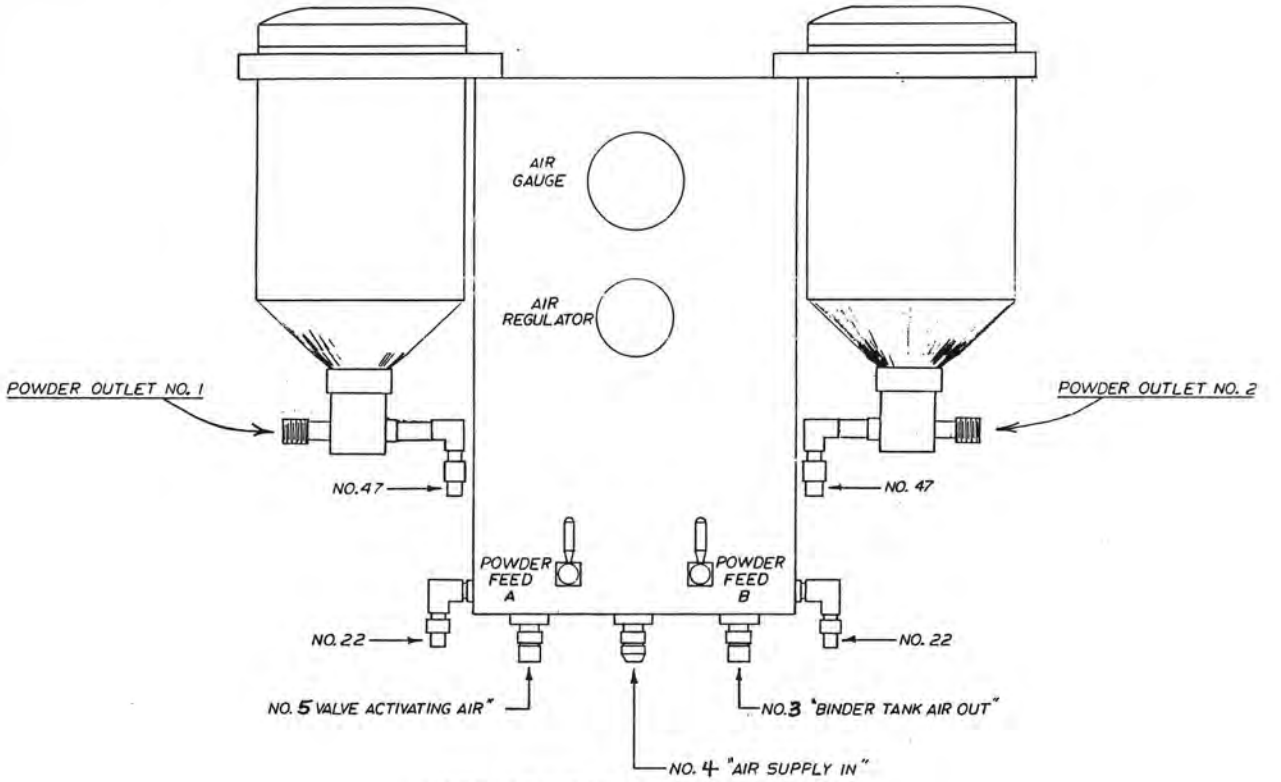
Powder Air Regulator (PSI)	Single Carburetor with "Y" (lbs/hr)	Two Carburetors (lbs/hr)
10	———	26-30
20	———	30-35
30	24-28	35-40
40	28-32	40-45
50	30-34	46-50

Converting from two carburetors to a one carburetor system:

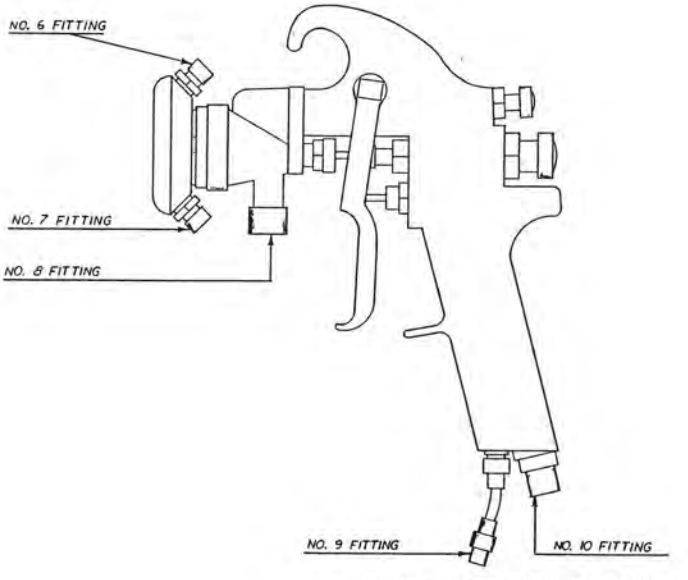
Disconnect both powder hoses from carburetor powder outlet fittings. Connect the special stainless steel "Y" connector to carburetor powder outlet "A" and then connect both powder hoses to the threaded "Y" connections. Turn the "B" powder feed toggle valve on the panel to the off position (toggle facing down).

The unit is now ready to operate as a single carburetor unit.

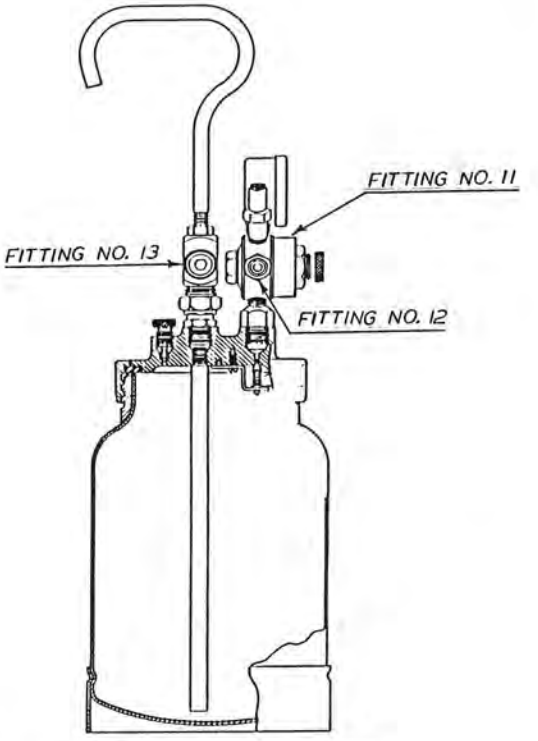
Caution: If only one hopper is used, and the "Y" connector is not utilized, powder will enter the gun nozzle through only one hose and the spray pattern will be altered.



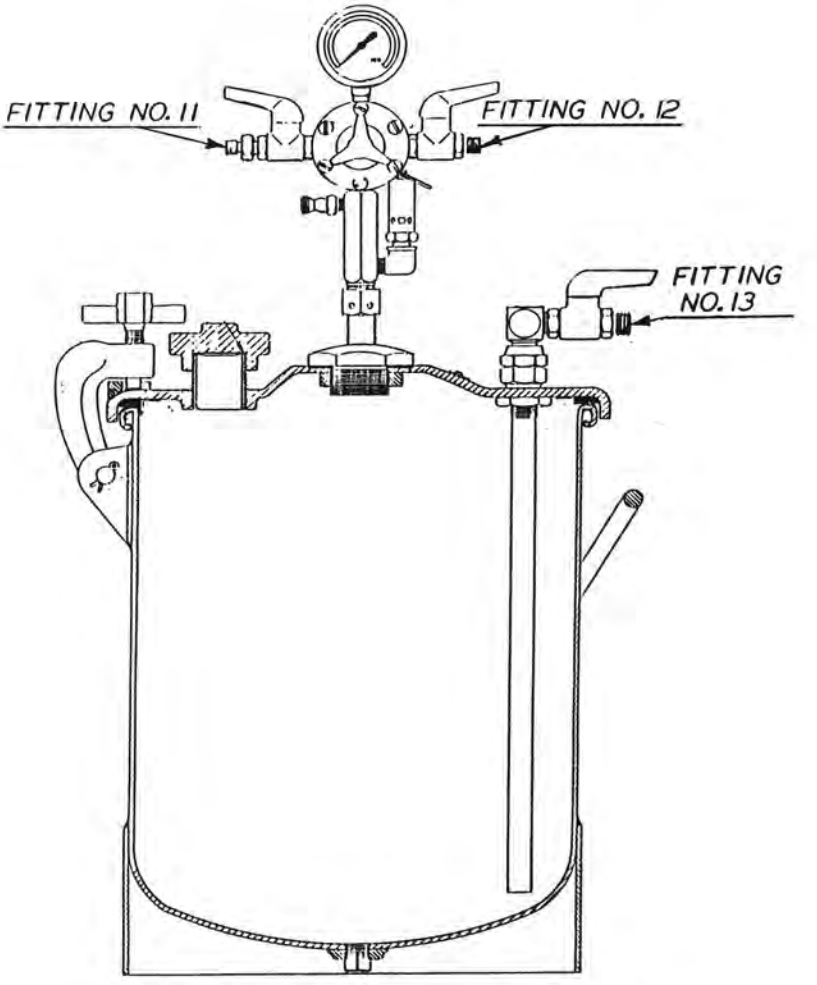
HOSE CONNECTIONS TO PANEL



HOSE CONNECTIONS TO GUN



HOSE CONNECTIONS FOR 2 QT. FLUID CUP



HOSE CONNECTIONS FOR 5 GAL. BINDER TANK

Explanation of Pressure Adjustments

A. Plant Air Pressure at air filter/regulator - Should be kept at 60-70 psi for all NicroSpray work. Pressures outside this range (either higher or lower) can adversely affect powder flow and system performance.

B. Powder Air Pressure (regulator on panel) - Controls the quantity of powder carried into the spray stream. Adjustment range is from 10 to 45 psi. Below 10 psi, powder may not be swept completely out of the hose, which can cause powder blockage in the hoses. Pressures above 50 psi may damage the gauge.

C. Binder Feed Pressure (regulator on binder cup or tank) - Some pressure is required to force binder into nozzle since this is an external atomizing nozzle (not aspirating type). Suggested pressure of 10 psi should be adequate for all operators and jobs. Higher pressures may cause slight leakage at the nozzle while gun is not spraying, which would soon plug the air opening. A safety valve is incorported in the regulator and/or tank and pressure cup to prevent over-pressurizing the binder can.

D. Binder Valve Adjustment (lower knob on back of gun) - Several considerations determine the optimum binder spray rate. At higher binder spray rates, the powder loss due to powder bouncing off dry areas at the perimeter of the spray pattern is minimized. The traverse speed at higher binder spray rates must be faster to prevent running. Parts to be vacuum processed should be sprayed with a minimum binder spray, controlled by the binder feed regulator ("C" above) so as to minimize the amount of binder that needs to be burned off (outgassed) in the vacuum furnace run.

E. Powder air "on/off" toggle valves (on panel) - These two toggles permit the use of gun for air drying and for binder rate adjustments without wasting powder. With the toggle valves closed (toggle is facing down), the spray gun trigger may be pulled to its first stop position for air drying (you will notice as the gun trigger is pulled back that there is a hesitation shortly after starting the pull; this is the first stop position). With the toggle valves open (toggles pointing straight out from panel) powder will flow through the powder hoses.

Use one or both hoppers: Since there are two hoppers and two toggle valves, the powder hoppers can be used singly or together. It is also possible to blend powders in the spray pattern by filling each hopper with a different kind of powder. By closing the toggle on one carburetor while leaving the other toggle open, either hopper can be operated by itself. Please note that powder will only flow through one of the gun nozzle openings, and the spray pattern will not be the same as with both powder hoppers operating.

Use one hopper and both powder hoses: It is possible to feed powder uniformly from one carburetor through both powder hoses into both fittings in the gun nozzle by using the special powder "Y" connector provided. By converting to the "Y" connector, the spray pattern will be more uniform.

Spraying Technique and Other Hints

Best spray results are usually achieved through experimentation, especially when beginning long runs of similar parts. Powder and binder loss can be avoided with simple preliminary testing. These tests should include capturing the powder overspray of a sample run(s) to determine spray efficiency. Every job and part configuration will have differing results.

