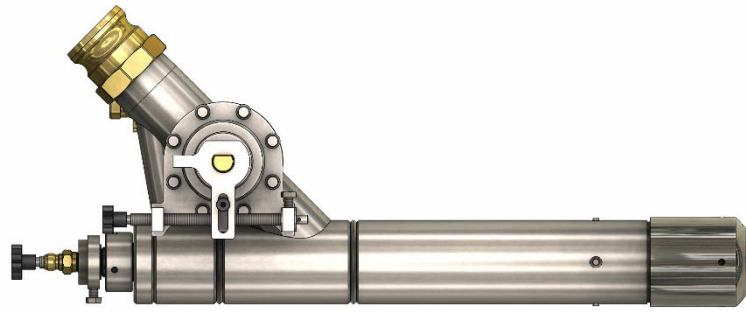




Selas Adjustable Gas Burner Installation Guide

SAFETY

These instructions pertain only to the Selas Adjustable Gas Burner and should only be used for its intended purpose. Only qualified personnel should work on the SAGB to ensure proper installation, especially when installing gas piping or electrical wiring. All installations **MUST** follow/meet region requirements. If unsure about this information, contact your local gas or electric company. This product can cause serious injury/harm if misused; any person working with the SAGB should be equipped with proper protective equipment, such as safety glasses, close-toed shoes, and adequate clothing attire. Contact the factory if you have any questions or concerns regarding the Selas Adjustable Gas Burner.

***Warning:** This guide does not provide every eventuality; the information provided should be considered when working with the SAGB Burner.*

Description

The Selas Adjustable Gas Burner, SAGB, is designed for regenerative glass furnaces, with an adjustable mechanism for flame length and an energy release position. Three sizes are available to provide flexibility for under port, side of port firing, end port, and cross-fired furnaces. Oil backup is available. Burner design includes the following features:

- Separate inner and outer gas streams.
- Inner gas stream (IGS) is controlled via an adjustment knob on the burner to adjust the heat release position within the flame.
- Outer gas stream (OGS) is controlled by another adjustment knob to set overall flame length.
- Only one gas inlet is needed for the use of the two gas streams.

Cold Installation

Provided with the burner is a burner and bracket layout drawing. This drawing shows the overall setup of the burner, bracket, and seal plate. Use the drawing to set the burner and all accessories in the correct position.

- Normally, the burner, bracket, and seal plate are installed cold before start-up to ensure a good fit. After the installation is made, the burner is removed to heat up, and the block is sealed with appropriate high-temperature fiber wool.
- The burner bracket is installed on appropriate support steel. The channel support supplied with the bracket should be welded in place per the drawing.
- Included with the burner bracket are the nuts and bolts needed to hold the bracket to the channel. Slots are set in the bracket to allow the bracket to be moved forward or back to set the correct position of the bracket as needed for the proper burner position.
- For under-port firing, use the included jack bolts on the bracket to hold the seal plate in position against the burner block.
- For the side of the port firing, install a user-supplied hold-down jack bolt, as shown in the drawing, from port steel to the seal plate to hold it in place.
- Set the burner in the bracket and push it against the seal plate to ensure a tight fit. Lock the burner in position.
- Set the wind cooling airline, as shown on the drawing, in position to provide cooling to the seal plate.
- Attach the gas and off-side air hoses to the burner. Ensure the hoses do not pull on the burner. In many cases, the field piping is not set close enough to the burner, causing the hoses to pull on the burner. If this happens, the field piping must be adjusted for a proper fit from the hoses to the burner.
- After all equipment is set in position and the setup is confirmed, remove the burner, and seal the block for the heat up.

Installation and Start-up

Once the furnace is above auto-ignition temperature, 1400°F (760°C), the SAGB burner can be installed and started.

- Follow plant safety protocols throughout the start-up. Ensure all personnel in the area are ready and aware that the main burner lights are off.
- On the offside
- Install the burners on the port and lock in position.
- Verify the burner and seal plate have a good firm seal.
- Install the air and gas lines to the burner.

