

# FAA NexGen Burner Information

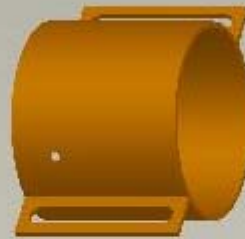
Updated September 2008



# NexGen Burner Housing



*Draft Tube*



*Coupling*

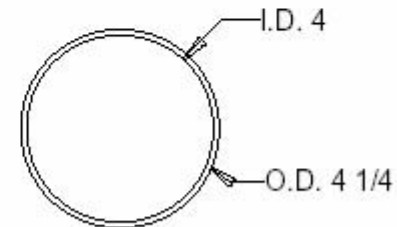
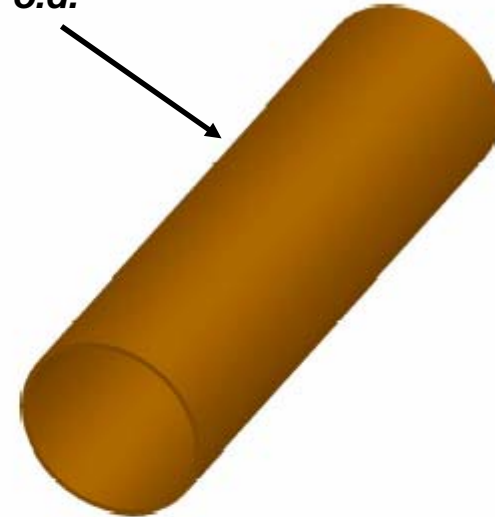
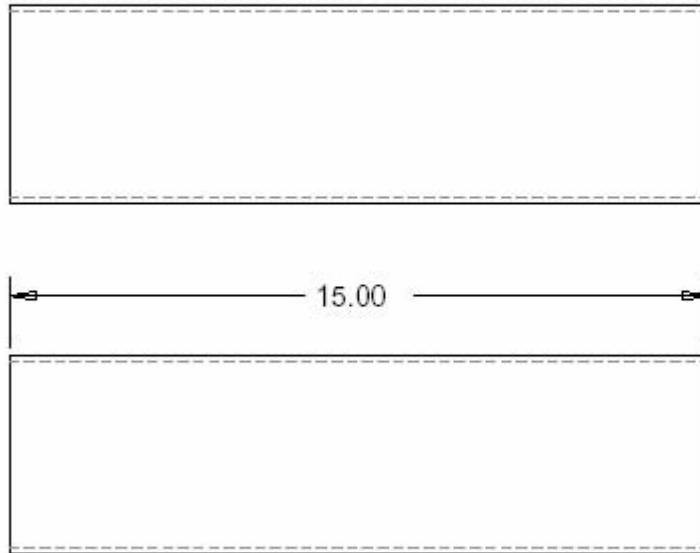


*Back Section*

# Draft Tube

**\*ALL DIMENSIONS ARE INCHES\***

***Mild seam steel tubing, 4" i.d., 4 1/4" o.d.***

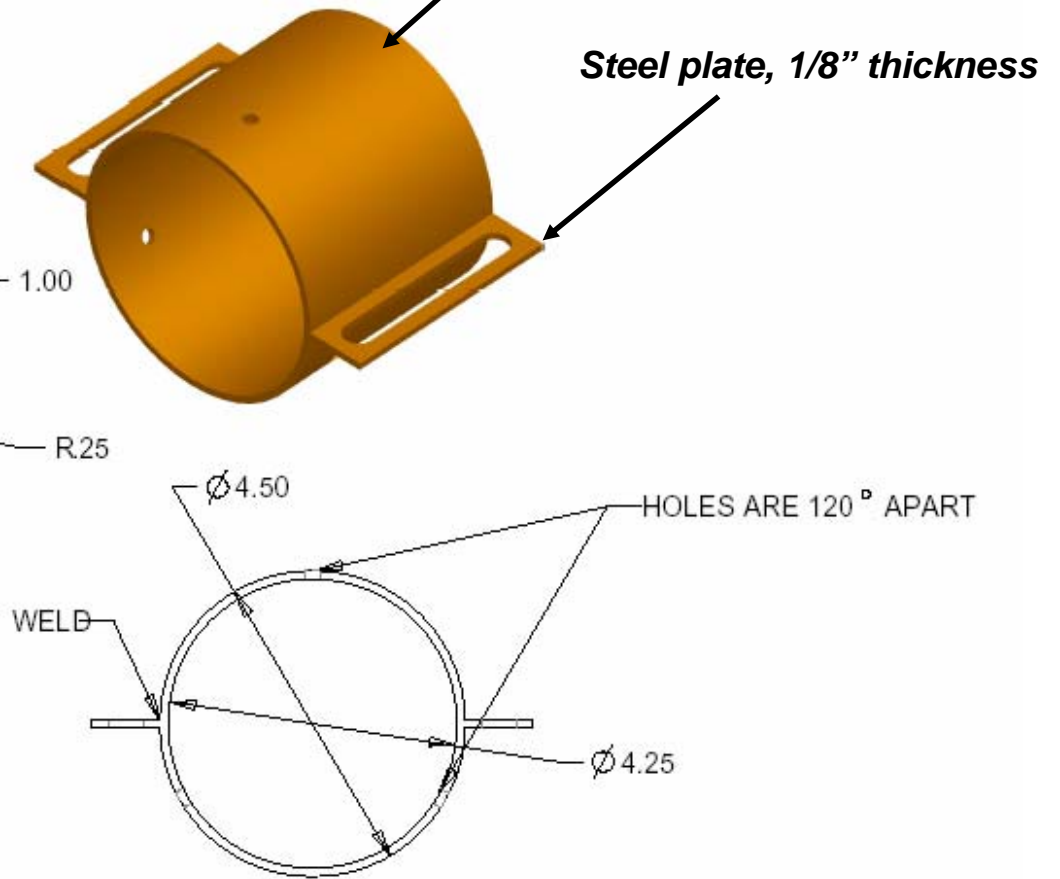
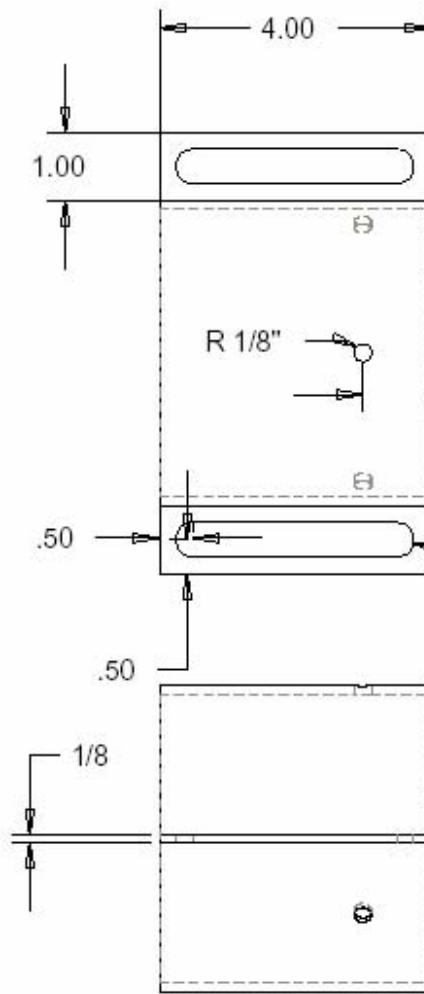