Under lab conditions, spray efficiencies of 80-90% and even 95% are common. However spray efficiency is dependent on many variables, including part configuration, binder rate, powder rate, fan valve settings, spray distance and operator technique. For example, when spraying a perforated metal workpiece, it is unlikely that the same spray efficiency would be achieved as on a large, flat solid workpiece. Also, it would be difficult to achieve the same efficiency on a 3/4" round part.

The Model N-5 is capable of spraying large amounts of binder and powder (over 50 lbs/hour). In the interest of speed and efficiency, an operator will want to spray as much powder as quickly as possible. However, this is not necessarily the best starting point and could result in high powder and binder losses. Although the unit is capable of very high spray rates, it is also capable of very low spray rates. The requirements of the application can only be determined by testing and experience. Suggest starting at low rates and slowly increasing powder and binder flow until optimum results are achieved.

Optimum gun distance from the workpiece being sprayed depends on operator technique, binder spray rate, and traverse speed. Excessive distance (more than 12") may result in "cobwebbing" (drying out of the binder while in transit to the part).

Gun should be moved back and forth or up and down parallel and perpendicular to the surface to be sprayed. Swinging the gun by pivoting at the elbow is poor spray practice and causes a variation in distance and impingement angle which results in uneven coatings and excessive powder loss. Whenever possible, gun should be aimed at right angles to work surface.

The gun trigger should remain pulled throughout each spraying of each part. Do not release the trigger at the end of each pass. Such on/off triggering of the gun during operation can cause powder buildup and blockage in the hoses.

When cylindrical parts are to be coated, they should be mechanically rotated while spraying to ensure uniformity. Traverse speed should be fast enough to prevent "slicking" or "running" of the sprayed surface and therefore depends on binder spray rate, work distance and fan-valve setting.

When not in use, the gun and hoses should be safely stowed away to prevent someone from tripping over the hoses. This can be done by draping the hoses over the panel, or hanging the gun from a wall hook (not provided).

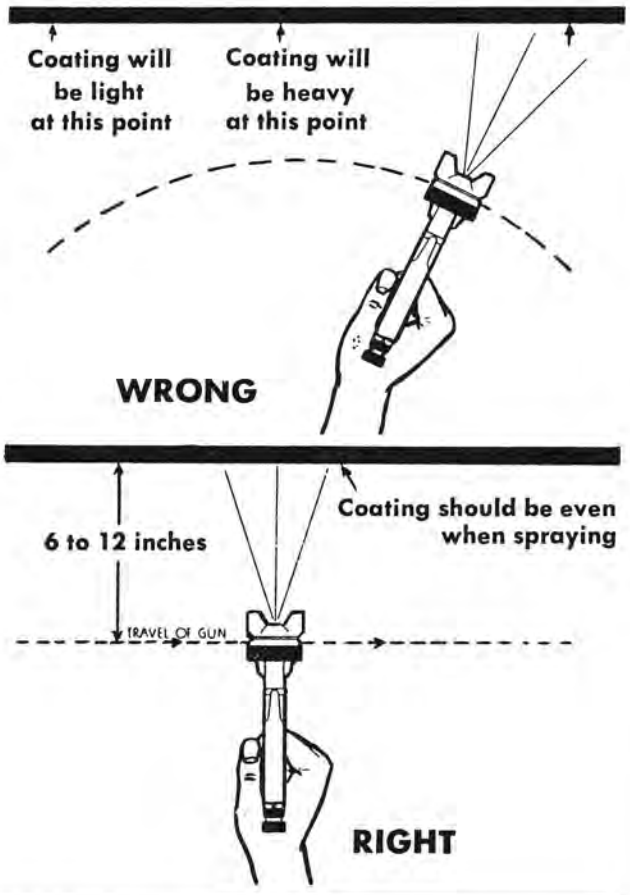
To prolong the life of the gasket in the pressure can, it is best to empty it of binder whenever the gun is going to be idle for a period of time, such as overnight.

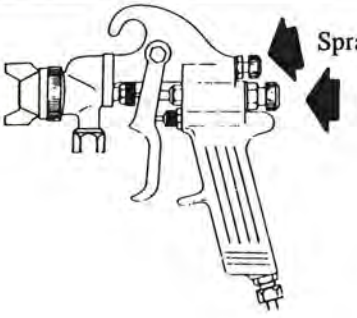
GUN HANDLING

The first requirement for a good resultant finish is the proper handling of the gun. The gun should be held perpendicular to the surface being covered, and moved parallel with it.

The distance between gun and surface should be 6 to 12 inches depending on material and atomizing pressure. The material deposited should always be even.
Lap each stroke over the preceeding stroke to obtain a uniform finish.

NOTE: To reduce overspray and obtain maximum efficiency; always spray with the lowest possible atomizing air pressure.





Spray width adjustment. Turn right for round, left for fan.

Fluid control screw. Turn to right to decrease flow, left to increase.

As width of spray is increased, more material must be allowed to pass through the gun to obtain the same coverage on the increased area.

TROUBLE SHOOTING INSTRUCTIONS

I. If powder does not flow:

A. Check powder air pressure gauge* for slight drop (0.3 psi or more) when trigger is pulled. If gauge does drop, refer to items B, C, or D, below. If gauge does not drop, refer to items E, F or G below.

B. Check powder level in hoppers.

C. Check to see if powder hose is blocked. Unscrew powder hose at gun handle, lower the free end of the hose, and shake excess powder out of hose. **Note**: Blockage is most frequently caused by releasing the gun trigger at the end of each pass across the work piece and restarting when moving back over the work. **Always spray continuously from start to finish.**

D. Check powder for foreign or oversize particles that can block the carburetor at the bottom of the hopper.

E. Check powder air "on-off" valve*.

F. Check to make certain air outlet of gun nozzle is not partially blocked with dried binder. If so, wipe or soak with thinner. This passage must allow adequate air flow to actuate the powder control mechanism in the panel.

G. In some cases, if the air supply pressure exceeds 70 psi, the internal mechanism which controls the powder on/off trigger in the panel could become locked in the 'off' position. Should this occur, turn off the air supply regulator. Remove the air from all lines by pulling the gun trigger until no more air is released. Turn the air supply regulator back on and set to 60-70 psi.

II. If binder does not flow:

A. Check binder valve opening adjustment.*

B. Check binder level in can.

C. Check binder pressure gauge.

D. Do not try to check for binder pressure in the can by cracking open the vent valve. Since this vent valve can also become clogged, it may give the appearance that there is no pressure in the can. Opening the pressurized can at this point could cause injury. Instead, shut down the air supply and bleed the air from the entire unit by depressing the gun trigger. Then proceed to remove the cover from the binder-can, and clear the check-valve inside.

E. Once the can is open, also check for a bad lid gasket, or one that is dirty. Such gaskets will not seal properly and will result in poor fluid flow, or no flow at all.

F. Check that the binder tank relief valve located on top of the binder tank lid (see page 16, part No. 712858-07-00) is not clogged and is closed.

G. Verify that the check valve in the binder tank is not stuck due to binder hardening. You should be able to move this valve very slightly (approx. 1/32" in either direction). If not, pour a small amount of thinner or solvent in the binder tank, replace the lid and shake vigorously for 30 seconds or until valve loosens.

III. If excessive overspray:

(See pages 9 and 10 for more information on pressure adjustments and spraying techniques.)

A. Increase binder flow. Excessive overspray can be caused by insufficient binder flow in proportion to the amount of powder being sprayed.

B. Decrease spray distance. Spray distance should not exceed 12 inches in most cases, and will vary greatly from job to job.

C. Increase/decrease spray pattern. Very wide or narrow spray patterns can cause the following problems. Spray pattern too wide: there is insufficient binder flow to cover the spray pattern, thus causing overspray. Spray pattern too narrow: the powder flow is excessive for the small concentrated pattern being sprayed.

D. Decrease powder flow. The powder flow is excessive for the pattern being sprayed.

Note: *Never use metal instruments to clean the air or material nozzles. The parts are carefully machined and any damage to them will cause faulty spray.*

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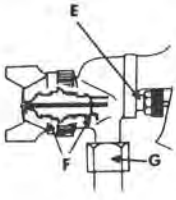
* See photo on page 2 for explanation

FAULTY PATTERNS and how to correct them

PATTERN	CAUSE	CORRECTION
	Dried material in side-port "A" restricts passage of air. Greater flow of air from cleaner side-port "B" forces fan pattern in direction of clogged side. 	Dissolve material in side-ports with thinner, then blow gun clean. Do not poke into openings with metal instruments.
	Dried material around the outside of the fluid nozzle tip at position "C" restricts the passage of atomizing air at one point through the center opening of air nozzle and results in pattern shown. This pattern can also be caused by loose air nozzle. 	Remove air nozzle and wipe off fluid tip, using rag wet with thinner. Tighten air nozzle.
	A split spray or one that is heavy on each end of a fan pattern and weak in the middle is usually caused by (1) too high an atomization air pressure, or (2) by attempting to get too wide a spray with thin material.	Reducing air pressure will correct cause (1). To correct cause (2), open material control to full position by turning to left. At the same time, turn spray width adjustment to right. This will reduce width of spray but will correct split spray pattern.
 SPITTING	(1) Dried out packing around material needle valve permits air to get into fluid passageway. This results in spitting. (2) Dirt between fluid nozzle seat and body or loosely installed fluid nozzle will make gun spit. (3) A loose or defective swivel nut on siphon cup or material hose can cause spitting.	 To correct cause (1) back up knurled nut (E), place two drops of machine oil on packing, replace nut and tighten with fingers only. In aggravated cases, replace packing. To correct cause (2), remove fluid nozzle (F), clean back of nozzle and nozzle seat in gun body using rag wet with thinner, replace nozzle and draw up tightly against body. To correct cause (3), tighten or replace swivel nut.

GENERAL MAINTENANCE

SPRAY GUN

1. Immerse only the front end of the gun until solvent just covers the fluid connection.
2. Use a bristle brush and solvent to wash off accumulated powder and binder.
3. Do not submerge the entire spray gun in solvent because:
   a. the lubricant in the leather packings will dissolve and the packings will dry out.
   b. the lubricant at wear surfaces will dissolve causing harder operation and faster wear.
   c. residue from dirty solvent may clog the narrow air passages in the gun.
4. Wipe down the outside of the gun with solvent dampened rag.
5. Lubricate gun daily. Use a light machine oil on:
   a. fluid needle packing.
   b. air valve packing.
   c. side port control packing.
   d. trigger pivot point.
   Coat the fluid control spring with vaseline.
6. Caution: Never use lubricants containing silicone. This material may cause finish defects.

PRECAUTIONARY NOTE

All parts on a spray gun should be screwed in hand tight at first; this will avoid the possibility of cross threading the parts. If the parts can not be turned by hand easily, make sure you have the correct parts, unscrew, realign, and try again. NEVER use undue force in mating parts.

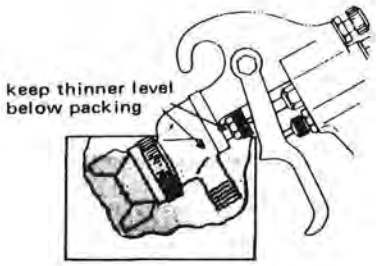
AIR NOZZLE, FLUID NOZZLE, NEEDLE ASSEMBLY

1. All nozzles and needles are precision made. They should be handled with care.
2. Except as described in 5., do not make any alterations in the gun. To do so could cause finishing difficulties.
3. To clean nozzles, soak them in solvent to dissolve any dried material, then blow them clean with air.
4. Do not probe any of the holes in the nozzles with metal instruments. If probing is necessary, use only a tool that is softer than brass.
5. Adjust the fluid needle valve so that when gun is triggered, air-flow occurs before fluid-flow.