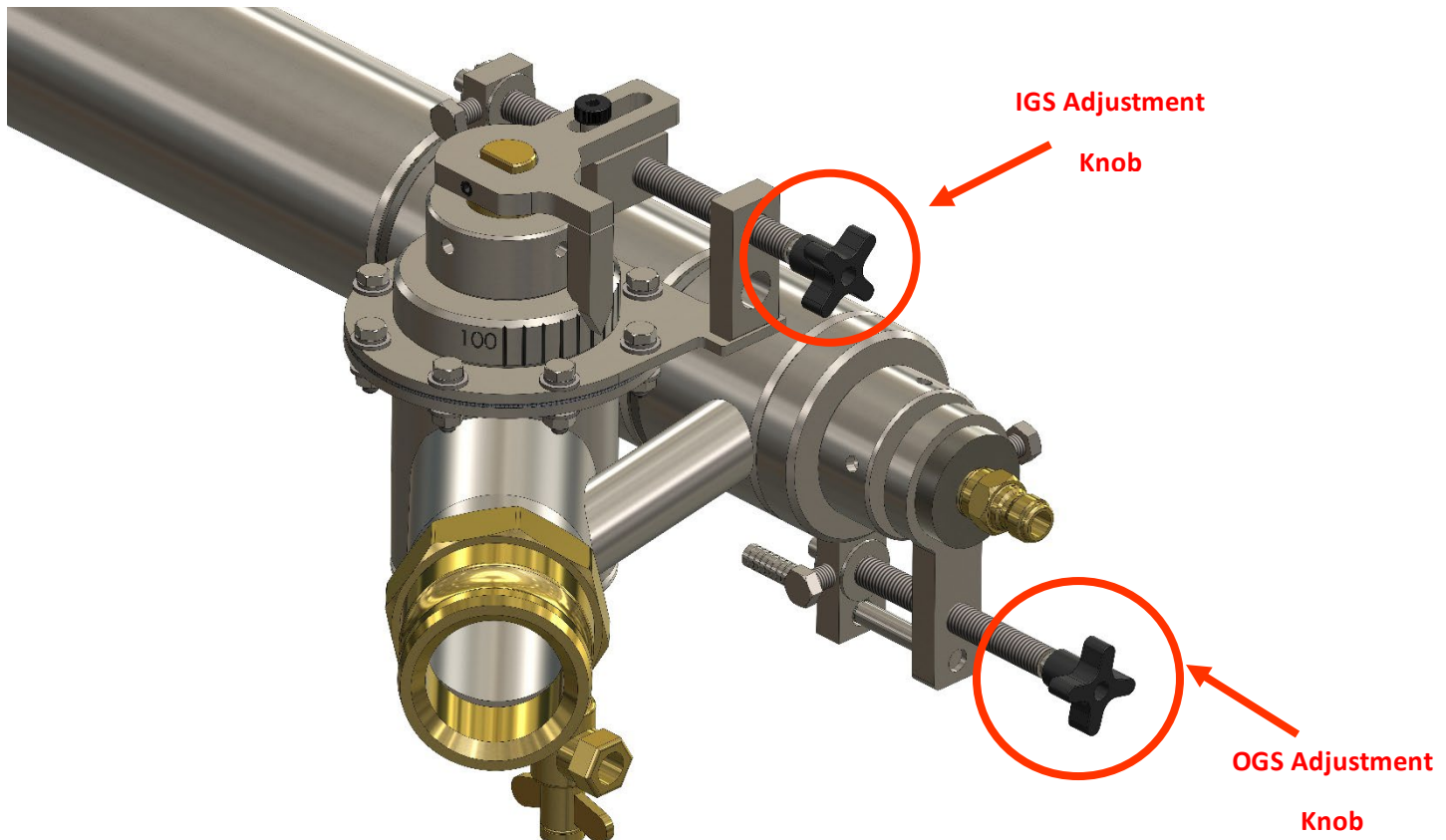
- Open the off-side cooling air valves to the burner set to the required operating pressure: 275 +/- 75 mbar (4 +/- 1 psig).
 - Note: Excessive cooling air can cause furnace gases to recirculate in the block, causing fouling and build-up of condensates in the block.
 - Too low pressure can allow the furnace gases to heat the burner parts or the seal plate.
- After the reversal, verify the combustion air is flowing to the port and that the gas reversal valve to the port is open.
- Slightly (15 to 25%) open the gas flow control valve to the port.
- Then, for each burner, open the gas valves individually.
- Verify ignition for the burners.
- Adjust gas flow as needed.
- Repeat for all ports.

