



ISER SINGLE ENDED RECUPERATIVE BURNER FOR IMMERSION FIRING



WARNING

These instructions are intended for use only by experienced, qualified combustion start-up personnel. Adjustment of this equipment and its components by unqualified personnel can result in fire, explosion, severe personal injury, or even death.

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These instructions are intended to serve as guidelines covering the installation, operation, and maintenance of Hauck equipment. While every attempt has been made to ensure completeness, unforeseen or unspecified applications, details, and variations may preclude covering every possible contingency. **WARNING: TO PREVENT THE POSSIBILITY OF SERIOUS BODILY INJURY, DO NOT USE OR OPERATE ANY EQUIPMENT OR COMPONENT WITH ANY PARTS REMOVED OR ANY PARTS NOT APPROVED BY THE MANUFACTURER.** Should further information be required or desired or should particular problems arise which are not covered sufficiently for the purchaser's purpose, contact Hauck Mfg. Co.



WARNING

This equipment is potentially dangerous with the possibility of serious personal injury and property damage. Hauck Manufacturing Company recommends the use of flame supervisory equipment and fuel safety shutoff valves. Furthermore, Hauck urges rigid adherence to National Fire Protection Association (NFPA) standards and insurance underwriter's requirements. Operation and regular preventative maintenance of this equipment should be performed only by properly trained and qualified personnel. Annual review and upgrading of safety equipment is recommended.

A. GENERAL INFORMATION

The Hauck ISER Single Ended Recuperative Burner is designed specifically for immersion firing in aluminum or galvanizing holding, melting, combination holders/melters, and aluminum filter boxes requiring indirect firing of the molten metal. The indirect firing technology increases heat transfer area and reduces dross formation increasing bath yield.

The ISER burner fires any clean industrial fuel gas with a maximum capacity of 270,000 Btu/hr (71 kW) at 10 osig (4310 Pa) static air pressure. The burners operate using high-low control. Direct spark ignition is standard with the ISER burner, and flame supervision can be accomplished via UV scanner or flame rod.

B. RECEIVING AND INSPECTION

Upon receipt, check each item on the bill of lading and/or invoice to determine that all equipment has been received. A careful examination of all parts should be made to ascertain if there has been any damage in shipment.

IMPORTANT

If the installation is delayed and the equipment is stored outside, provide adequate protection as dictated by climate and period of exposure. Special care should be given to all motors and bearings, if applicable, to protect them from rain or excessive moisture.

C. CAPACITIES

	STATIC AIR PRESSURE (OSIG) AT BURNER INLET TAP				
	1 OSIG	2 OSIG	4 OSIG	8 OSIG	10 OSIG
Burner Input @ 10% Excess Air (Btu/hr)	77,690	110,000	154,400	237,400	270,200
Max. Air Flow (Not Firing) (scfh)					---
Max. Air Flow (scfh)	805	1,140	1,600	2,460	2,800
Burner Air Orifice ΔP ("wc)	---	---	---	---	---
Gas Inlet Pressure ("wc)	0.9	1.8	3.6	7.3	8.8
Max. Excess Air – Flame Rod (%)	---	---	---	---	---
Max. Excess Air – UV Scanner (%)	---	---	---	---	---
Min. Ignition Gas Flow (scfh)	20	20	20	20	20

NOTES:

1. Capacities based on natural gas with HHV of 1034 Btu/ft³, 0.59 S.G. and a stoichiometric air/gas ratio of 9.74:1 with burner firing into chamber under no pressure.
2. Air and gas flows based on 60°F @ sea level; capacities for preheated air will differ from those shown.
3. All data based on industry standard air and gas piping practices.
4. Flame detection available via flame rod or UV scanner.

Table 1. Burner Capacities

C. CAPACITIES (Continued)

	STATIC AIR PRESSURE (OSIG) AT BURNER INLET TAP				
	430 Pa	860 Pa	1725 Pa	3450 Pa	4310 Pa
Burner Input @ 10% Excess Air (kW)	20.6	29.1	40.8	62.8	71.4
Max. Air Flow (Not Firing) (nm ³ /hr)					---
Max. Air Flow (nm ³ /hr)	21.6	30.5	42.9	65.9	75.0
Burner Air Orifice ΔP (Pa)	---	---	---	---	---
Gas Inlet Pressure (Pa)	225	450	895	1,820	2,190
Max. Excess Air – Flame Rod (%)	---	---	---	---	---
Max. Excess Air – UV Scanner (%)	---	---	---	---	---
Min. Ignition Gas Flow (nm ³ /hr)	0.55	0.55	0.55	0.55	0.55

NOTES:

1. Capacities based on natural gas with LHV of 36.74 MJ/nm³, 0.59 S.G. and a stoichiometric air/gas ratio of 9.74:1 with burner firing into chamber under no pressure.
2. Air and gas flows based on 0°C @ sea level; capacities for preheated air will differ from those shown.
3. All data based on industry standard air and gas piping practices.
4. Flame detection available via flame rod or UV scanner.