POINTERS ON CLEANING

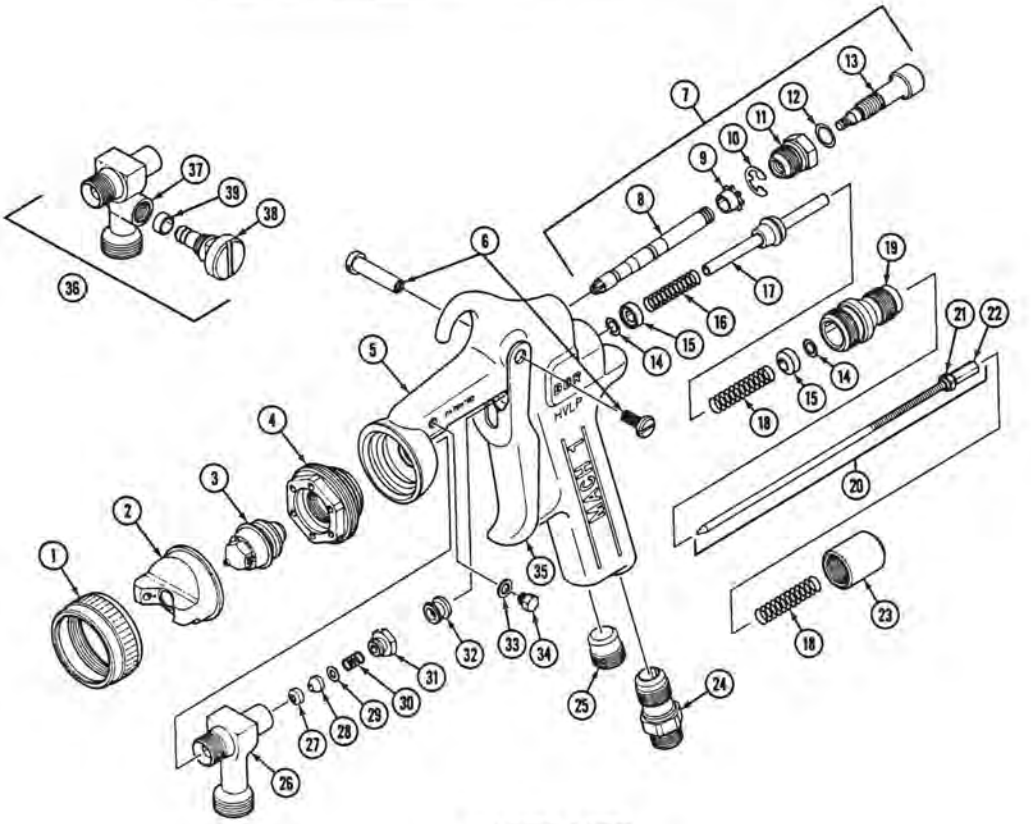
WHEN USED WITH PRESSURE TANK

Shut off air supply to tank and release pressure on tank. Open vent and loosen air nozzle. Hold a piece of cloth over the air nozzle and squeeze trigger. Air will back up through fluid nozzle, and force fluid out of hose into tank. Next, put enough thinner into tank to wash hose and gun thoroughly. Spray thinner through the gun until it is clean. Attach fluid hose to air line and blow it out thoroughly to remove all traces of materials and to dry it.



Note: For best results, use a non-ozone depleting thinner. Contact Wall Colmonoy Corporation for details.

SPRAY GUN



PARTS LIST

(When ordering, please specify PART NO.)

ITEM NO.	PART NO.	DESCRIPTION	QTY.
1	54-3531	RETAINING RING	1
2	★	AIR NOZZLE	1
3	★	FLUID NOZZLE	1
4	54-3543	HEAD INSERT	1
5	54-3922	GUN BODY ASSY.	1
6	54-3919	TRIGGER STUD & SCREW KIT	1
7	54-3946●	FAN CONTROL ASSY. #6	1
8	54-3956	CONTROL STEM	1
9	54-3917	GUIDE BUSHING	1
10	54-3511	RETAINING RING	1
11	54-4218	CONTROL BODY	1
12	20-6160	O-RING	1
13	54-4217	CONTROL SCREW	1
14	20-4615	O-RING, Teflon	2
15	54-3515	SEAL RETAINER	2
16	54-3520	SPRING	1
17	54-3512	SPINDLE ASSY.	1
18	54-3518	SPRING	2
19	54-3541	HOUSING	1
20	★★■	NEEDLE ASSY., Stainless Steel	1
21	54-3604	NEEDLE LOCK NUT	1
22	54-3603	NEEDLE CAP	1
23	54-3606	MATERIAL VALVE CONTROL KNOB	1
24	54-768	AIR CONNECTION	1
25	54-3504	PLUG	1
26	54-3533	FLUID INLET, Stainless Steel	1
27	54-4264▲■	GLAND ADAPTER	1
28	54-4265▲■	NEEDLE SEAL	1
29	54-4266▲■	SEAL BACKUP	1
30	54-4267▲■	SPRING	1
31	54-4263▲■	PACKING NUT	1
32	54-3513	VALVE SPINDLE CAP	1
33	54-3925	GASKET	1
34	54-3928	PLUG	1
35	54-3547	TRIGGER	1
36	54-4275	ADJUSTABLE FLUID INLET ASSY. (Optional)	1
37	54-4300	ADJUSTABLE FLUID INLET (Optional)	1
38	54-4305	SPINDLE ASSY. (Optional)	1
39	54-4303	PACKING SEAL	1

★ Select from Air and Fluid Nozzle Chart

★★ Nozzle Chart

◆ Also available is Spare Kits 54-3605. Please order kit separately.

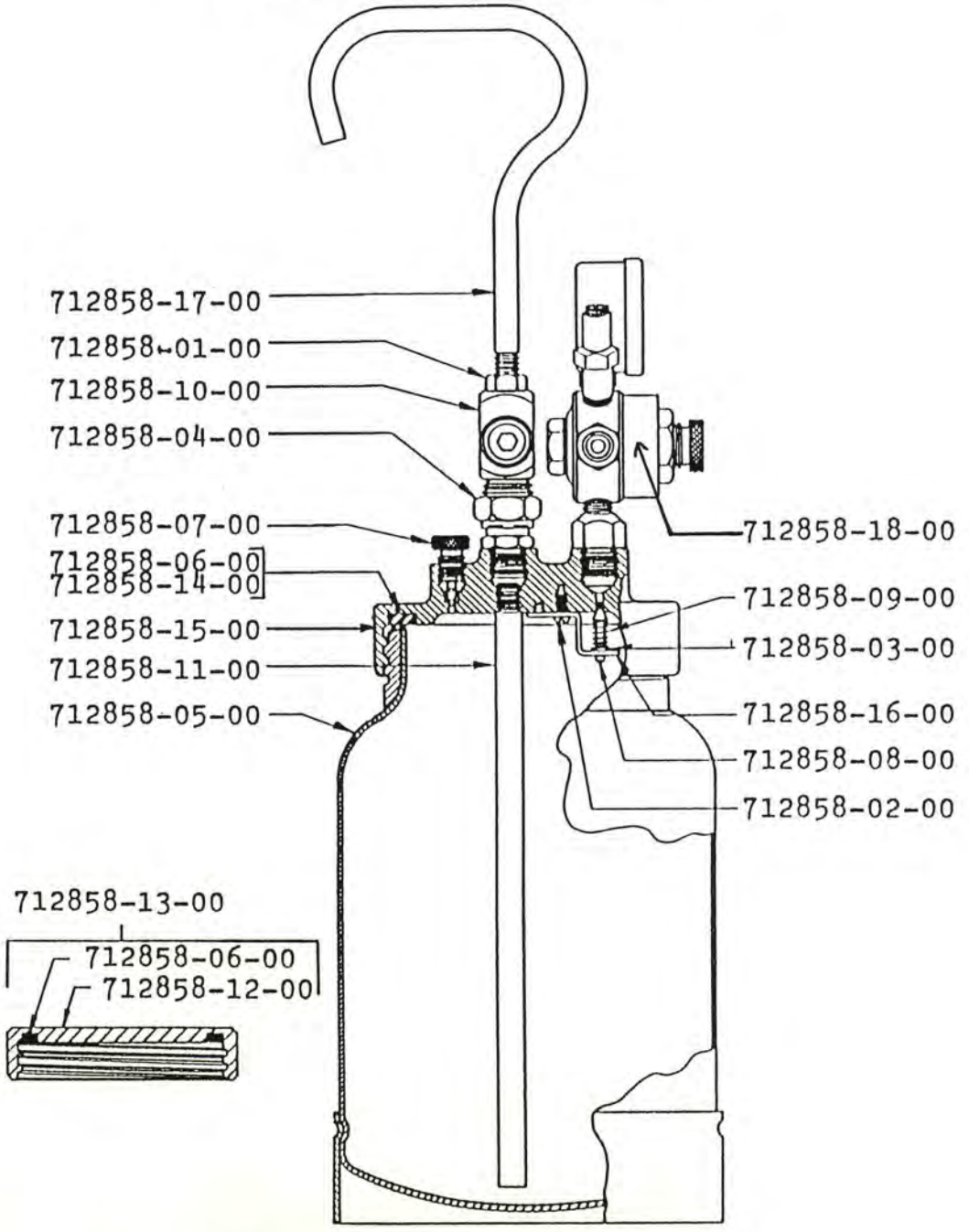
● Optional: Fan Control Assy. #10 (54-3915) Requires up to 95 psi air inlet pressure to gun.

■ Part of Self-Adjusting Packing Kit (54-4262) with needle.

■■ For Special Purpose Nozzles

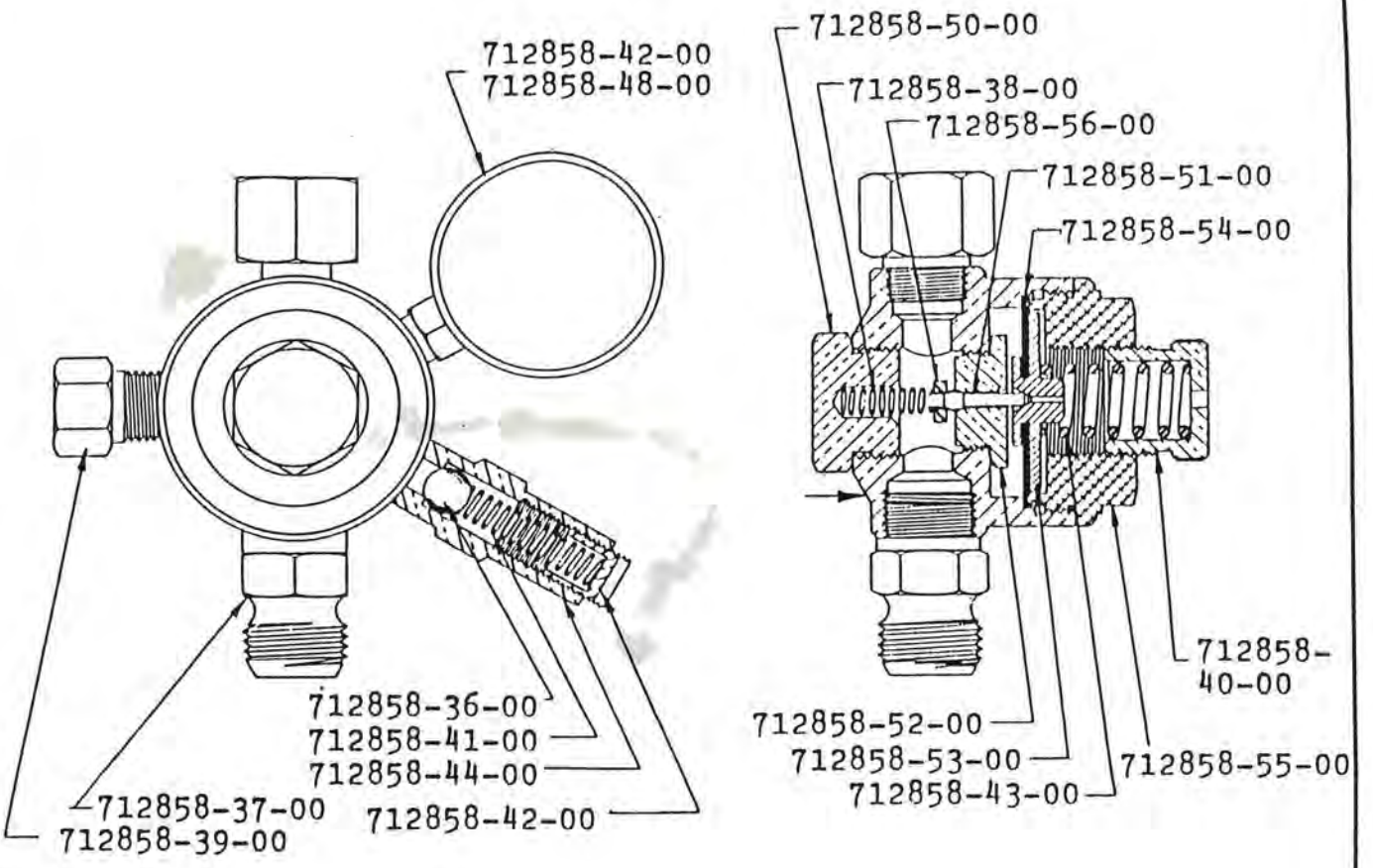
▲ Part of Self-Adjusting Packing Kit (54-4261) without needle.