# Coupling

**\*ALL DIMENSIONS ARE INCHES\***

**Mild seam steel tubing, 4 1/4" i.d., 4 3/4" o.d**

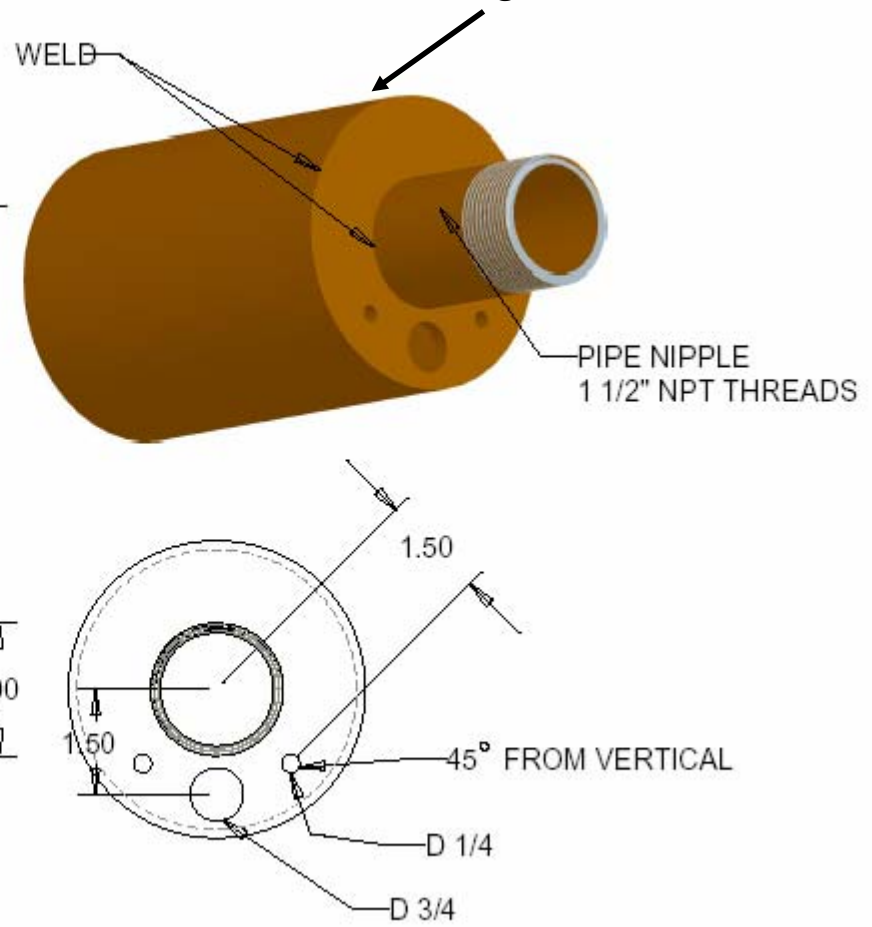
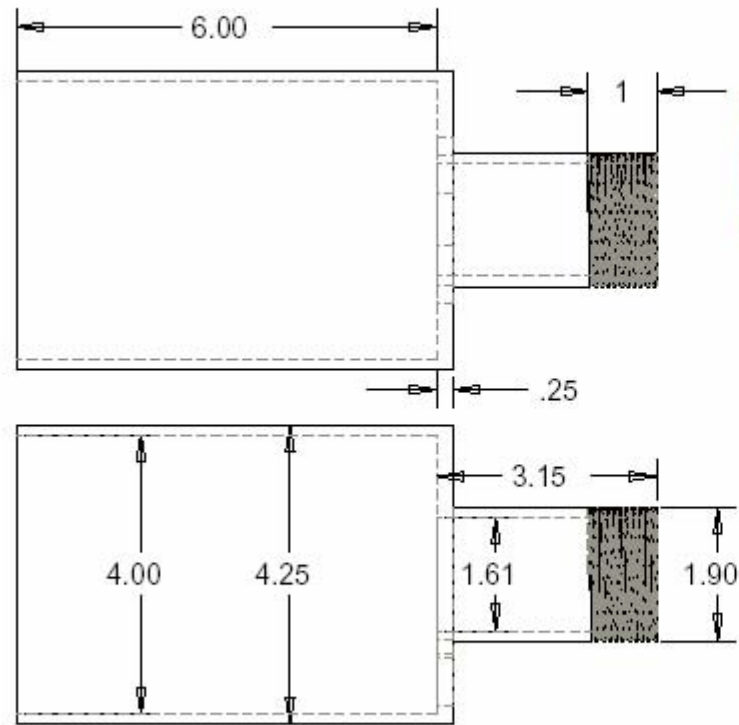
**Steel plate, 1/8" thickness**