Table 2. Metric Burner Capacities

D. DIMENSIONS

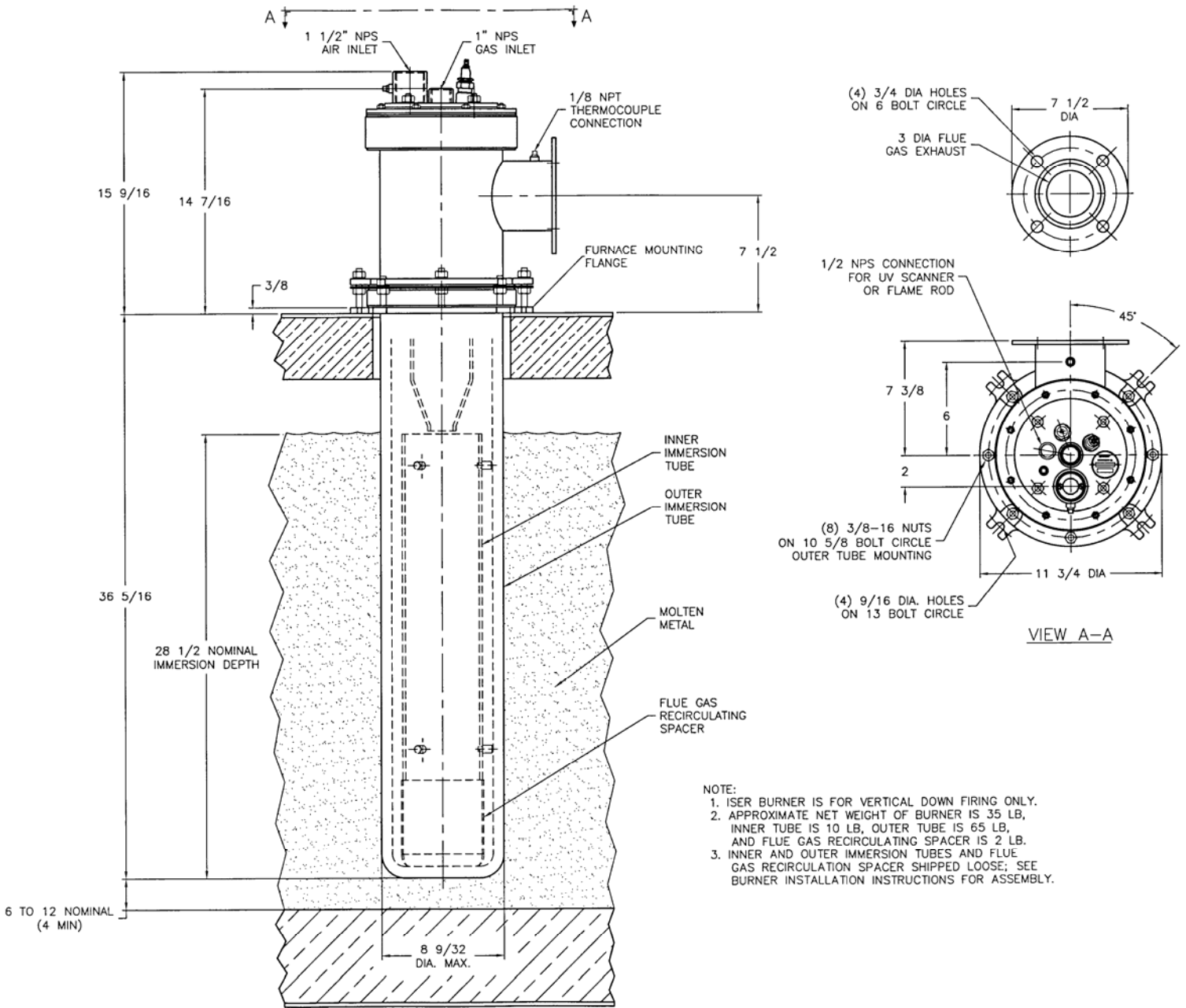


Figure 1. Dimensions

D. DIMENSIONS (Continued)

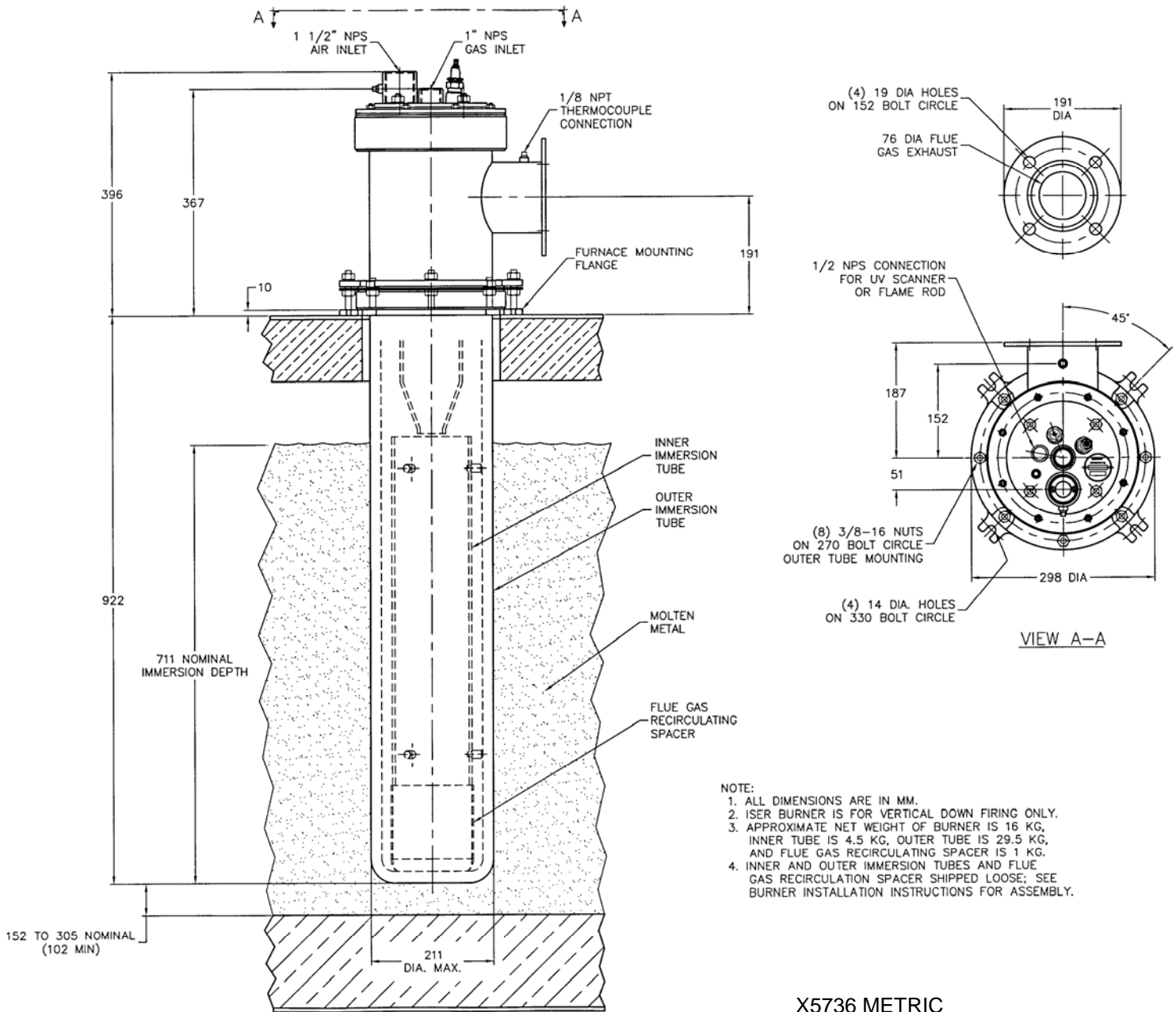


Figure 2. Metric Dimensions

E. INSTALLATION

ISER burners and the associated tubes must be installed for vertical down firing only. The burner mounting flange assembly is mounted on the roof of the chamber and functions to not only hold the immersion tube submerged in the molten bath, but also to secure the ISER burner to the roof of the chamber.

CAUTION

While the ceramic components in the ISER burner and the ceramic components associated with the tube have excellent thermal shock characteristics, they are subject to damage from rough handling, dropping, or impact with work tools. Exercise care when handling and installing the ISER burner and ceramic immersion tubes to prevent the possibility of breakage.