2-QT. PRESSURE CAN ASSEMBLY



712858-01-00	Jam nut 5/16" hex
712858-02-00	Machine screw, rd.hd. 6-32 x 1/4"
712858-03-00	Check valve washer
712858-04-00	Center post assembly
712858-05-00	Cup (2 Qt)
712858-06-00	Cover gasket (Thiokol)
712858-07-00	Relief valve stem
712858-08-00	Check valve
712858-09-00	Spring, check valve
712858-10-00	Fluid outlet
712858-11-00	Fluid tube (2 qt)
712858-12-00	Cover
712858-13-00	Cover Assembly
712858-14-00	Cover gasket (leather)
712858-15-00	Container cover
712858-16-00	Check valve bracket
712858-17-00	Handle
712858-18-00	Regulator assembly

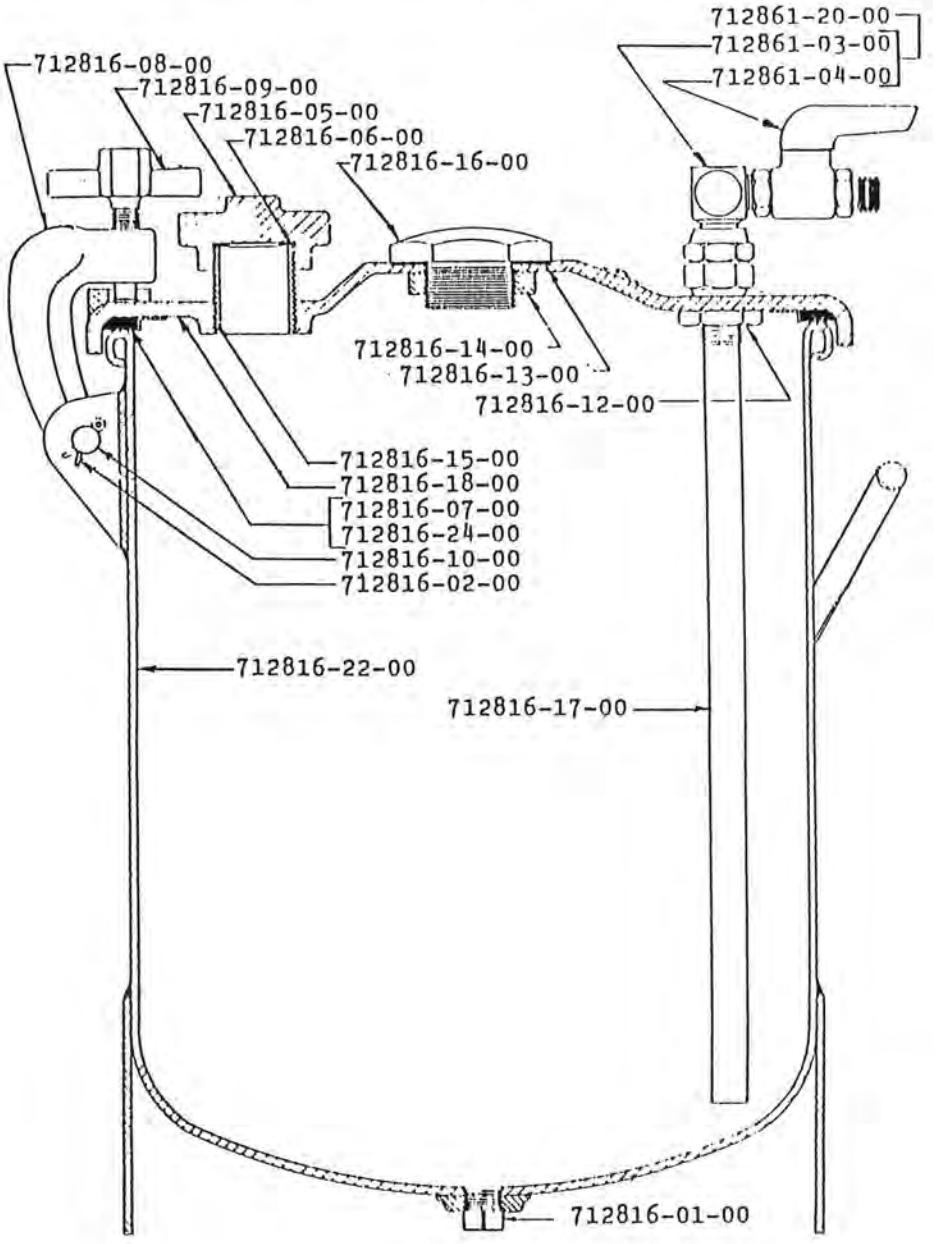
BINDER FEED REGULATOR



712858-18-00	AIR PRESSURE REGULATOR ASSEMBLY
712858-36-00	Ball 1/4" Dia. (Stainless Steel)
712858-37-00	Air connection, 1/4 NPS
712858-38-00	Valve spring
712858-39-00	Air connection, 1/4 NPS
712858-40-00	Adjusting cap
712858-41-00	Safety valve spring
712858-42-00	Air gauge, 60 PSI
712858-43-00	Adjusting spring
712858-44-00	Safety valve body
712858-45-00	Safety valve spring screw
712858-46-00	Safety valve , 30 PSI
712858-47-00	Regulator body
712858-48-00	Gauge lens (replacement)
712858-49-00	Support
712858-50-00	Rear cap *
712858-51-00	Adjusting valve*
712858-52-00	Valve seat *
712858-53-00	Diaphragm disc *
712858-54-00	Diaphragm *
712858-55-00	Front cap *
712858-56-00	Valve washer *
712858-57-00	Repair kit

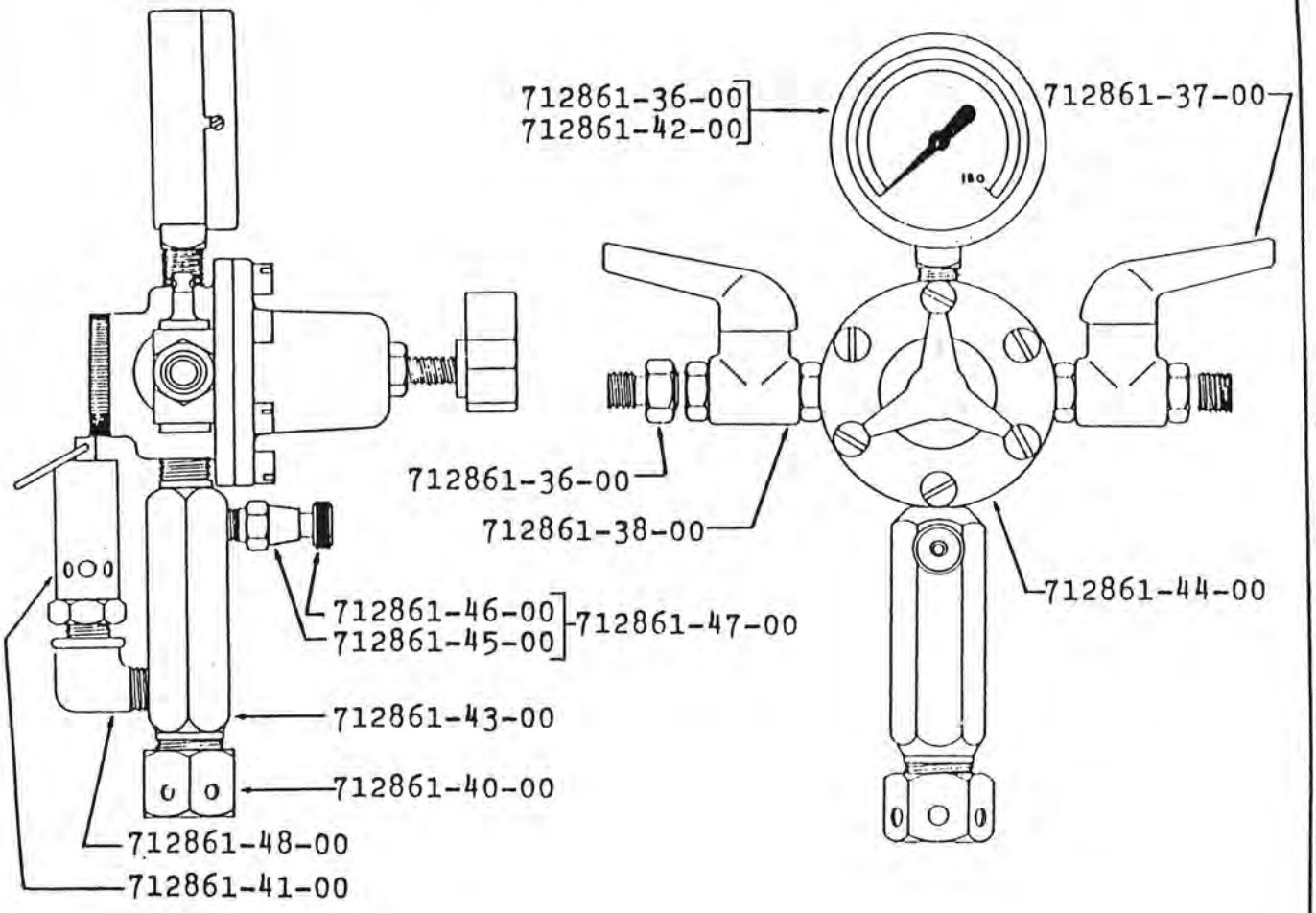
* = Included in repair kit

5-GALLON PRESSURE TANK ASSEMBLY



712861-01-00	Pipe plug 1" NPT	712861-15-00	Filler nipple
712861-02-00	Cotter pin, 1/8" dia. x 3/4"	712861-16-00	Tank head plug
712861-03-00	Connection	712861-17-00	Fluid tube
712861-04-00	Ball valve, 3/8" NPS	712861-18-00	Head assembly
712861-05-00	Filler cap	712861-19-00	Head assembly (Teflon)
712861-06-00	Filler cap gasket	712861-20-00	Single outlet assembly
712861-07-00	Head gasket (Thiokol)	712861-21-00	Inner container cover
712861-08-00	"C" clamp	712861-22-00	Galvanized inner container
712861-09-00	Clamp screw	712861-23-00	Air outlet, 1/4" NPS, double
712861-10-00	Clamp pin	712861-24-00	Head gasket (Rubber)
712861-11-00	Tank head	712861-25-00	Bottom outlet kit, single
712861-12-00	Fluid tube locknut	712861-26-00	Bottom outlet kit, double
712861-13-00	Plug gasket	712861-27-00	Top fluid outlet, 3/8" NPS,
712861-14-00	Plug locknut, 1 1/4" NPS L.H.	712861-28-00	Air control unit