# Back Section

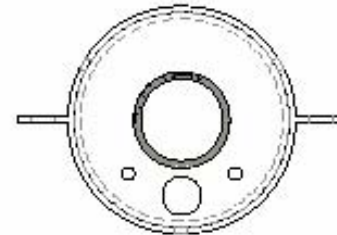
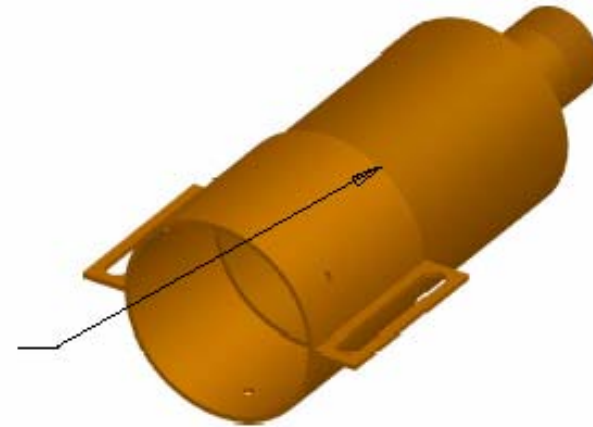
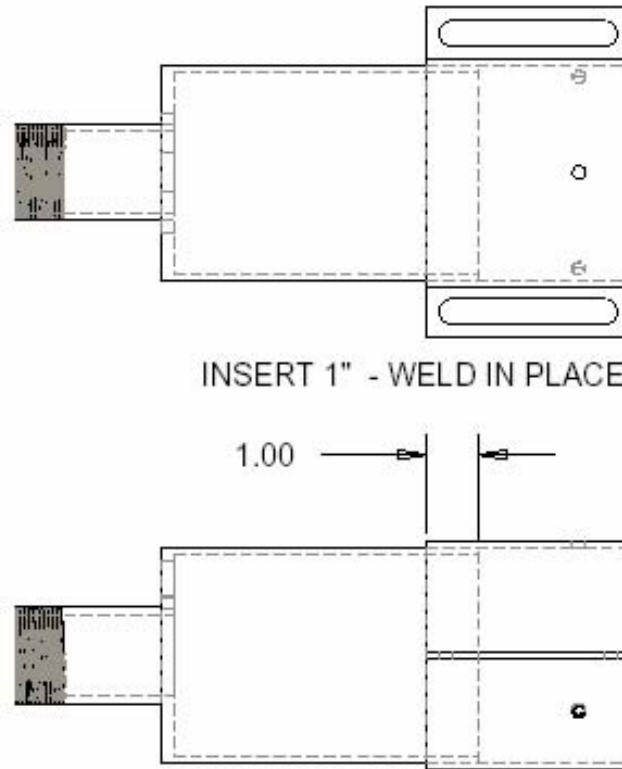
**\*ALL DIMENSIONS ARE INCHES\***