IMPORTANT

Special care should be taken to store ceramic outer immersion tubes in a dry place at a temperature range from 60 to 75°F (15 to 24°C). The ceramic outer immersion tube should be wrapped in polyethylene to protect it from absorbing moisture.

Burner/Tube Installation in an Empty Furnace (See Figure 3)

Furnace refractory must be subjected to a proper pre-heat and dry-out schedule (consult furnace manufacturer). Immersion tubes should not be installed in the furnace until after the refractory dry-out.

1. Furnish a 8½" (216 mm) diameter opening in the furnace roof shell.
2. Weld the appropriate size studs of appropriate length to the furnace shell to accept the furnace mounting flange (5) per Figure 1 or 2.
3. Install the furnace mounting flange (5) on the furnace shell with appropriate washers and nuts.
4. Use care to position outer immersion tube (2) on horizontal surface.
5. Place flue gas recirculation spacer (4) into outer immersion tube (2) and use a wooden tool to gently insert until spacer bottoms out in the tube.
6. Place inner tube (3) into outer immersion tube (2) and gently insert until inner tube bottoms out on the spacer.
7. Place lower outer tube mounting gasket (6) onto furnace mounting flange (5), and gently insert outer immersion tube (2) until it seats on gasket.
8. Place upper outer tube mounting gasket (7) on top of outer immersion tube flange (2).
9. Place outer tube retaining ring (8) over upper outer tube mounting gasket (7).
10. Loosen all eight nuts [four (9) and four (11)] located below the outer tube retaining ring (8).