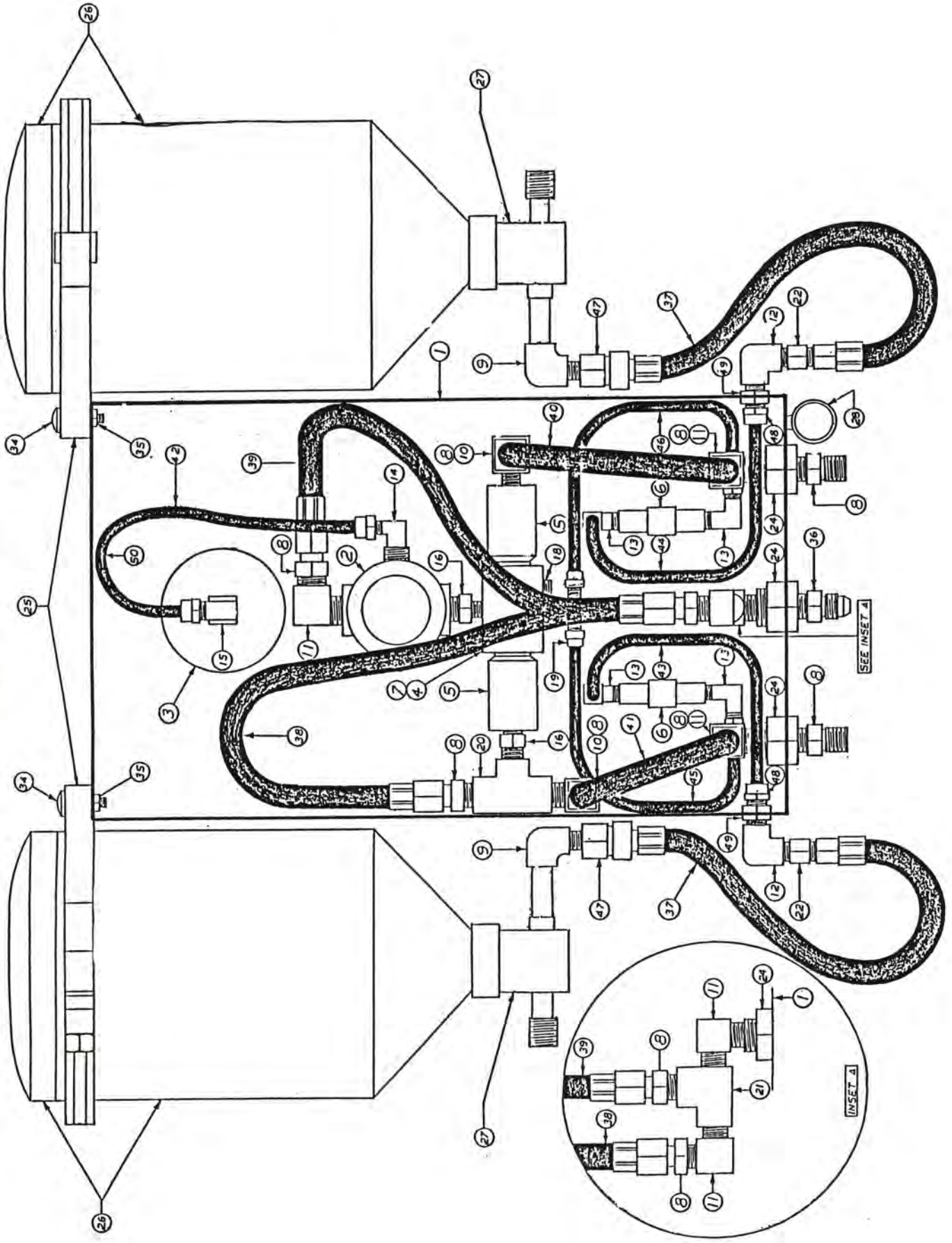
AIR CONTROL UNIT
(Used to regulate fluid pressure only in pressure tank)



712861-36-00	Adaptor
712861-37-00	Air valve
712861-38-00	Air valve
712861-39-00	Gauge
712861-40-00	Nut
712861-41-00	Valve
712861-42-00	Gauge lens (glass)
712861-43-00	Body
712861-44-00	Air regulator
712861-45-00	Body
712861-46-00	Stem
712861-47-00	Valve
712861-48-00	Elbow

OPERATION: To increase pressure on the fluid, turn regulator knob CLOCKWISE. To decrease pressure, turn knob COUNTER-CLOCKWISE.
NOTE: To rapidly vent the tank, open 61-46 Stem.

PANEL ASSEMBLY



PANEL ASSEMBLY

712846-01-00	Panel with back plate
712846-02-00	Air regulator with knob & decal
712846-03-00	Air gauge 0-60 PSI
712846-04-00	Fourway control valve
712846-05-00	Miniature pilot actuator
712846-06-00	Toggle valve
712846-07-00	Spring
712846-08-00	Bushing, right hand
712846-09-00	Elbow, 1/8" MPT x 1/8" FPT
712846-10-00	Elbow, 1/8" MPT x 1/4" FPT
712846-11-00	Elbow, 1/4" MPT x 1/4" FPT
712846-13-00	Elbow, 1/4"P x 1/8" MPT
712846-14-00	Elbow, 1/4" P x 1/4" MPT
712846-15-00	Elbow, 1/4" P x 1/8" FPT
712846-16-00	Reducing bushing, 1/4" MPT x 1/8" MPT
712846-17-00	Pipe Plug, hex 1/4" MPT
712846-18-00	Pipe plug, slotted 1/8" MPT
712846-19-00	Tee 1/4" P x 1/4" P x 1/8" MPT
712846-20-00	Tee 1/4" FPT x 1/4" FPT x 1/4" FPT
712846-21-00	Tee 1/4" MPT x 1/4" FPT x 1/4" FPT
712846-22-00	Oxygen fitting 1/8" MPT x 3/8" -24
712846-24-00	Anchor Connector 1/4" FPT x 1/4" FPT
712846-25-00	Bracket & clamp assembly
712846-26-00	Hopper & cover assembly
712846-27-00	Carburetor, powder
712846-28-00	Hanger, 2 quart container
712846-29-00	Rubber bumper
712846-30-00	Cap screw, socket hd. 8-32 x 1 1/2"
712846-31-00	Hex nut 8-32
712846-32-00	Starwasher
712846-33-00	Sheet metal screw, hex hd, slotted #6 x 3/8"
712846-34-00	Machine screw, Phillips hd, 1/4"-20 x 3/4"
712846-35-00	Hex nut 1/4" -20
712846-36-00	Male connector 1/4" MPT x 9/16" -18
712846-37-00	Air hose, carburetor 1/4" I.D. x 11"
712846-38-00	Air hose 1/4" I.D. x 13"
712846-39-00	Air hose 1/4" I.D. x 11"
712846-40-00	Air hose 1/4" I.D. x 9 1/2"
712846-41-00	Air hose 1/4" I.D. x 8 1/2"
712846-42-00	Poly-Flo tubing 1/4" O.D. x 11"
712846-43-00	Poly-Flo tubing 1/4" O.D. x 9 1/2"
712846-44-00	Poly-Flo tubing 1/4" O.D. x 9 1/2"
712846-45-00	Poly-Flo tubing 1/4" O.D. x 6"
712846-46-00	Poly-Flo tubing 1/4" O.D. x 9"
712846-47-00	Socket quick connect
712846-48-00	Male connector 1/4"P x 1/8" MPT
712846-49-00	Anchor connector 1/8" FPT x 1/8" FPT
712846-50-00	Orifice plug

Item Nos. on Panel

BRAZING FILLER METAL SELECTOR CHART

WALLCOLMONOY CORP. (USA) v2.2e

NICROBRAZ®

(nickel-based)

	B (No P)									Si (No B)				P (No B)			Co
	125	L.C.	L.M.	130	135	150	160	170	171	33	30	31	152	10	50	51	210
AWS A5.8:	BNi-1	BNi-1a	BNi-2	BNi-3	BNi-4	BNi-9		BNi-10	BNi-11		BNi-5	BNi-14		BNi-6	BNi-7	BNi-12	BCo-1
AMS:	4775	4776	4777	4778	4779						4782					4783	
RECOMMENDATIONS FOR SPECIFIC APPLICATIONS																	
For high temperature, high-stress moving engine components	A	A	B	B	C	A	C	A	A	A	A	A	A	C	C	B	A
For heavy, non-moving structures (variable gaps)	A	A	A	B	B	A	A	A	A	A	B	B	B	C	C	C	B
For honeycomb and other thin materials	C	C	B	B	B	B	C	C	C	B	A	A	A	A	A	A	A
For nuclear reactor core assemblies	●	●	●	●	●	●	●	●	●	A	A	A	A	B	A	A	●
For large, machinable or softer fillets	B	B	C	C	A	C	A	B	B	B	C	C	B	C	C	C	C
Use for contact with NaK	A4	A	A4	A4	B4	A	B	B	A	A	A4	A	A	C	A4	A4	A
For use with tight or deep joints	C	C	B	B	C	B	C	C	C	A	B	B	A	A	A	A	B

A = Best B = Satisfactory C = Least Satisfactory ● = Contains boron; has high neutron absorption. May be used in nuclear plant equipment, but not in core.

COMPARATIVE PHYSICAL AND METALLURGICAL PROPERTIES From 1 (highest) to 10 (lowest)

Joint strength[2]	1	1	1	2	2	1	2	1	1	1	1	1	1	4	2	2	1
Solution and diffusion with base metal	1	1	1	1	2	1	2	2	2	3	3	3	3	4	4	4	4
Fluidity	3	3	2	2	3	2	4	4	3	2	2	2	2	1	1	2	2
Oxidation resistance[3] of joints, up to	1	2	2	2	3	1	4	1	1	2	2	2	2	5	5		1
°F:	2200	2200	2000	2000	1800	2200	1700	2200	2200	2000	2200	2000	2000	1400	1575	1575	2200
°C:	1205	1205	1090	1090	980	1205	925	1205	1205	1095	1205	1095	1095	775	860	855	1205
Brazing range °F from:	1950	1950	1850	1850	1950	1950	1900	2100	2100	1925	2100	2000	1922	1700	1800	1800	2100
to:	2200	2200	2150	2150	2150	2200	2050	2200	2200	2150	2200	2200	2050	2000	2000	2000	2250
°C from:	1065	1065	1010	1010	1065	1065	1056	1150	1150	1050	1150	1093	1050	925	980	980	1150
to:	1205	1205	1175	1175	1175	1205	1121	1205	1205	1177	1205	1204	1121	1095	1095	1095	1230
Suggested brazing temps. °F:	2050	2050	1950	1900	2050	2150	1950	2150	2150	2050	2175	2050	1976	1800	1950	1950	2150
°C:	1120	1120	1065	1040	1120	1065	1065	1175	1175	1120	1190	1120	1080	980	1065	1065	1175
Recommended joint gaps (clearance) in. from:	0.002	0.002	0.001	contact	0.002	0.001	0.005	0.004	0.003	0.001	0.001	0.001	0.001	contact	contact	contact	0.001
to:	0.005	0.006	0.004	0.002	0.004	0.004	0.010	0.010	0.008	0.008	0.004	0.004	0.004	0.001	0.001	0.002	0.004
mm from:	0.05	0.05	0.03	contact	0.05	0.03	0.12	0.10	0.08	0.025	0.03	0.03	0.025	contact	contact	contact	0.03
to:	0.12	0.15	0.10	0.05	0.10	0.10	0.25	0.25	0.20	0.203	0.10	0.10	0.102	0.03	0.03	0.05	0.10

Corrosion Resistance: All Nicrobraz filler metals have good corrosion resistance in a wide variety of corrosive media. Corrosion resistance depends on type of base metal, brazing filler metal, and their interaction during the brazing process. Tests are required for specific information.

[1] Recommendations and comparisons given are based on information from our laboratory testing program, our processing plants, and processing plants of our customers.

[2] Joint strength depends on brazing cycle, joint design, joint clearance, base metal, etc. See Technical Data Sheet on evaluating the strength of brazing joints.

[3] Tests conducted on Inconel base metal joints. Exposed 500 hours in still air temperature indicated. No deterioration of fillet. Nicrobraz 170 tests conducted on Hastelloy X.

[4] This filler metal has been tested and approved by DOE laboratories and by private industry manufacturers of nuclear reactors. Tests were conducted on brazed joints of type 304 and 301 stainless steel, and Inconel base metals.