**Mild seam steel tubing, 4" i.d., 4 1/4" o.d.**



# Assembled Back Section and Coupling

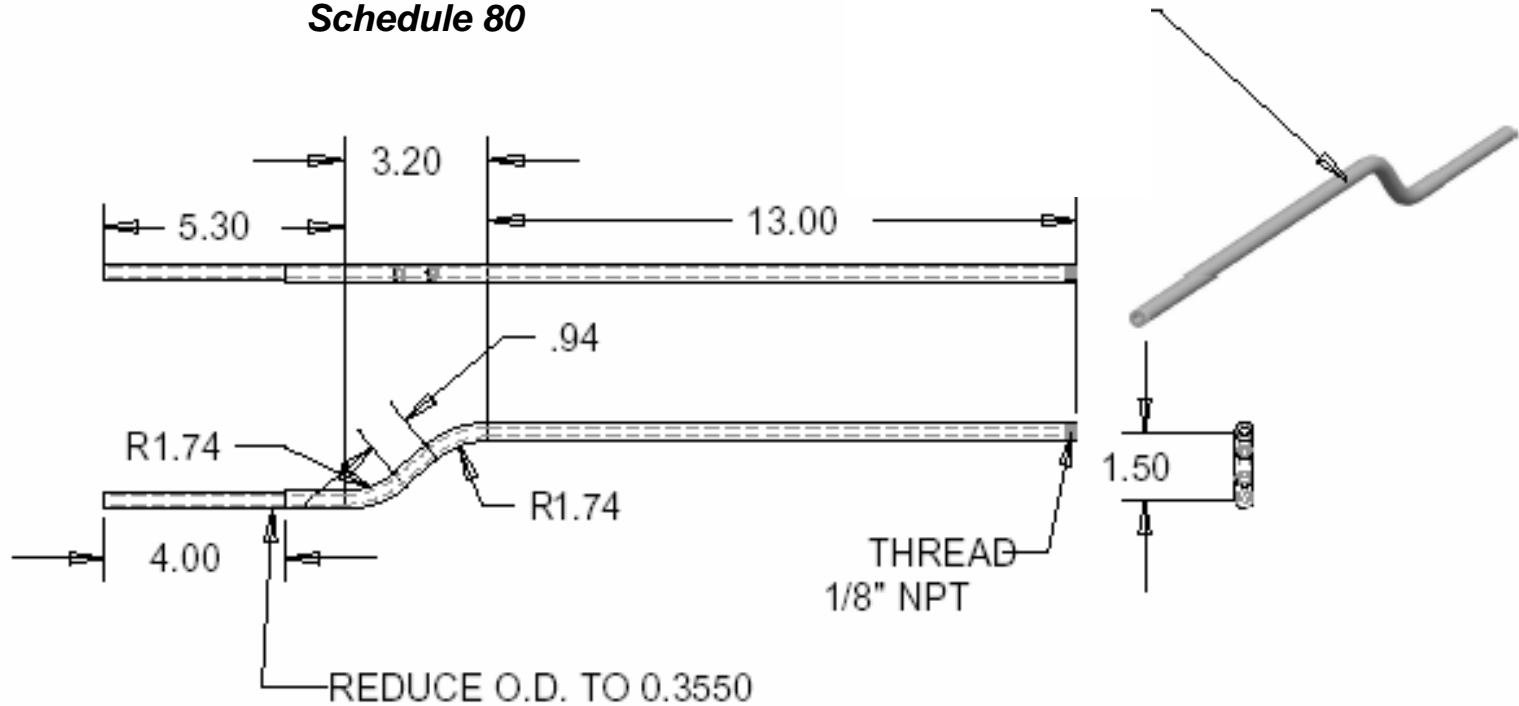
*\*ALL DIMENSIONS ARE INCHES\**



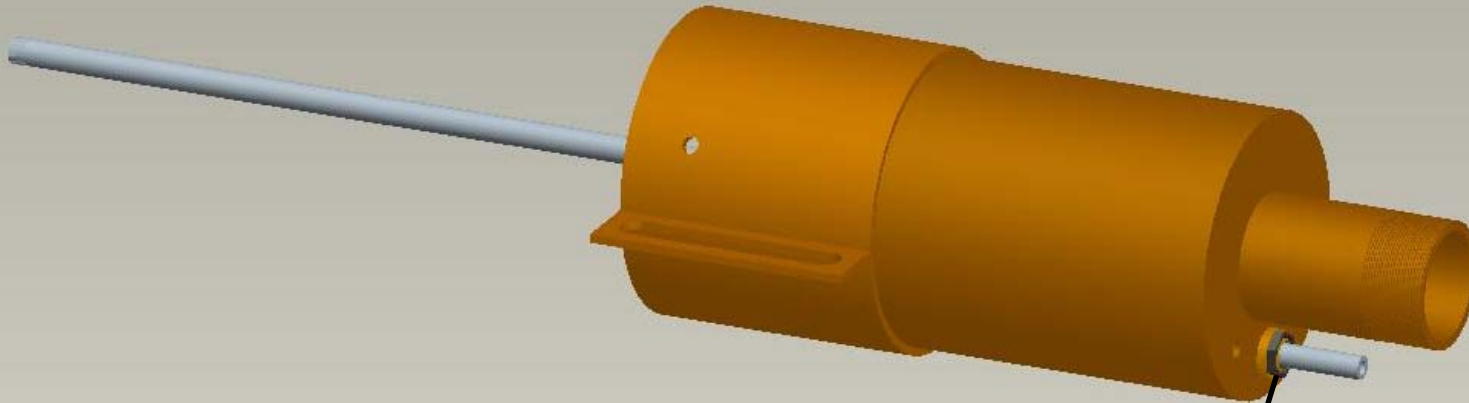
# Fuel Tube

**\*ALL DIMENSIONS ARE INCHES\***

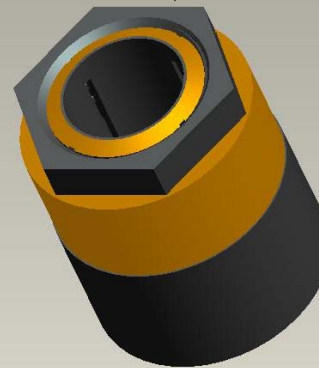
**Thick-Wall Steel Seamless Pipe 1/8" Pipe Size  
Schedule 80**