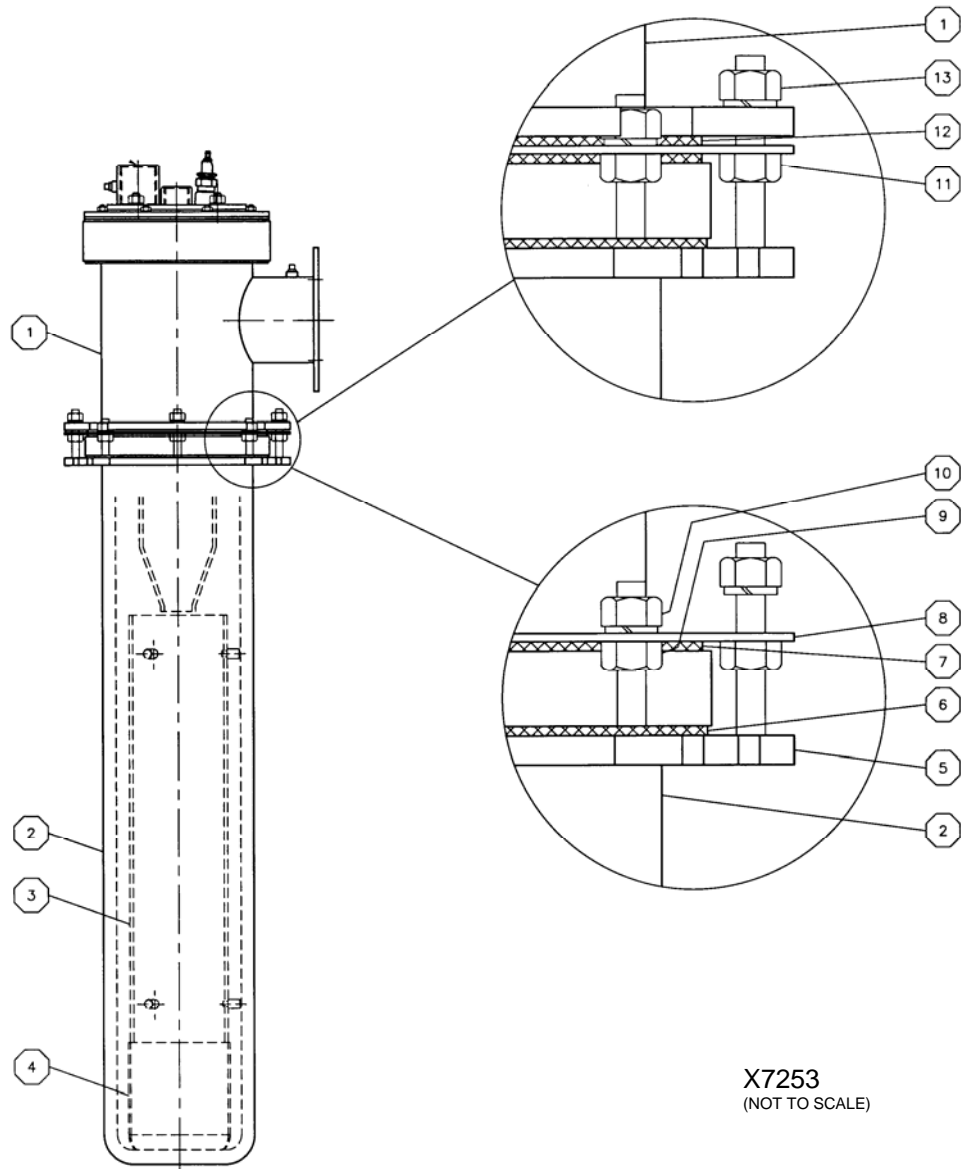


Figure 3. Burner/Immersion Tube Installation

11. Install four washers on the four short studs and torque four nuts (10) located above the outer tube retaining ring (8) to 20 in-lb (2.3 N-m).
12. Tighten four nuts (9) against the outer retaining ring (8).
13. Place burner mounting gasket (12) on top of outer tube retaining ring (8).
14. Install ISER burner (1) over four remaining long studs on the furnace mounting flange (5).
15. Install four washers on the four long studs and torque four nuts (13) above the burner mounting flange to 20 in-lb (2.3 N-m).
16. Tighten four nuts (11) against the outer retaining ring (8).

Air and Fuel Connections

NOTE

All piping must be properly supported and aligned to avoid stresses on the burner and associated equipment. Hauck recommends that flexible connections be used on all air and fuel lines to isolate the burner from piping movement due to expansion, contraction, and vibration.

1. If necessary, the burner backplate can be rotated in 90° increments to accommodate air and gas piping requirements as follows:
 - a. Remove the screws and washers holding the burner backplate to the burner housing.
 - b. Rotate the burner backplate until the air and gas inlets are in the desired location.
 - c. Make sure the gasket between the burner backplate and the burner housing is properly seated.
 - d. Replace the washers and screws and tighten.
2. Install the air line to the burner backplate using a flexible connection. Avoid elbows and abrupt directional changes in the piping where possible as turbulence can affect flow measurement accuracy, and reduce pressure at the burner.
3. Install the gas line to the burner backplate using a flexible connection. Avoid elbows and abrupt directional changes in the piping where possible as turbulence can affect flow measurement accuracy, and reduce pressure at the burner.
4. Install exhaust piping from the burner exhaust outlet. If piping into a common exhaust header, it is recommended to include an 'air break' to allow dilution cooling air.
5. Inspect all bolted joints on the burner and immersion tube to ensure that the fasteners are tight and gaskets are properly seated.
6. Leak test all gas piping in accordance with standards, local codes, and insurance underwriter's requirements.