Normally, the flame is unstable at the initial light off, even after removing the heat-up burners. This is because the furnace is empty, with no glass under the flame. Also, combustion air temperatures are still cold as the regenerators have not heated up. Cold air takes up less volume, so the air velocity is much lower than normal operating temperatures. Once the furnace is at full operating temperatures, the regenerators will still take a few days to heat up to normal temperature.

Initial Burner Set Up

Once the burners are firing and the heat up burner is removed, the burners can be balanced.

- For the side of port firing, the two burners should be set to equal gas flows. Set each burner pressure or flow so both are equal.
- For under port firing, it is best to set all equally at first. On cross-fired furnaces, the burners typically are all set with equal flow. On end port furnaces, typically the outer burner is set with more flow and the inner burner less flow.
- Initially, the outer gas stream, OGS, would be set at higher velocities (tip forward). Normally, firing rates are low at this time, and the combustion air is not up to temperature, so it may be best to have a higher gas velocity.
- For the inner gas stream (IGS) for under port firing, after light-off set to about 1/3 to 1/2 open.
- For IGS on the side of the port firing, after light-off set at about 1/4 open.
- Initial burner firing angles can be set by adjusting the bracket angles up or down or rotating left or right. Fine-tuning the firing angles is best done after the tank is full of glass and at normal operating temperatures.



Burner Operation

As mentioned above there are two adjustments on the burner, the OGS adjustment for setting flame length. The IGS adjustment is used to move the heat release in the flame. Additionally, the burner bracket settings affect the flame performance.

There are 16 rings on the OGS position indicator. Rotating the adjustment knob moves the inner gas tip in relationship to the outer gas tip. With the inner gas tip forward, the position on the OGS indicator is 0, a positing ring. This then increases the velocity of the OGS and shortens the flame. With the inner gas tip pulled back, the position on the OGS indicator, as noted, is the 16th ring. At this position, the velocity of the OGS is then slow, and the flame length is longest.

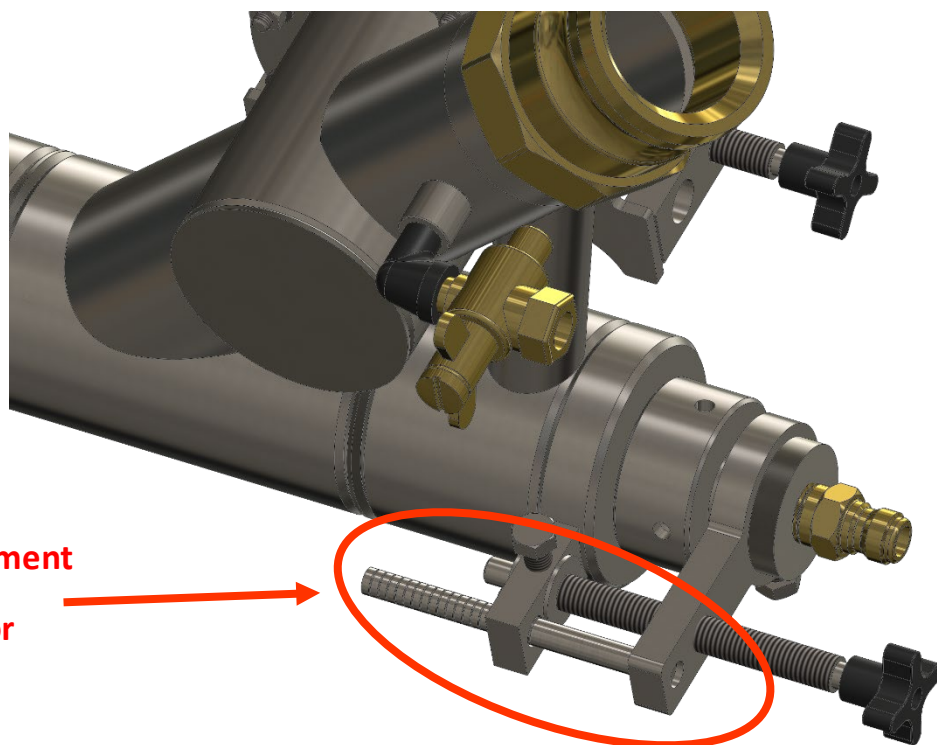
The IGS is adjusted with a knob located on the side of the burner inlet. By rotating this from 0% to 100%, gas is moved from the IGS to the OGS. Rotating the dial from 100% to 0% moves gas from the OGS to the IGS. A lower % on scale gives the more gas to the IGS, and a higher % on the scale gives more gas to the OGS.