# Assembly



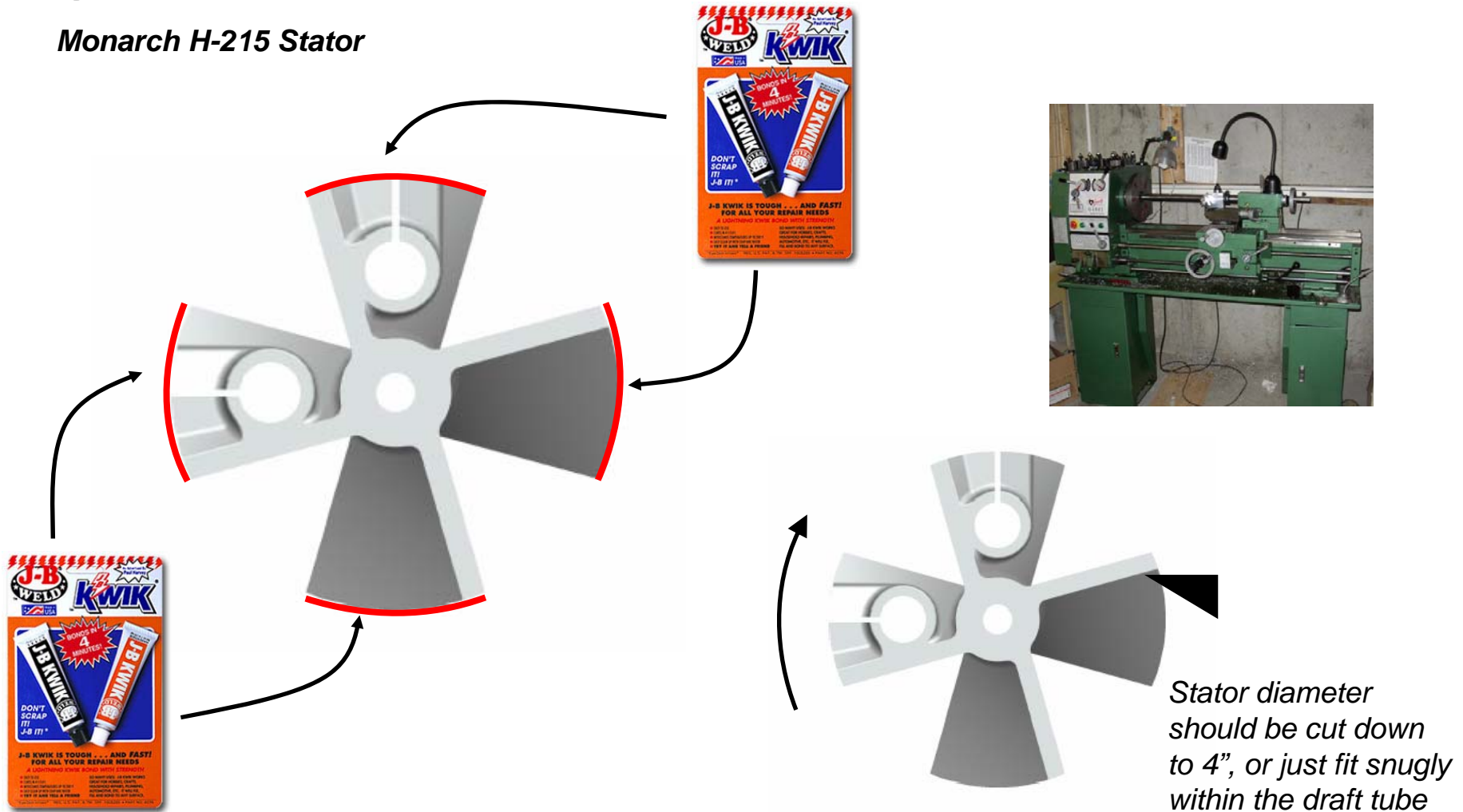
***Steel Quick-Grip Keyless Bushing for  
3/8" Shaft Size, for 3/4" Component  
Bore, Fenner Drives Trantorque GT mini  
p/n: 6202109***