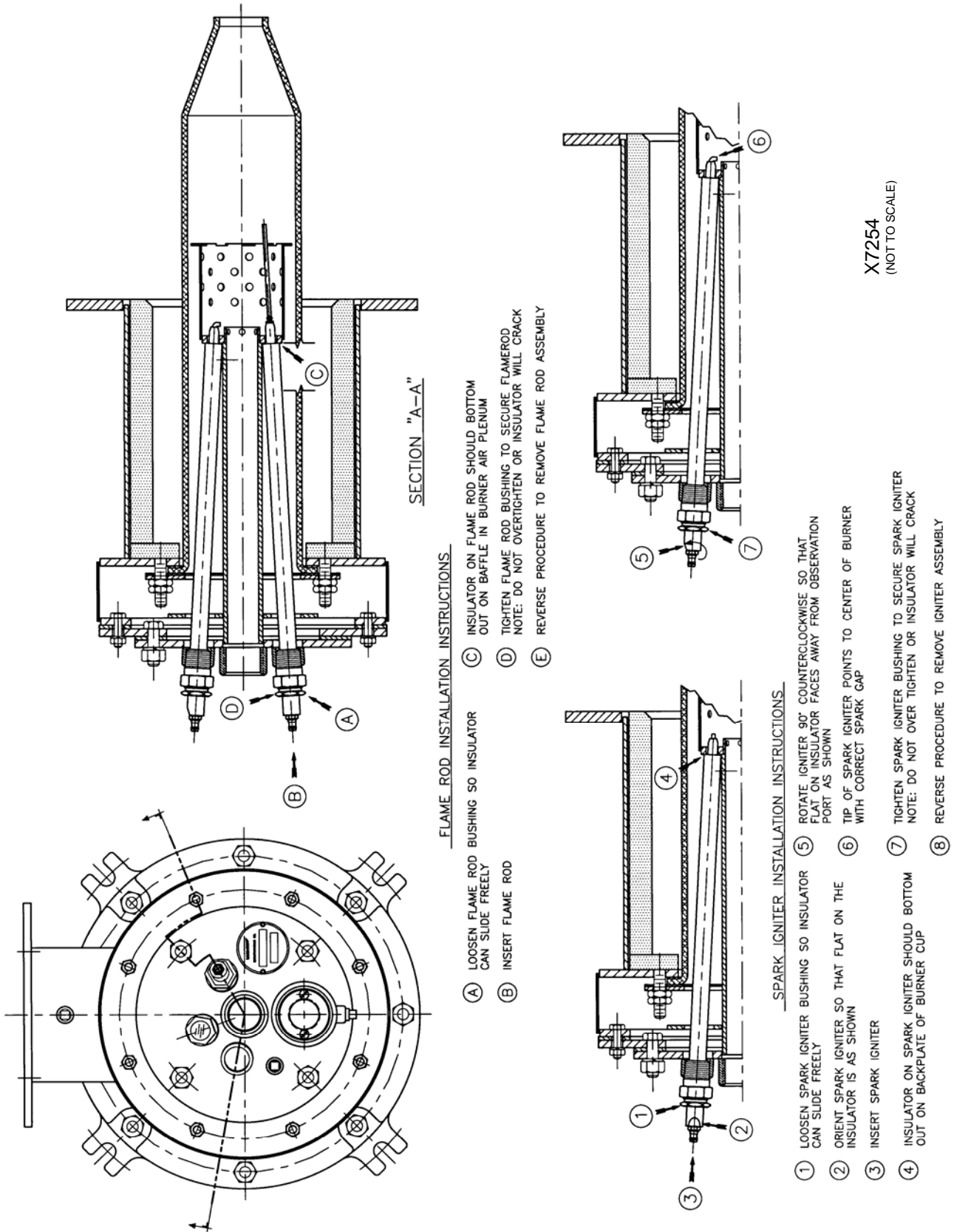
F. IGNITION

Ignition of the ISER burner is by a direct spark igniter. A 5000/6000 volt standard coil type ignition transformer or a half-wave "spark blind" solid state type transformer can be utilized. Both transformers yield satisfactory results, however, the standard coil type transformer provides reliable ignition over a wider range of air/fuel ratios than the half-wave type.



WARNING

When using a standard coil ignition transformer, provisions must be made to eliminate the ignition spark falsely satisfying the "flame on" UV scanner. Hauck designed flame supervisory panels accomplish this by "timing out" the spark transformer after a short (10 seconds for most applications) trial for ignition.



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(NOT TO SCALE)

Figure 4. Spark Igniter and Flame Rod Installation

1. Carefully remove the burner sub-assembly to ensure that the spark igniter and flame rod are properly installed (see Figure 4).
2. Connect the ignition wire from the transformer to the spark igniter electrode connection. A snap-on ignition type connector is recommended.
3. Energize the ignition transformer and verify that an adequate spark is produced across the gap of the igniter.
4. De-energize the ignition transformer.
5. If the spark is adequate, reinstall the burner assembly into the burner housing using care to avoid damaging the ceramic combustor tube, and secure the washers and nuts.
6. If the spark is weak or absent, adjust the location of the bent electrode tip by turning the igniter slightly clockwise or counterclockwise, and repeat until adequate spark is obtained. If spark is still weak or absent, consult Hauck.

G. INITIAL SET-UP

ISER burners typically operate with automatic control systems. The burners operate using high-low control. In a typical system, ignition will be preceded by a series of steps.

CAUTION

Initial adjustment and burner start-up should be undertaken only by trained and experienced personnel familiar with combustion systems, control safety circuitry and overall installation procedures.

NOTE

For safety reasons, it is recommended that the burner be ignited under low fire conditions when utilizing high-low control.

1. Once installed, the burner is ready for initial set-up. The specific operation of the burner will depend on the individual system components in the entire combustion system. Refer to the instruction sheets that accompany the individual components.
2. Combustion air pressure should be set at the combustion air control valve. Typical settings will be specific to the application. For high-low control, Hauck recommends that the combustion air settings remain at minimum until the burner has been ignited (refer to the burner capacities in Section C for burner air flows at low fire conditions).
3. Adjust the gas limiting orifice valve two turns open from the closed position to provide for lean light-off (readjustment of the gas limiting orifice may be necessary for final burner set-up). Loosen the locknut and adjust as required; clockwise adjustment of the screw will decrease gas flow while counterclockwise adjustment will increase gas flow. Tighten locknut when adjustment is complete.