There is a small lockdown bolt on both the OGS and IGS adjustment mechanisms. Before adjusting, loosen the bolt. Once the adjustment is completed, tighten the bolt.

Increasing gas flow through the IGS delays mixing, moving heat release away from the firing port. Decreasing gas flow through the IGS speeds mixing, moving heat release closer to the firing port but lowering NO_x.

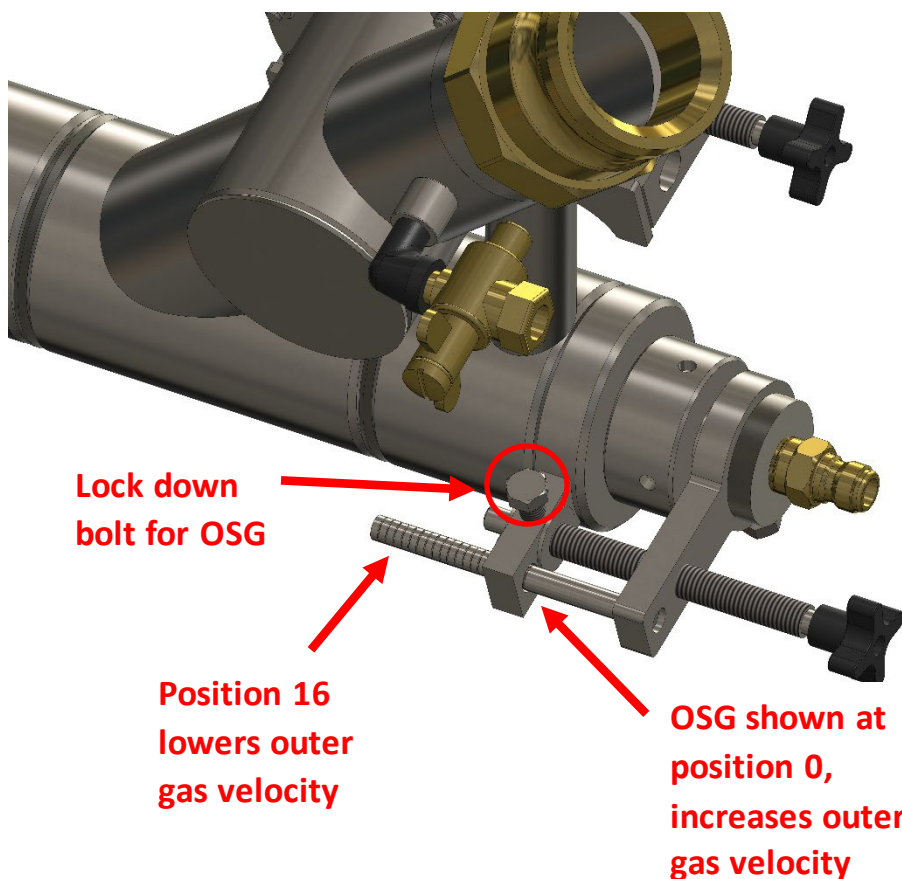
OGS adjustment forward, counterclockwise, (CCW) rotation, towards 0 ring, increases velocity of the OGS, adjustment backward, clockwise (CW) rotation, towards 16th ring, decreases velocity.