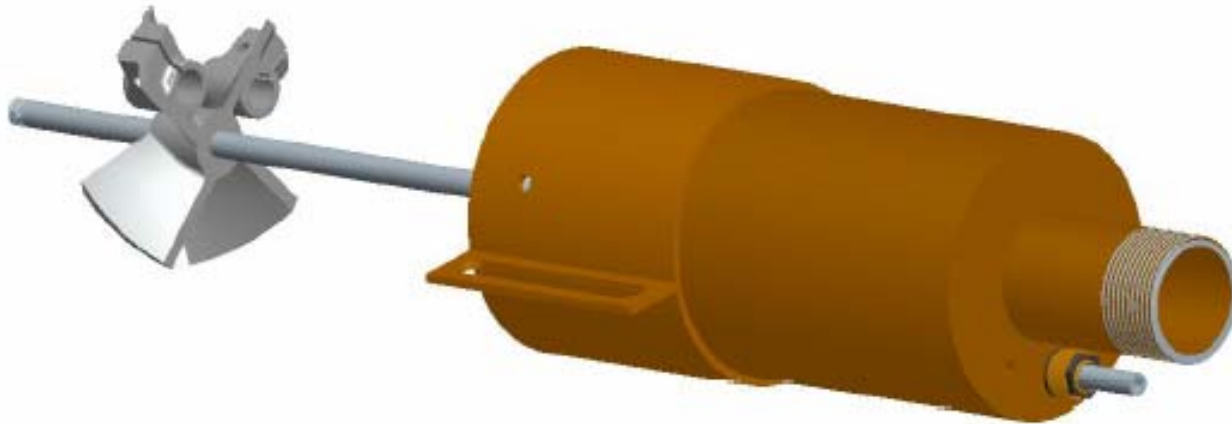


# Stator

## Monarch H-215 Stator

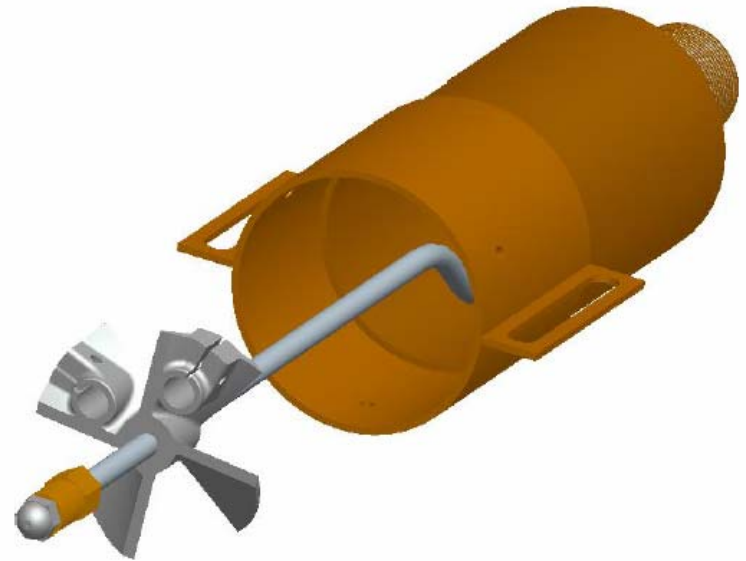
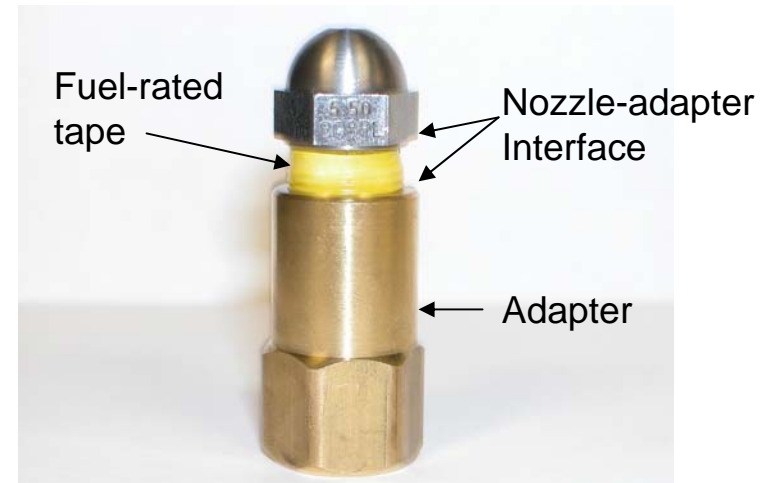


# Assembly

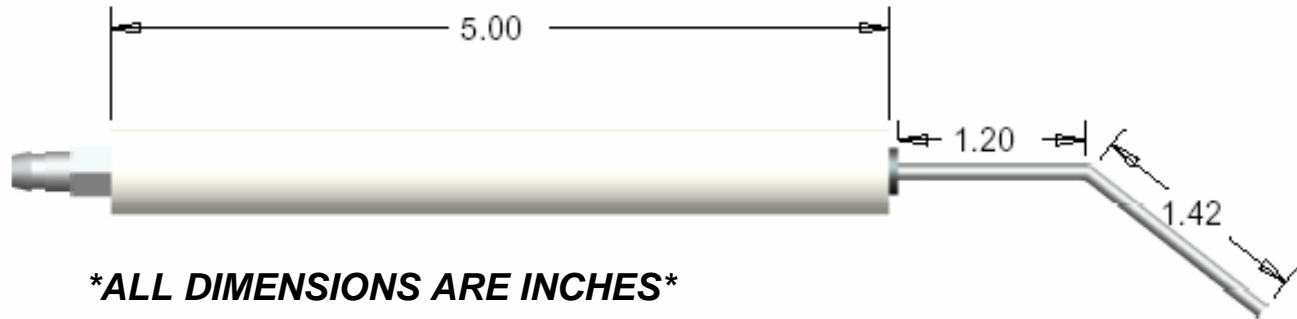


# Fuel Nozzle

- **Monarch 5.5 GPH 80° PL hollow cone nozzle**
- **Standard female nozzle adapter, brass, 1/8" NPT**
- **Fuel rated thread tape used to prevent fuel leakage**



# Igniters



*Westwood Products, South River, NJ*

[www.westwoodproducts.com](http://www.westwoodproducts.com)