IMPORTANT

An ISER burner should not be operated at high fire until the immersion tube is adequately immersed in the molten bath. Serious damage and/or premature failure of the outer immersion tube can occur via rapid expansion of any moisture contained in the tube.

4. Refer to Section F for spark igniter set-up.
5. Once the spark igniter is set and the initial gas and air adjustments are made, the burner can be ignited. Ignite the burner, or burners. For high-low control, it may be necessary to adjust the bias of the gas ratio regulator to achieve proper gas flow for ignition at low fire. When all burners are ignited, increase the combustion air to the high fire position (refer to burner capacities in Section C for burner air flows at high fire conditions).
6. Once the high fire combustion air is set, adjust the gas limiting orifice (step 3) to achieve the desired gas flow at high fire.
7. Verify air/gas ratio using orifice meters in the air and gas lines, or by measuring the oxygen (O₂) and carbon monoxide (CO) levels in the exhaust gas flue. Verify that the CO level is at a minimum, while the O₂ level is maintained between 2-3% by volume.
8. For high-low control, drive the burner to the low fire position and verify that the settings are consistent. Repeat steps 5 through 7 as necessary until high and low fire settings remain consistent and the desired flame characteristics are achieved.
9. To shut down the burner system:
 - a. Return the burner to low fire position if using high-low control.
 - b. Close all fuel shutoff valves.

H. OPERATION

Once properly installed, ignited and fired, the burner is ready for operation. The operation of the burner will depend on the specific items in the combustion control system and the application of the burners. Refer to the instruction sheet that accompanies each item. For high-low control, the burner should be ignited at low fire conditions. When the burner is operating in high-low control, the spark igniter can be shut off since the burner is designed to maintain ignition of the air/gas mixture.

The immersion tube is a critical component in an ISER burner installation, hence, precautions should be taken during furnace operation to minimize potential damage to the tubes. Dross buildup around the tubes is a normal occurrence and does not need to be removed until the immersion tube is replaced (see Section I). Any attempt to clean around the tubes (i.e., knock off the dross) will almost always result in damage to the tube. Caution should also be exercised when loading the bath to ensure that inserted ingots do not come in contact with the immersion tubes.

I. MAINTENANCE

Hauck ISER burners have been engineered to provide dependable performance while requiring low maintenance. As with any product, it is important to follow operating instructions and all procedures carefully to obtain optimum performance. Please refer to the applicable ISER Parts List to become familiar with the various burner components and assemblies.

CAUTION

Be sure burner internals have cooled sufficiently before attempting to disassemble any components. Use care when separating gasket surfaces to avoid damage to the gaskets and ceramic components.

Under normal operating conditions an immersion tube will typically last six to nine months. However, from time to time immersion tubes will fail and have to be replaced. Normally the first warning sign of tube failure is that the exhaust gas flue will exhibit a dull red glow. In zinc baths, zinc oxide smoke will pour from the burner exhaust. In many applications if the immersion tube fills with molten metal, the burner flame will probably go out.

IMPORTANT

Immediate failure (breakage) of an immersion tube is almost always the result of:

- Rough handling.
- High moisture level during storage.

Reduced life expectancy of immersion tubes tends to be the result of:

- Poor burner set-up.
- Extreme operation, i.e., over-fired or left in the molten bath unfired.
- Low metal level, i.e., tube not submerged to nominal immersion depth.

Typically, ISER installations utilize a system that simplifies the removal of damaged immersion tubes and the installation of replacement immersion tubes. The system employed must rigidly hold and guide the immersion tube in a safe manner to overcome the buoyant forces exerted on the tube by the molten bath. Depending on what type of system is installed, the procedures listed below for immersion tube removal and replacement installation will require modification as applicable (consult furnace manufacturer).

Immersion Tube Removal From Operational Molten Bath (See Figure 3)

1. Switch off the burner at the control panel. This will isolate the electrical supply from the flame rod.
2. Remove the spark electrode cable.
3. Remove the burner failure sensor thermocouple (if applicable) from the burner exhaust gas flue.
4. Ensure that the ISER burner is free of all restrictions that will impede the removal of the burner (1), i.e., remove any flue ducting or extraneous piping.

5. Turn off the gas and air valves to the burner which is being worked on.
6. Disconnect the air and gas piping leading up to the burner.
7. On the four longer studs, loosen four nuts (11) located below the outer tube retaining ring (8) that secure the burner (1).
8. Remove four nuts (13) and washers located above the outer tube retaining ring (8).