BRAZING FILLER METAL SELECTOR CHART

WALLCOLMONOY CORP. (USA) v2.2e

NICROBRAZ®
(nickel-based)

WALLCOLMONOY
HI TEMP BRAZING ALLOYS

	125	L.C.	L.M.	10	30	31	33	152	50*	51	130	135	150	160	170	171	210	CuBraz
DESCRIPTION	For well diffused, high strength, heat resistant joints, and highly stressed structures, such as jet engine parts.	Low-carbon filler metal, similar to Nicrobraz 125. Good chemical corrosion resistance.	Low-melting filler metal, similar to Nicrobraz 125 in properties and uses. Lower brazing temperatures.	Free-flowing, low melting, chromium-free filler metal, good for marginal atmospheres. Minimizes base metal erosion.	Used similar to Nicrobraz 125, plus nuclear reactor uses where boron cannot be used. High strength with low base-metal penetration.	Enhanced flow characteristics over typical high Cr alloys. Provides higher burst strength in heat exchanger applications than typical Ni alloys.	Similar to Nicrobraz 152, with higher silicon content to improve resistance to oxidation and corrosion.	Similar to Nicrobraz 31, with higher Cr and P content to narrow the melting range and reduce atmosphere sensitivity, while maintaining high resistance to oxidation and corrosion.	Low-melting, free-flowing filler metal for honeycomb structures and thin-walled tube assemblies. Has low solubility.	Similar to Nicrobraz 50, except for greater strength, and heat and corrosion resistance.	Good general purpose filler metal. It flows freely in marginal atmospheres, in deep or tight joints. Applications similar to Nicrobraz 125.	Wide melting range, free-flowing properties, machinability, and low diffusion with most base metals.	Excellent for jet engine parts and similar highly stressed components. Good strength at lower brazing temperatures.	For wide clearance joints where heavier fillits or greater joint ductility and machinability are desired.	Extra high strength at high temperatures. Good for brazing base metals containing cobalt, tungsten, and molybdenum.	Applications similar to Nicrobraz 170 except for better flow.	High elevated temperature strength and low base metal penetration. Especially good for brazing cobalt based alloys.	Copper powder mixed in a gel-type binder, for air-powered applications. For brazing iron or steel assemblies.
SPECIFICATIONS AWS A5.8 AMS & OTHERS[7,8]	BNi-1 4775	BNi-1a 4776 PWA 996	BNi-2 4777 B50TF204	BNi-6 PWA 36100	BNi-5 4782 B14Y3 B50TF81	BNi-14			BNi-7	BNi-12	BNi-3 4778 B50TF205	BNi-4 4779 B50TF206	BNi-9 B50TF207		BNi-10 PWA 693	BNi-11	BCo-1 4783 B50T56 PWA 713	BCu-1a 4740
NOMINAL COMPOSITION (%)	Cr 14.0 B 3.0 Si 4.5 Fe 4.5 C 0.7 Ni Bal.	Cr 14.0 B 3.0 Si 4.5 Fe 4.5 C 0.06 max. Ni Bal.	Cr 7.0 B 3.1 Si 4.5 Fe 3.0 C 0.06 max. Ni Bal.	P 11.0 C 0.06 max. Ni Bal.	Cr 19.0 Si 10.2 C 0.06 max. Ni Bal.	Cr 22.0 Si 6.5 P 4.5 Ni Bal.	Cr 29.0 Si 6.5 P 6.0 Ni Bal.	Cr 30.0 Si 4.0 P 6.0 Ni Bal.	Cr 14.0 P 10.0 C 0.06 max. Ni Bal.	Cr 25.0 P 10.0 Ni Bal.	B 3.1 Si 4.5 C 0.06 max. Ni Bal.	B 1.9 Si 3.5 C 0.06 max. Ni Bal.	Cr 15.0 B 3.5 C 0.06 max. Ni Bal.	Cr 11.0 B 2.25 Si 3.5 Fe 3.5 C 0.5 Ni Bal.	Cr 12.0 B 2.5 Si 3.5 W 16.0 Fe 3.5 C 0.50 Ni Bal.	Cr 10.0 B 2.5 Si 3.5 W 12.0 Fe 3.5 C 0.4 Ni Bal.	Ni 17.0 Cr 19.0 B 0.8 Si 8.0 W 4.0 C 0.40 Co Bal.	Cu 99 min.
MELTING POINT[2] SOLIDUS/LIQUIDUS °F °C	1780 / 1900 970 / 1040	1780 / 1970 970 / 1075	1780 / 1830 970 / 1000	1610 875	1975 / 2075 1080 / 1135	1730 / 1960 943 / 1071	1770 / 1910 970 / 1045	1730 / 1875 943 / 1024	1630 890	1620 / 1740 880 / 950	1800 / 1900 980 / 1040	1810 / 1935 990 / 1055	1930 1055	1780 / 2120 970 / 1160	1780 / 2020 970 / 1105	1780 / 2000 970 / 1095	2025 / 2100 1108 / 1150	1981 1083
BRAZING RANGE °F °C	1950-2200 1065-1205	1950-2200 1065-1205	1850-2150 1010-1175	1700-2000 925-1095	2100-2200 1150-1205	2000-2200 1093-1204	1925-2150 1050-1177	1922-2050 1050-1121	1800-2000 980-1095	1800-2000 980-1095	1850-2150 1010-1175	1950-2150 1065-1175	1950-2200 1065-1205	1900-2050 1036-1121	2100-2200 1150-1205	2100-2200 1150-1205	2100-2250 1150-1230	2000-2100 1093-1150
SUGGESTED BRAZING TEMP.3 (°F / °C)	(2050 / 1120)	(2050 / 1120)	(1950 / 1065)	(1800 / 980)	(2175 / 1190)	(2050 / 1120)	(2050 / 1121)	(1976 / 1080)	(1950 / 1065)	(1950 / 1065)	(1900 / 1040)	(2050 / 1120)	(2150 / 1175)	(1950 / 1065)	(2150 / 1175)	(2150 / 1175)	(2150 / 1175)	(2050 / 1120)
RECOMMENDED ATMOSPHERE[4]	A, B	A, B	A, B	A, B, C, D	A, B, C	A, B, C	A, B, C	A, B, C	A, B, C	A, B, C	A, B	A, B	A, B	A, B	A, B	A, B	A, B	A, B, C, D
OXIDATION RESISTANCE UP THROUGH[5] °F °C	2200 1205	2200 1205	2000 1085	1400 760	2200 1205	2000 1095	2000 1095	2000 1905	1575 855	1575 855	2000 1090	1800 980	2050 1120	1700 925	2200 1205	2200 1205	2200 1205	800 427
DENSITY LB/CU. IN. (SPECIFIC GRAVITY)	0.282 (7.80)	0.282 (7.80)	0.288 (7.97)	0.294 (8.13)	0.276 (7.65)	0.278 (7.65)	0.275 (7.61)	0.280 (7.75)	0.285 (7.90)	0.285 (7.90)	0.294 (8.13)	0.303 (8.38)	0.295 (8.16)	0.297 (8.22)	0.307 (8.50)	0.305 (8.45)	0.284 (7.87)	0.324 (8.96)
FOR MORE INFORMATION, SEE TECHNICAL DATA SHEET NUMBER	2.1.2	2.1.5	2.1.3	2.1.6	2.1.7	2.1.7.1 Rev D	2.1.7.3	2.1.11.1	2.1.8	2.1.8.5	2.1.10	2.1.17	2.1.11	2.1.12	2.1.13	2.1.13.1	2.1.19	2.1.16.1

Powders are -140 mesh size, U.S.S.S. (105 micron) unless otherwise specified (140F mesh, AWS A5.8)

* U.S. Patent Nos. 2,868,639 and 3,188,203 and 5,183,636 respectively.

[1] All filler metals available as powder, flux-powder paste, in gel-suspension, and plastic-bonded sheet or transfer tape. Some are also available as cast rod.

[2] This data was taken from cooling curves prepared in Wall Colmonoy Corporation Laboratories.

[3] The exact brazing temperature for any specific joint depends on the joint and base metal properties desired. It will also depend on the different base metal, brazing filler metal, and joint design combinations. Consequently it may sometimes be necessary to determine the ideal brazing temperature by experiment.

[4] Recommended atmospheres for brazing filler metals (stainless steels and high-chromium base metal require class A, B, or C).
A. Pure dry hydrogen or inert gases. B. Vacuum. C. Dissociated ammonia, nitrogen atmosphere - 60 F (-50C) dew point or drier.
D. Exothermic; rich, unpurified 6:1 air to gas ratio, or purified and dried.

[5] All oxidation-resistance tests were conducted on Inconel except Nicrobraz 170 which was conducted on Hastelloy X. Exposed 500 hrs. in still air. No deterioration of fillet.

[6] Brazed joint hardness is always less than the as-cast filler metal hardness. It will depend on base metal composition, joint clearance, brazing temperature, and time at heat.

[7] To get materials to these specifications you must order by spec number. (Chemistry and lot mesh size may have tighter limits than standard product and require special ordering.)

[8] ASME Boiler and Pressure Vessel Code, Sec II-C, SFA5.8 is met by filler metal designations BNi-1 through BNi-13 and BCo-1. Ask for information on additional specs met by Nicrobraz filler metals.

WALLCOLMONOY
HI TEMP BRAZING ALLOYS

NICROBRAZ® Special Purpose Filler Metals

New Nicrobraz filler metals are continually being developed, many of them for specific customer requirements. The table below includes several such materials.

Brazing Filler Metal	Specifications	Nominal Composition	Melting Point °F Solidus / Liquidus °C	Brazing °F Range °C	Remarks
3002	B50TF143	Cr 15.0 Ni Bal. Si 8.0	1975 / 2075 1080 / 1135	2150-2200 1175-1205	A modified Nicrobraz 30, for thin-gauge honeycomb
3003	B50TF142 PWA 797	Cr 17.0 B 0.10 Si 9.0 Ni Bal.	1980 / 2080 1080 / 1140	2100-2150 1150-1175	A modified Nicrobraz 30, with greater flow than 3002

Nicrobraz 5000-series filler metals:

These free flowing metals are designed to braze thin-walled and delicate structures where heavier and more ductile fillets are desired. Alloys form strong, relatively ductile joints with a minimum of aggression. May be used with cast iron where temperatures must be below normal range.

They can be used in pure dry hydrogen or inert gases and hard vacuum (down to 1 x 10^{-4} Torr = 133 x 10^{-4} mbar). Note: Greater vacuums are not recommended as chromium and other elements may be removed from the filler metal or base metal at specific temperatures.

Brazing temperatures as low as 1700°F (925°C) can be used if the atmosphere is pure enough to keep austenitic stainless steel clean. The exact brazing temperature depends on flow and size of fillet required.

5007		Cr 11.2 C 0.06 P 8.0 Ni Bal.	1630 / 1805 890 / 985	1850-2050 1010-1120	See above
5025		Cr 7.0 Cu 50.0 P 5.0 Ni Bal.	1630 / 1980 890 / 1080	1950-2100 1065-1150	See above
5027		Cr 4.9 Cu 65.0 P 3.5 Ni Bal.	1630 / 1980 890 / 1080	1950-2100 1065-1150	See above

LARGE CLEARANCE JOINTS (.010 to .100-in. = .25 to 2.5 mm) are most effectively brazed using one of our NICROGAP® alloys to fill the gap, plus a suitable brazing filler metal to induce bonding. The use of a Nicrogap alloy helps prevent conditions of underfill, voids, erosion, and excessive filler metal flow in the brazed joint. See Technical Data Sheet.

JOINT STRENGTH & DUCTILITY (fracture toughness) The exact joint strength and ductility of any assembly brazed with Nicrobraz filler metal depends on joint design, joint clearance, brazing cycle, and base metal composition, as well as filler metal composition. See Technical Data Sheet on evaluating the strength of brazed joints.

Most base metals brazed with Nicrobraz filler metals can have a joint strength above the base metal yield if the brazement is properly designed, and if the brazing operation is properly conducted. Also, under the same conditions, the joint ductility can be sufficient to withstand cyclic loading and thermal fatigue.