1-800-442-1630

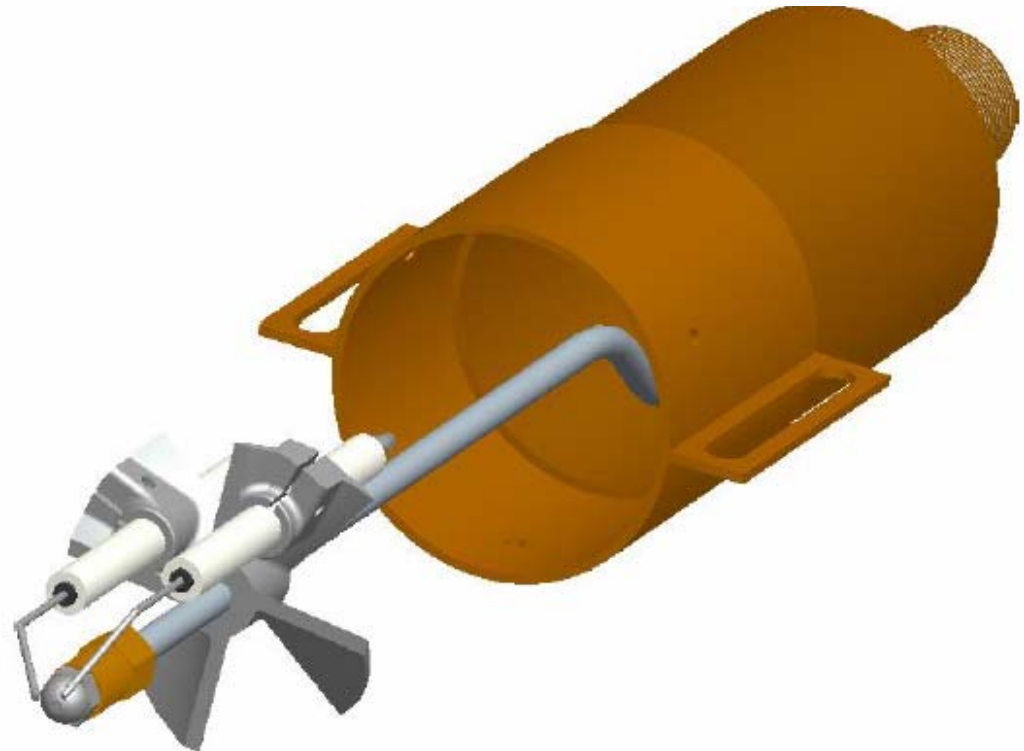
*p/n E5-2M5*

*Insulator length 5"*

*Insulator diameter 9/16"*

*Electrode diameter 3/32"*

*Connector diameter 3/16"*



# Igniter Wires



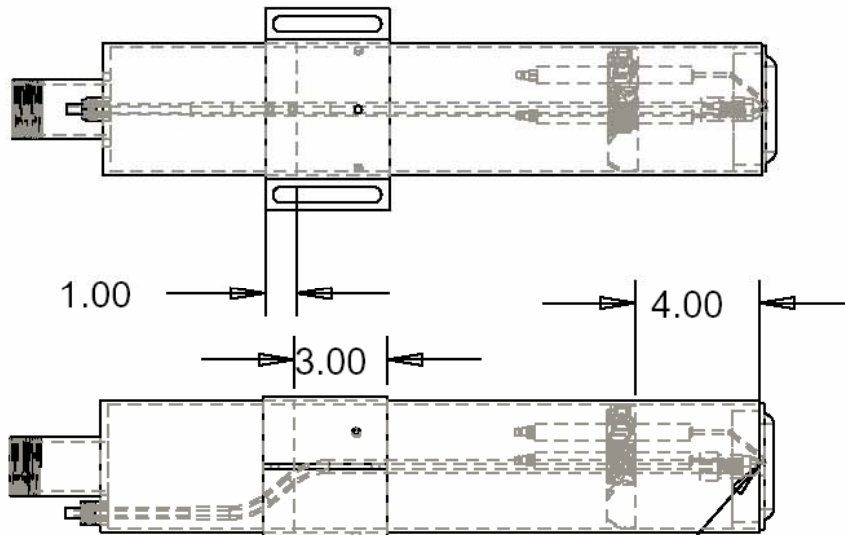
# Turbulator

- **Monarch F-124 4 x 2 3/4" turbulator**
  - *Note: Although the turbulator pictured says 4 x 2 1/4", the manufacturer used this part and bored out the center hole to 2 3/4"*
  - *Be sure to measure the center bore to check it is 2 3/4" diameter, as this will affect the exit velocity*