CAUTION

Do not remove the immersion tube retaining bolts (10) at this stage.
Buoyancy would force the tube out of the bath which could cause injury or equipment damage.

9. Remove the burner (1).
10. Inspect the inside of the outer immersion tube (2) for any liquid metal ingress; if metal is visible, then the immersion tube will have to be replaced. If there is no liquid metal evident in the tube, then inspect for debris around the inner tube (3) and flue gas recirculation spacer (4).
11. Before removing the immersion tube, use a long heavy iron bar to penetrate the bottom of the tube to allow molten metal to fill the tube. **Before attempting this operation be sure that all personnel are protected with the proper safety clothing.** Any debris from the destroyed immersion tube will float to the surface where it may be collected later.
12. On the four shorter studs, loosen four nuts (9) located below the outer tube retaining ring (8) that secure the outer immersion tube (2).
13. Remove four nuts (10) located above the outer tube retaining ring (8).
14. Remove the damaged outer immersion tube from the molten bath.
15. Place the immersion tube onto a tray filled with sand and allow to cool.

Replacement Immersion Tube Installation in Operational Molten Bath (See Figure 3)

1. Using a paint pencil, draw horizontal lines 1" (25 mm) apart on the outer immersion tube (2). Alternatively, the 1" (25 mm) markers may be drawn along the lifting platform.
2. Outer immersion tube (2) must be preheated and dried to remove all moisture prior to installation. This can typically be accomplished by placing the tube on top of the furnace. Allow the immersion tube to heat up in the range of 120 to 160°F (50 to 70°C) for 4 to 8 hours.

CAUTION

When assembling the immersion burner, keep in mind that any mechanical damage on the outer or inner immersion tube will reduce its operational life expectancy.

3. Remove the outer immersion tube (2) from the preheat area and position in a horizontal surface.

4. Place flue gas recirculation spacer (4) into outer immersion tube (2) and use a wooden tool to gently insert until spacer bottoms out in the tube.
5. Place inner tube (3) into outer immersion tube (2) and gently insert until inner tube bottoms out on the spacer.

CAUTION

Serious damage to an immersion tube may result if the tube is suddenly installed in a molten bath. It is recommended that an immersion tube be gradually submerged into a molten bath as outlined below.

6. Place lower outer tube mounting gasket (6) onto furnace mounting flange (5).
7. Gently slide the furnace mounting flange (5) over the outer immersion tube (2) until it seats on the outer tube mounting gasket (6).
8. Place the upper outer tube mounting gasket (7) on the top of the outer immersion tube flange (2) and bolt down the outer tube retaining ring (8) to the four short studs with four washers and nuts (10); torque nuts to 20 in-lb (2.3 N-m).
9. Stand the assembled immersion tube up vertically and secure. Place the burner mounting gasket (7) on the top of the outer tube retaining ring (8) and bolt down the burner (1) to the four long studs with four washers and nuts (13); torque nuts to 20 in-lb (2.3 N-m).
10. Remove any locking device that holds down the burner deck, and turn on the power to the lifting platform (if applicable). Verify that the burner deck is not locked down prior to raising or serious damage to the operator and equipment could result.
11. Fully raise the burner deck. With chain hoist, lift burner and immersion tube assembly up and into place lining up the studs on the furnace roof shell with the furnace mounting flange (5) (ensure burner orientation is correct). Secure assembly with appropriate nuts. If there is not enough room above the raised burner deck to insert the tube, then leave the burner deck in its down position and using the overhead crane lift the tube/burner assembly directly over the opening in the deck. Then slowly raise the deck taking care to not cause any damage to the tube. Once the deck reaches its fully extended position, secure the tube/burner assembly to it using the appropriate nuts.
12. Slowly lower the deck (if required) until the immersion tube is almost touching the molten bath.
13. Wait three minutes and lower the unit 1" (25 mm) and stop (using lines drawn on the outer immersion tube or the lift as points of reference). Repeat this sequence every three minutes by incrementally moving the deck unit down 1" (25 mm) until it is fully lowered. Secure the burner deck into place using the locking device (as applicable).

J. RECOMMENDED SPARE PARTS LIST

Item	Qty.	Part Number	Description
1	1	53400X012	Spark Igniter Assembly
2	1	55908X008	Flame Rod (If Applicable)
3	1	20579	UV Scanner (If Applicable)
4	*	401171	Burner Combustor Tube
5	*	401113	Tube Replacement Kit Assembly w/Gaskets

* - Quantity dependent upon number of immersion tubes installed; consult Hauck.

Table 3. Recommended Spare Parts