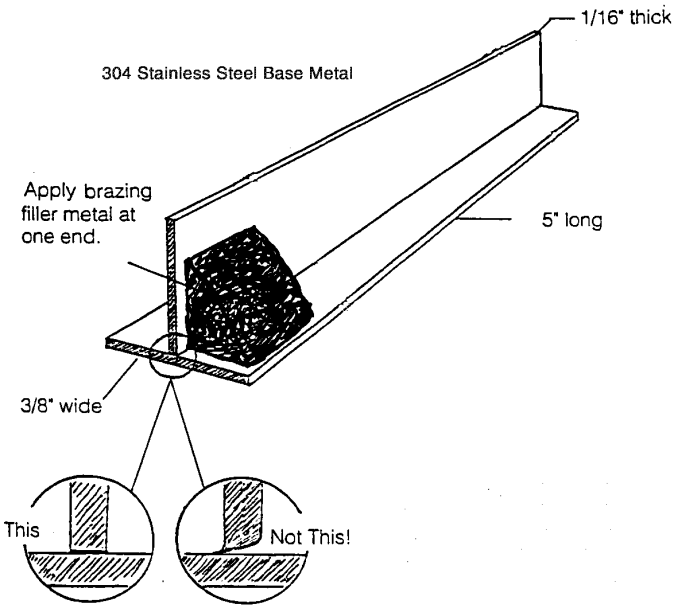
CORROSION RESISTANCE All Nicrobraz filler metals have good corrosion resistance in a wide variety of corrosive media. Corrosion resistance will depend on the type of base metal, brazing filler metal, and the interaction during the brazing process. Tests are required for specific information.

REMELT TEMPERATURE depends on brazing cycle, joint clearance, and filler metal used. In most cases, remelt temperature is higher than filler metal melting range.

WALLCOLMONOY
HI TEMP BRAZING ALLOYS

T-Specimens

Identifying Quality Issues During High Temperature Furnace Brazing



Use of T-Specimens is an excellent way to inspect and verify the quality of the furnace atmosphere during a brazing cycle.

Description:

One of the problems facing most brazing facilities today is on-site monitoring of atmosphere quality during the furnace brazing cycle. If brazed parts are removed from the furnace discolored, or poorly brazed, it is difficult to determine what went wrong and when it occurred during the cycle.

By using stainless steel T-Specimens in every load of parts, you can readily determine if a problem exists with the furnace, the atmosphere, the base metals being joined, or the brazing filler metal; and also when the problem occurred: during the heat-up or the cool-down cycle.

What is a T-Specimen:

A T-Specimen is an inverted "T" constructed of two pieces of 304 stainless sheet-metal strip, designed for use in any nonoxidizing, low-dew point furnace atmosphere (-40°F (-40°C), or drier), such as vacuum, pure-dry hydrogen, dissociated ammonia, nitrogen, or argon. T-Specimens provided by Wall Colmonoy are laser tack welded stainless steel and are ready for use.

A measured amount of brazing filler metal is placed at one end of the T-Specimen. The filler metal, in most cases, must be the same as that used on the main assemblies in the furnace load. The value of any observations will be greatly distorted if a different lot, batch, or type of filler metal is used on the T-Specimen than is used on the brazed assemblies.

Why Use 304 Stainless:

Because the chromium in 304 stainless steel is very sensitive to the atmosphere, it makes it a reliable and accurate indicator of atmosphere quality. Do not use T-Specimens made of any other material, regardless of the base metal being brazed.

Include at least one T-Specimen in every furnace brazing run.

Interpreting the Results:

The table on page 2 shows how to interpret the results of five different scenarios that can occur inside the brazing furnace, when nickel-based brazing filler metals (BFMs) are used.

Scenario 1: The base metal and T-Specimen is clean and bright with good filler metal flow. Conclusion: The furnace atmosphere and BFM are good.

You have a bright, clean, well brazed part.

Scenario 2: The base metal emerges from the furnace dark or discolored, with no filler metal flow, but the T-Specimen is bright and clean, with good filler metal flow. Conclusion: The atmosphere and BFM are good. A problem exists with the base metal (it may contain aluminum or titanium, etc., which is easily oxidized, even in normally "good" vacuum atmospheres.)

Scenario 3: Both base metal and T-Specimen are discolored, but filler metal flow is good on both. Conclusion: The base metal, filler metal and atmosphere were all good through the brazing range (because the BFM flowed well).

An atmosphere problem developed during the cooling cycle. (There may be a leak in an argon line being used to rapid cool the parts, or the parts may have been "too hot" when removed from the furnace.)

Scenario 4: Both the base metal and T-Specimen emerge dark or discolored, and the filler metal has not flowed at all. Conclusion: An atmosphere problem occurred at the beginning of the heating cycle (oxidizing both the base metal and filler metal, thereby preventing BFM flow). There may be a severe furnace leak, or a furnace contaminated with material which readily out-gasses during heating, thus contaminating the atmosphere.

Scenario 5: The base metal and T-Specimen emerge bright and clean, but the filler metal has not melted or flowed. Conclusion: Either the furnace was never turned on, or the filler metal may be bad. By including a T-Specimen with a BFM lot known to be good, and using this as a "control specimen", it can quickly be verified whether the original BFM was bad, or if a marginal atmosphere oxidized out the boron, silicon or phosphorus from the BFM prior to reaching brazing temperature.

This would render the BFM useless, even though the parts "cleaned up" enough at brazing temperature to emerge from the furnace looking clean and bright.

Atmosphere Quality Test for Nickel-Based Filler Metals:

This test uses a T-Specimen and is for nickel-base filler metals only. Nickel-based filler metals have varying degrees of sensitivity to the furnace atmosphere. The following nickel-based filler metals are listed in descending order of their sensitivity.

Nicrobraz (nickel-based)	**Nominal Composition - % by weight**					
	B	**Cr**	**Fe**	**P**	**Si**	**Ni**
30		19.0	-	-	10.2	Bal
125*	3.0	14.0	4.5	-	4.5	Bal
L.M.*	3.1	7.0	3.0	-	4.5	Bal
130*	3.1	-	-	-	4.5	Bal
50	-	14.0	-	10.0	-	Bal
10 (very insensitive)	-	11.0	-	-	-	Bal

**Suitable only in vacuum, pure, dry hydrogen and argon atmospheres. Boron containing filler metals react with nitrogen.*

The filler metal remaining at the point-of-application is the indicator.

A very good atmosphere leaves only a stain of the filler metal at the point-of-application.

No Residue — Very good atmosphere for the specific filler metal being tested.

"On Site" Q.C. Via T-Specimens							
Scenario	**Part**	**BFM Flow On Part**	**304 T-Spec.**	**BFM Flow on T-Spec.**	**Conclusions**		
					Atmosphere	**BFM**	**Remarks**
1	Bright	Good	Bright	Good	Good	Good	---
2	Dark	Poor or None	Bright	Good	Good	Good	Base metal problem
3	Dark	Good	Dark	Good	Good during heating	Good	Leak in quench line, or parts removed hot
4	Dark	Poor or None	Dark	Poor or None	Bad during heating	?	Furnace leak? Contaminated parts?
5	Bright	Poor or None	Bright	Poor or None	Good	Poor ?	Atmosphere leaching B, Si or P from BFM?

A Small Residue — Satisfactory for most applications. 25% Residue — Marginal atmosphere, which may not be suitable.

50% Residue — Very marginal, losing too much filler metal, and is probably unacceptable.

75-100% Residue — Not suitable for filler metal used.

The poorer the atmosphere, the higher the partial pressure of oxygen, and the larger the quantity of filler metal residue remaining at the point-of-application. The oxygen removes the melting-point depressant, leaving the high-melting nickel or nickel-chromium alloy.

The T-Specimen can also be used to test for surface contamination, Nicroblast, grit blasting benefits, or testing for any other brazing variable. A standard new (uncontaminated) T-Specimen should always be run along with the test, for comparison.

Availability:

Complete T-Specimens: Laser tack welded stainless steel T-Specimens ready for use.

The T-Specimen is not suitable for filler metals of copper, silver, gold, aluminum, etc. Use the vertical variable clearance specimen (VVC) for testing these filler metals in varying brazing atmosphere quality and varying processing conditions.

The information provided herein is given as a guideline to follow. It is the responsibility of the end user to establish the process information most suitable for their specific application(s).
Wall Colmonoy Corporation (USA) assumes no responsibility for failure due to misuse or improper application of this product, or for any incidental damages arising out of the use of this material.

updated October 2013

WALLCOLMONOY
HI TEMP BRAZING ALLOYS

The comprehensive range of Nicrobraz® Stop-Off™ products meet the needs of almost all applications

Nicrobraz® Stop-Off™ Materials

Aid in Brazing and Heat Treating Operations by Preventing Unwanted Filler Metal Flow and the Accidental Fusing Together of Parts

Description:

Nicrobraz® Stop-Off™ materials are designed to protect metal surfaces from the flow of molten brazing filler metal, or to prevent metal surfaces from adhering to each other in furnace brazing operations.

The various Nicrobraz® Stop-Off™ materials differ in composition, type, and, to some extent, purpose. It should be noted that all Stop-Off™ materials are extremely effective and should not be allowed to find their way into joints which are to be brazed. Should this happen, brazing will not occur.

Nicrobraz® Green Stop-Off™ and Yellow Stop-Off™ are essentially surface-active materials which prevent high-temperature-molten filler metal from bonding to a protected surface, either by penetration or by flowing under the Stop-Off™.

Nicrobraz® Red, White, Orange, and Blue Stop-Off™ materials act as parting compounds, designed to prevent mating surfaces from being brazed together. They effectively prevent the flow of filler metal into unwanted areas. However, on the rare occasion when furnace atmosphere conditions are extremely good, filler metal may be able to creep under the Stop-Off™ layer. These Stop-Off™ materials are generally effective in any type of brazing atmosphere, including vacuum, and with any type of base metal. Nicrobraz® Orange and Blue Stop-Off™ are recommended for very-high-vacuum applications and for use with reactive metals such as titanium, zirconium, and similar base metals.

Nicrobraz® Stop-Off™ comes in several forms, as shown in the table on page 2. The solvent-based Type I materials are flammable, and should be handled as such. Normal caution should be exercised in their use. They should only be used in well ventilated areas. The water-based Type II products may be preferable, since they have no objectionable smell and are not flammable. (Read the material safety data sheet, before use, for further instructions on using and storing these materials.)

Stop-Offs are being used successfully in brazing, both in controlled-atmosphere furnaces and with flux and torches, as well as in molten-salt dip brazing of aluminum. Specific mineral fluxes, however, may react with Stop-Off™ compounds, resulting in reduced effectiveness of the Stop-Offs, or in more difficult removal of the flux residue. To be effective, in all cases, the Stop-Off™ must completely cover the desired surface; no base metal should be visible through the Stop-Off™.

Nicrobraz® Stop-Off™

GENERAL USE	FORMS	CONTAINER SIZES
Green Surface protection. Prevents filler metal from bonding to a protected surface. May also be used as a masking agent when thermal spraying metallic coatings.	**Type I** (solvent base)	1 Kg and 3 Kg
	Type II (water base)	1 Kg, 5 Kg, and 200 Kg
	Felt-Tip Pen	10 mL pens (12 in a box)
Yellow General-purpose Stop-Off™ used in controlled atmosphere furnace and torch brazing, as well as in molten salt bath dip brazing. Can be used on almost any base metal, except reactive metals.	**Type II** (water base)	1.5 Kg
White Acts as a parting compound. Special grade designed for furnace brazing, prevents accidental brazing of mating surfaces, stacked parts or parts to fixtures. Prevents flow of brazing filler metal. Easy to remove.	**Powder** (used alone or with Nicrobraz® Cement)	1 Kg and 25 Kg
	Type I (solvent base)	1 Kg
	Type II (water base)	1.5 Kg and 40 g cartridges.
Red Acts as a parting compound and filler metal barrier. Works on any base-metal surface. Designed for furnace use. Residue is easily removed. Soluble in dilute acid.	**Type II** (water base)	1 Kg
Orange Prevents accidental brazing of mating surfaces and unwanted flow of filler metal. Special formula for very high vacuum furnace applications and for use with titanium and zirconium. Used in super-plastic forming operations.	**Type I** (solvent base)	1 Kg and 3 Kg
Blue Performs in extremely high temperatures. Formulated for use on reactive base metals such as titanium and zirconium.	**Type II** (water base)	1 Kg

Yellow Stop-Off™

Yellow Stop-Off™ for Torch Brazing
image source: AWS Brazing Handbook P. 238

Description:

This is a general purpose water-base Stop-Off™ used in controlled-atmosphere furnace work to prevent the molten filler metal from flowing into unwanted areas such as threads, holes and cast surfaces. This product combines the protection offered by the Nicrobraz® Green Stop-Off™ material with the ease of removal of the Nicrobraz® White Stop-Off™ products.