- Higher velocity produces shorter flame; lower velocity produces longer flame.



**OGS Adjustment
Indicator**

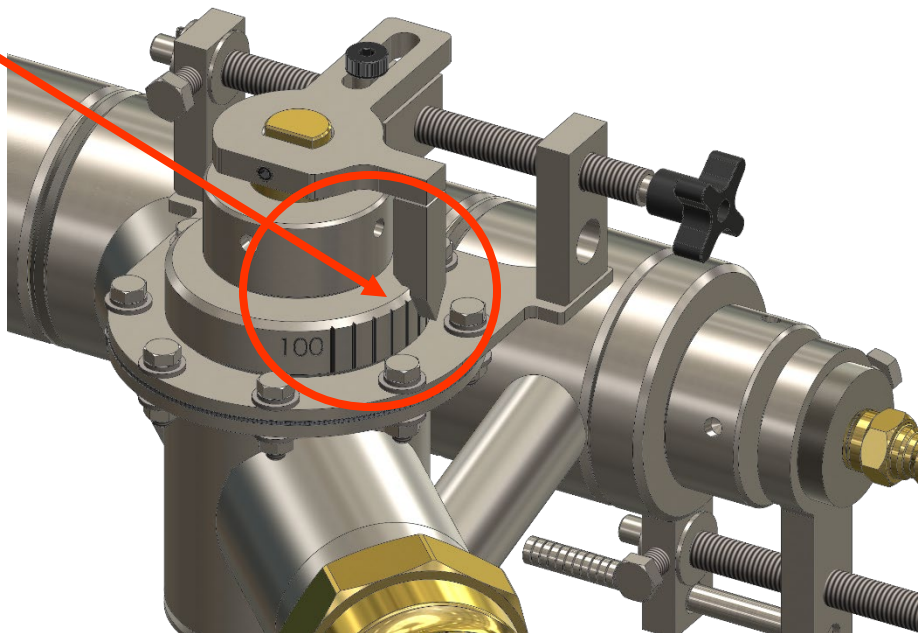
OGS Details



IGS Adjustment Indicator

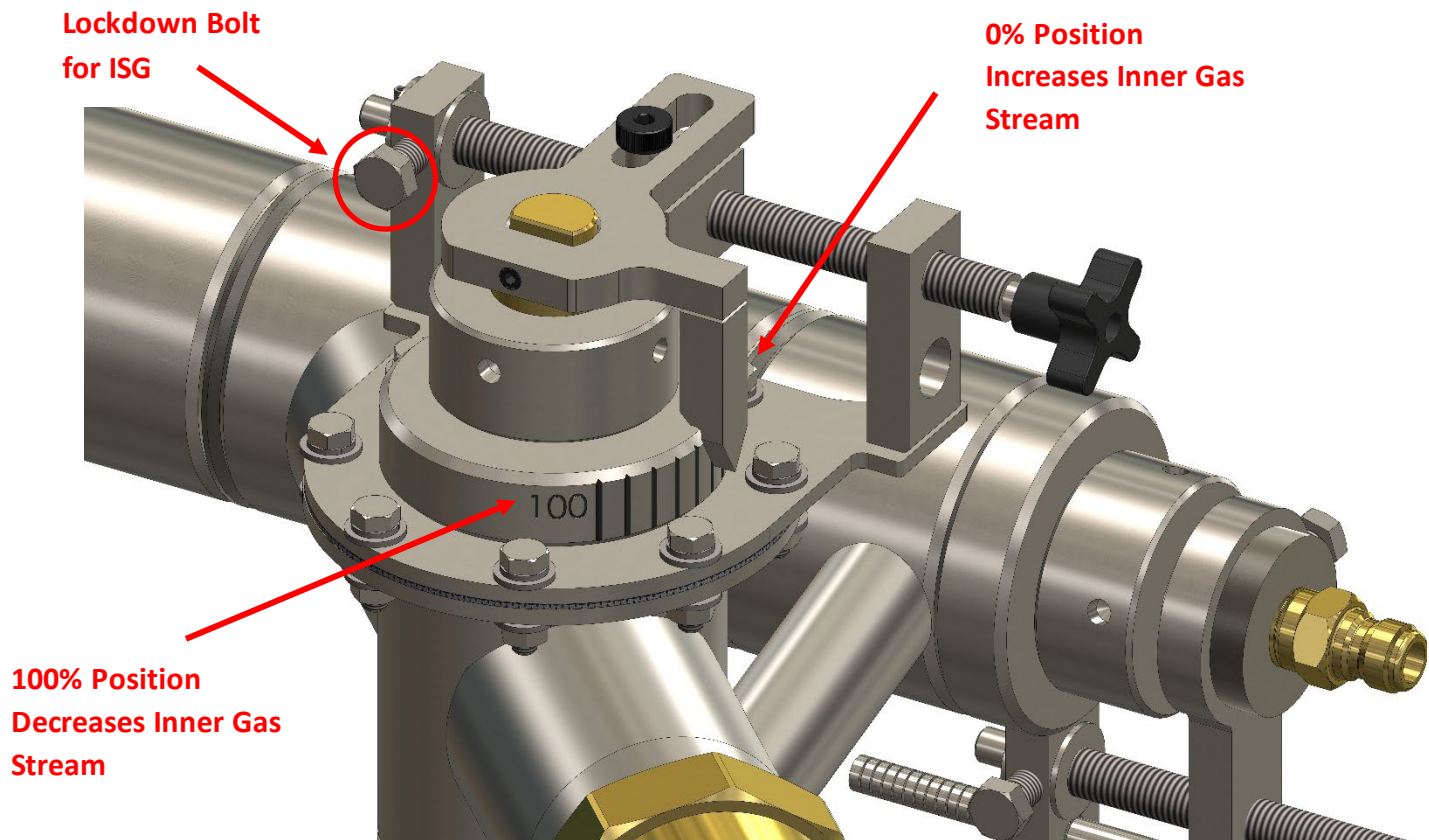
Rotating the IGS adjustment clockwise (CW) (toward 100%) decreases the gas flow to the IGS, rotating counterclockwise (CCW) (toward 0%) increases flow to IGS.

- Increasing gas flow through the IGS increases fuel momentum, pushing the heat release away from firing port.
- Decreasing gas flow through the IGS lowers the fuel momentum, moving heat release closer to the firing port but lowers NO_x .



The OGS controls the flame length and appearance. The IGS moves the heat release in the flame. The outer gas stream protects the inner gas stream from mixing with the combustion air, lowering NO_x .

ISG Adjustment Details



End Port Firing

Traditionally on an end port, the flame must be long to reach the throat end wall, and the heat release is extended to move the heat away from the port. To achieve this desired firing set up, normally:

- The burner close to the outside wall is set with more flow, and the burner close to the opposite port is set with less flow. This setup tends to extend the outside flame down the furnace length and minimize short circuits on the inside burners.
- Typically, the OGS is set to at least $\frac{1}{2}$ the full-back position to $\frac{3}{4}$ the full-back position to lengthen the flame.
- The IGS is normally set to give more gas to the inner stream, adjustment knob rotated CCW (toward 0%). This helps to push the heat release down the tank toward the throat end wall. Initially and to 10 to 25%.
- Normally, large/longer end port furnaces must push the heat further toward the front wall, increasing IGS (lower % position). Smaller end port furnaces may need the IGS to be decreased (slightly higher % position).
- When pushing more gas to the IGS this will push heat toward the front of the furnace.