Recommended Uses:

It can be used with almost any type of base metal (except reactive metals, such as titanium and zirconium), brazing method, or filler metal. It is effective with nickel, copper and silver brazing filler metals. Yellow Stop-Off™ Type II can be used with flux for controlled-atmosphere furnace and torch brazing, as well as molten-salt-dip brazing of aluminum. When flux is used, the Stop-Off™ layer should be heavy and the flux layer thin. A heavy layer of flux will lower the effectiveness of the Stop-Off™.

Removal Procedures:

Any Yellow Stop-Off™ residue remaining after brazing is not harmful to surfaces and does not need to be removed. However, if removal is desired, the brazement can be blasted, wire brushed, or etched in a solution of deionized or distilled water, 10% nitric acid, and 2% hydrofluoric acid heated to 65°C (150°F) or in a molten-salt cleaning bath.

Green Stop-Off™

Green Stop-Off™ pen in use

Description:

Designed for all-purpose use, Nicrobraz® Green Stop-Off™ can be used with almost any type of base metal (except reactive metals, such as titanium and zirconium), any brazing method, or any brazing filler metal. It is the finest surface-protection agent made, and as such, provides the best assurance you can get that filler metal will not reach any protected metal surface. By confining the filler metal to joint areas, the amount of required filler metal may be greatly reduced. In addition to its primary function of protection against brazing filler metal where it is not wanted, it is used to protect areas not meant to be overlaid when flame spraying metallic coatings.

Nicrobraz® Green Stop-Off™ will not contaminate the atmospheres used in general furnace brazing applications. It comes in various forms, as described below.

Liquid, Type I (solvent-base):

Nicrobraz® Green Stop-Off™ can be thinned to any viscosity desired with standard lacquer thinners or acetone. It is usually applied by brushing, which assures accurate placement and excellent control of quantity. Screen printing, spraying, or dipping may also be used, after obtaining the proper viscosity for these methods. Whichever method is used, extreme care should be exercised in application, to prevent contaminating the brazed joint. Nicrobraz® Green Stop-Off™, as has been stressed earlier, is supremely effective as a barrier against filler metals. When a flux is used (as in torch brazing), the Stop-Off™ layer should be heavy and the flux layer thin. A heavy layer of flux will lower the effectiveness of the Stop-Off™ layer. (When using flux, Nicrobraz® Yellow Stop-Off™ is generally most effective.)

Type II (water-base):
This is identical to the Type I Nicrobraz® Green Stop-Off™ in performance and recommended uses. It differs in that it is a water-base material requiring less frequent agitation, has greater covering capacity, is practically odorless, and is not flammable.

Green Stop-Off™ (Type I) felt-tip pen:
This is the easiest-to-use form. Besides making barriers against the flow of molten metals with the stroke of a pen, it can be used for making heat-resistant markings on any metal surface. Markings will survive temperatures through 1650°C (3000°F) in the brazing furnace.

Application Procedure for Felt-Tip Pen:
Shake pen well before and during use. Ensure that pen is shaken sufficiently to hear the mixing ball rattle, prior to use. To start flow, press pen tip down several times until it is saturated. Draw lines, as with any marker pen, on surfaces that are clean and free of oils, rust or wax. To replenish flow, press down once. Keep capped when not in use.

Removal Procedure:
Nicrobraz® Green Stop-Off™ residue remaining after brazing is not harmful to surfaces and may be removed by any of several methods. (1) vapor blasting, (2) grit blasting, (3) wire brushing, (4) polishing, (5) pickling in a solution of deionized or distilled water, nitric acid (10%), and hydrofluoric acid (2%), heated to 65°C (150°F).

Recommended Uses:
Use Nicrobraz® Green Stop-Off™ to prevent the flow of brazing filler metal into threads, holes, cast surfaces, and the like. It can be used with almost any base metal, ferrous or non-ferrous. The exceptions are reactive metals such as titanium, zirconium, and their alloys (which require Nicrobraz® Orange or Blue Stop-Off™). Nicrobraz® Green Stop-Off™ holds back any type of brazing filler metal, including nickel-based, copper, silver, etc.

White Stop-Off™

White Stop-Off™ brushed onto bracket

Description:
Nicrobraz® White Stop-Off™ acts as a parting compound to prevent the accidental brazing of surfaces of adjoining parts being furnace-processed. It also prevents the sintering or cohesion of stacked parts during furnace heat treatment. It is specifically formulated to prevent contamination of either the base metal or filler metal. White Stop-Off™ may be used in vacuum brazing furnaces without causing contamination or objectionable outgassing. It comes in three forms, as described below.

Powder:
Nicrobraz® White Stop-Off™ powder can be mixed with any of the solvent- or water-based Nicrobraz® Cements. Reference specific Technical Data Sheets. The proportions of powder to cement may be varied to get the consistency needed for the intended use. The mixture may be applied by brushing, dipping, or spraying with a paint gun. It should be agitated frequently to keep it in suspension.

Type I (solvent base):
Nicrobraz® White Stop-Off™ when shaken well can be applied by brushing, dipping or spraying. It can be thinned to any desired viscosity with a standard lacquer thinner or acetone, both of which are flammable. The application should be heavy enough so that the base metal cannot be seen through the Stop-Off™.

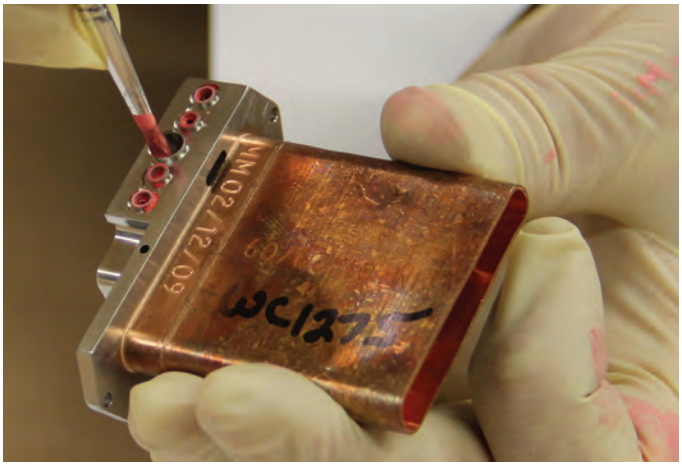
Type II (water-base):
This is a very viscous material that is normally applied with a syringe to areas such as small holes, to prevent filling with brazing filler metal. It can be thinned with deionized or distilled water for brushing, dipping

or spraying. It has excellent covering properties, is practically odorless and is not flammable.

Removal Procedure:

Nicrobraz® White Stop-Off™ remaining after brazing is easily brushed or wiped away. Any Nicrobraz® cement used with the Stop-Off™ will gas off completely, leaving only the powder residue. To remove from interior surfaces, immerse the piece in a solution of deionized or distilled water, 10% nitric acid, and 2% hydrofluoric acid heated to 65°C (150°F), or in a molten-salt cleaning bath.

Red Stop-Off™



Red Stop-Off™ applied to small holes on an ultra-cell

Description:

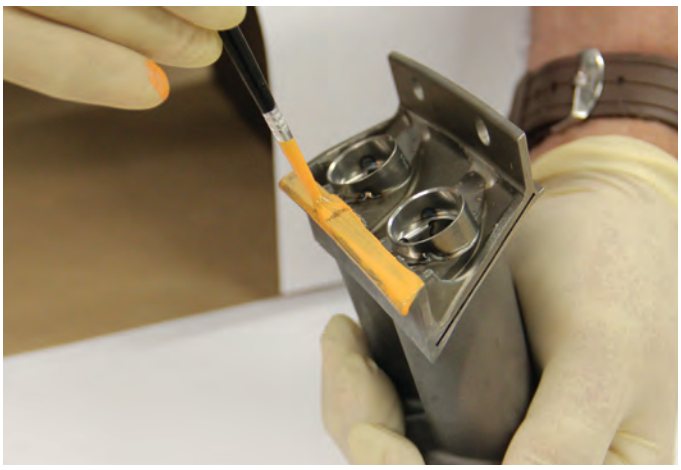
Nicrobraz® Red Stop-Off™ Type II (water base) acts as a parting compound designed for furnace use. It can also act as a barrier against molten brazing filler metal. It works on any base-metal surface and is ideal for furnace work of any kind. It is chemically soluble, which assures complete removal of any remaining residue, making it an excellent choice for use on parts with small internal holes, fine threads, fine wire screens, or other parts with fine details. At high temperatures, it does not contaminate furnace atmospheres, either vacuum or hydrogen, argon, or other gases.

Nicrobraz® Red Stop-Off™ Type II can be thinned to the desired consistency with deionized or distilled water. As with the Nicrobraz® Green Stop-Off™, brushing is the recommended method of application, however, it can also be applied by spraying, dipping or screen printing. Regardless of the method, care must be taken during application so as not to inhibit the proper brazing of the joint.

Removal Procedure:

Residue remaining after brazing is easily removed by either (1) Brushing where joint design permits, (2) Use of a 10-15% nitric-acid solution, at room temperature to 50°C (120°F) for austenitic stainless steel base metals, or (3) Use of a 10-15% hydrochloric acid solution at room temperature to 50°C (120°F) for low-carbon and alloy steel base metals. Short time immersions in these solutions will not harm austenitic or martensitic stainless steels, or have any detrimental effect on mild steel.

Orange Stop-Off™



Orange Stop-Off™ brushed on vane segment

Description:

Nicrobraz® Orange Stop-Off™ is specially formulated for use with reactive metals, such as titanium and zirconium, and for use in very-high-vacuum furnaces. It is applied to areas where the flow of filler metal is not wanted, or to surfaces that are not to be joined. Nicrobraz® Orange Stop-Off™ is made from high-purity materials and will not contaminate metals, or a high-vacuum atmosphere. It is also an effective high-temperature lubricant, and will prevent damage to surfaces that are in contact and subject to movement, as in a super-plastic forming operation.

Type I (solvent base):

Nicrobraz® Orange Stop-Off™ can be thinned to any viscosity desired with standard lacquer thinners or solvents. It is usually applied by brushing, which assures accurate placement and excellent control of quantity; but can also be applied by spraying or dipping, after thinning to the proper viscosity for these methods. Whichever method of application is used, care must be taken to assure that none of the Stop-Off™ gets into the areas to be brazed.

Removal Procedure:

Residues remaining after brazing can be easily removed by wiping or brushing. The binder gases off completely during the heating cycle, leaving only an easily removed powder.

Blue Stop-Off™

Blue Stop-Off™ brushed onto surface part

Description:

Nicrobraz® Blue Stop-Off™ Type II (water base) is specially formulated for preventing the flow and adherence of brazing filler metals on reactive base metals, such as titanium and zirconium, and on super alloys. It is also an effective lubricant in super-plastic forming and drawing applications, by preventing damage to contacting surfaces subject to movement. It has excellent covering capacity, is practically odorless, and nonflammable.

Nicrobraz® Blue Stop-Off™ performs in extremely high temperatures and ultra-high vacuum furnace atmospheres. Made of high-purity materials, Nicrobraz® Blue Stop-Off™ will not contaminate metals or high-vacuum atmospheres. It is effective with a wide range of brazing filler metals.

Application Method:

Nicrobraz® Blue Stop-Off™ may be applied using a variety of methods, including brushing, spraying and dipping. Brush application assures the most accuracy and control. When spraying or dipping, the Stop-Off™ material should be thinned with deionized or distilled water to the desired consistency.

Removal Procedure:

Residues remaining after brazing can be easily removed by wiping or brushing. The binder gases off completely during the heating cycle, leaving only an easily removed powder.

Safety:

Type I stop offs are solvent-based and may have associated physical hazards such as flammability. Type II stop offs are water-based and, although not flammable, may have specific hazards which need to be addressed.

Conduct application of stop off compounds in a suitable area taking into consideration the engineering controls which may be required. Read and understand the MSDS before using any stop off product.

The information provided herein is given as a guideline to follow. It is the responsibility of the end user to establish the process information most suitable for their specific application(s).
Wall Colmonoy Corporation (USA) assumes no responsibility for failure due to misuse or improper application of this product, or for any incidental damages arising out of the use of this material.

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