Crossfire Furnace Side of Port Firing

For side of port firing on a cross-fired furnace, the flame must be at least halfway across the furnace, and the heat release is usually pulled back slightly. In many cases, operators have used shorter flames, which can be achieved, but realistically, the shorter flames are less efficient. To achieve this desired firing set up, normally:

- The burners are typically set up with equal flow on a port.
- Typically, the OGS is set to at least $\frac{1}{2}$ the full-back position to $\frac{3}{4}$ the full-back position to set the desired flame length.
- The IGS is normally set to give more gas to the inner stream, adjustment knob rotated to about 25%. This helps to push the heat release across the furnace.

Burner Firing Angles, Under Port Firing

If the firing angle is set too high, the flame will be unstable and erratic. If the firing angle is set too flat, the mixing with the combustion air is delayed, which may cause incomplete combustion. Normally, with under port, there is little left/right adjustment to the flames, though in some cases on an end port, the outside burner could be set slightly away from the port centerline and the inside burner slightly toward the port centerline.

Burner Firing Angles, Side of Port Firing

For the side of the port firing, the flame intersection of the two burners is usually set slightly past the port outlet.

For either type of firing under the port or side of the port, angling the flame above or on the glass is possible. No recommendation is given as to what is better, as there are many operations with either setup. The key to all these settings is that it is possible with the two gas streams, IGS and OGS, and with burner firing angles to set the flame up as desired.

Maintenance and Routine Operation

Normal operation of the burner should require little maintenance. A good routine for checking the burners and operation will ensure a good long life and operation. Checks should include normal furnace operating data, which are not listed and may influence burner performance. The discussion here is specific to the burner.

Shift Observations and Checks

1. Gas flow
2. Gas pressure
3. Offside cooling air pressure
4. Flame shape and appearance
5. Changes in gas flow or pressure could indicate dirty nozzles
6. Changes to flame shape or angles could indicate burner block blockage

Periodic Checks (weekly or as needed)

1. Physically check burner, seal plate, and bracket for any obvious issues, gas leaks, air leaks, proper wind cooling, good burner setting to seal plate, nothing loose or moved.
2. Remove and clean burners blocks as needed based upon changes in the flame appearance or unusual changes to flows/pressures.

Burner Removal and Installation

1. A spare burner should be available before any burner removal.
2. Remove/replace burners on the offside only, following plant safety protocol.
3. Shut off gas and cooling air.
4. Remove gas and air hoses.
5. Unlatch the burner from the bracket and remove it.
6. Inspect the burner block for debris or any blockage. Clean if necessary.
7. Install the spare burner and ensure it is positioned properly to the seal plate.
8. Lock down the bracket burner, hold down arm with latch clamp.
9. Connect hoses.
10. Open gas and air valves.
11. Check firing after reversal.

Cleaning

1. Normally for cleaning, the outer and inner tips are removed. Both tips can be cleaned of debris using a steel brush to clean the surfaces.
2. The outer nozzle gasket should be checked and changed if cracked or damaged.
3. On the burner bracket, due to the heat, the adjustment screws may freeze up. A fresh coat with high-temperature grease on these surfaces will help keep the parts free.
4. For most routine maintenance, this is all that is required.

Other Burner Maintenance

1. The burner part drawing included in the documentation shows all the various burner parts and general assembly. Follow this diagram for any burner part replacement.
2. Typical parts that could need changing include:
 - a. Outer tip gasket
 - b. Burner packing
 - c. Burner tips
 - d. Seal plates
 - e. Changing these parts would be based on general wear and tear; tips and seal plates can last years and years (campaign), gaskets one (1) to five (5) years.
3. At a campaign end, we recommend changing all gaskets. Depending upon the length of operation, changing some/most of the burner tips may be appropriate. Changing all seal plates at the start of a new campaign would be recommended. Burner buckets should be cleaned, and all moving parts checked for proper operation.