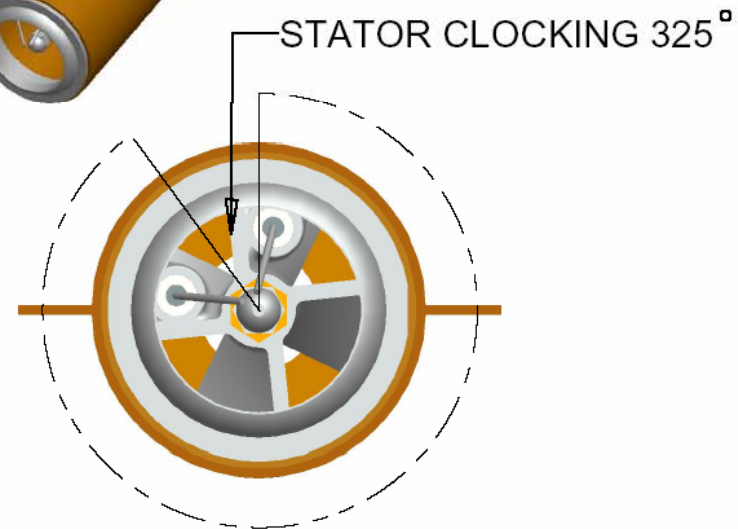
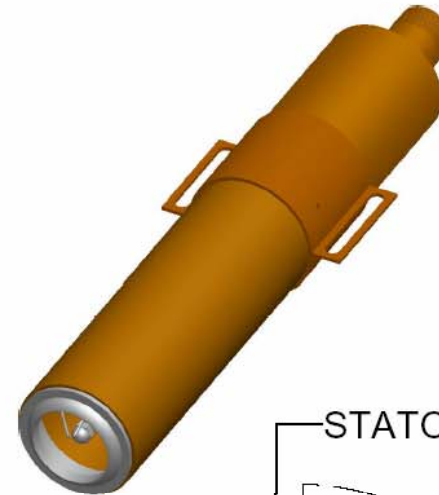


# Assembled NexGen Burner Housing

*\*ALL DIMENSIONS ARE INCHES\**



NOZZLE DEPTH 5/16"  
IGNITOR DEPTH 5/32"  
STATOR DEPTH 4 5/16"  
FROM TURB EXIT PLANE



# Regulator and Muffler

- **Air Pressure Regulator**

- ARO Ingersoll Rand high flow general purpose regulator, p/n 27364-000



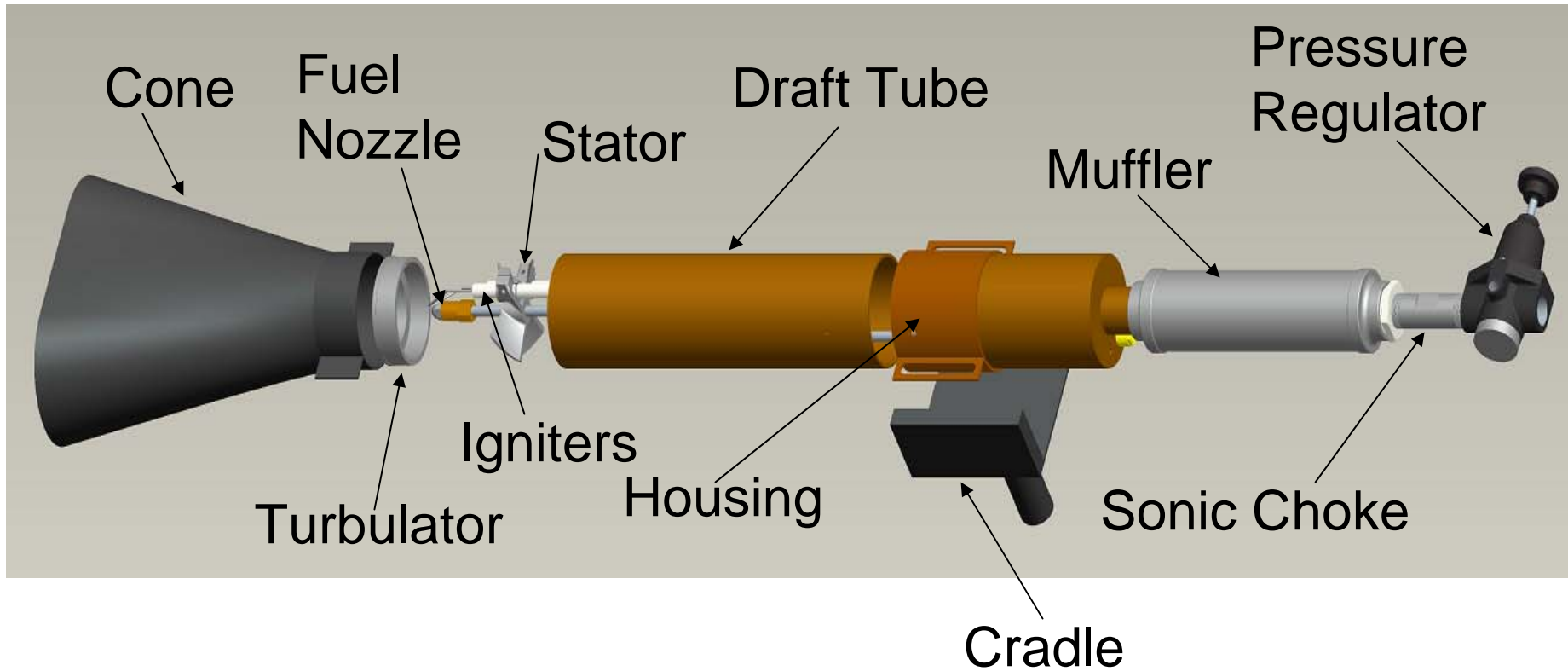
- **Muffler**

- Heavy duty inline muffler, McMaster-Carr p/n 5889K73
- Can use a foam insert to further reduce the burner noise
  - Reticulated foam, typically used for explosion protection in military fuel tanks, is an ideal solution
  - Foam can be cut into a 12" long x 2 1/2" diameter cylinder to fit inside the muffler
  - Foam insert has no effect on burner output

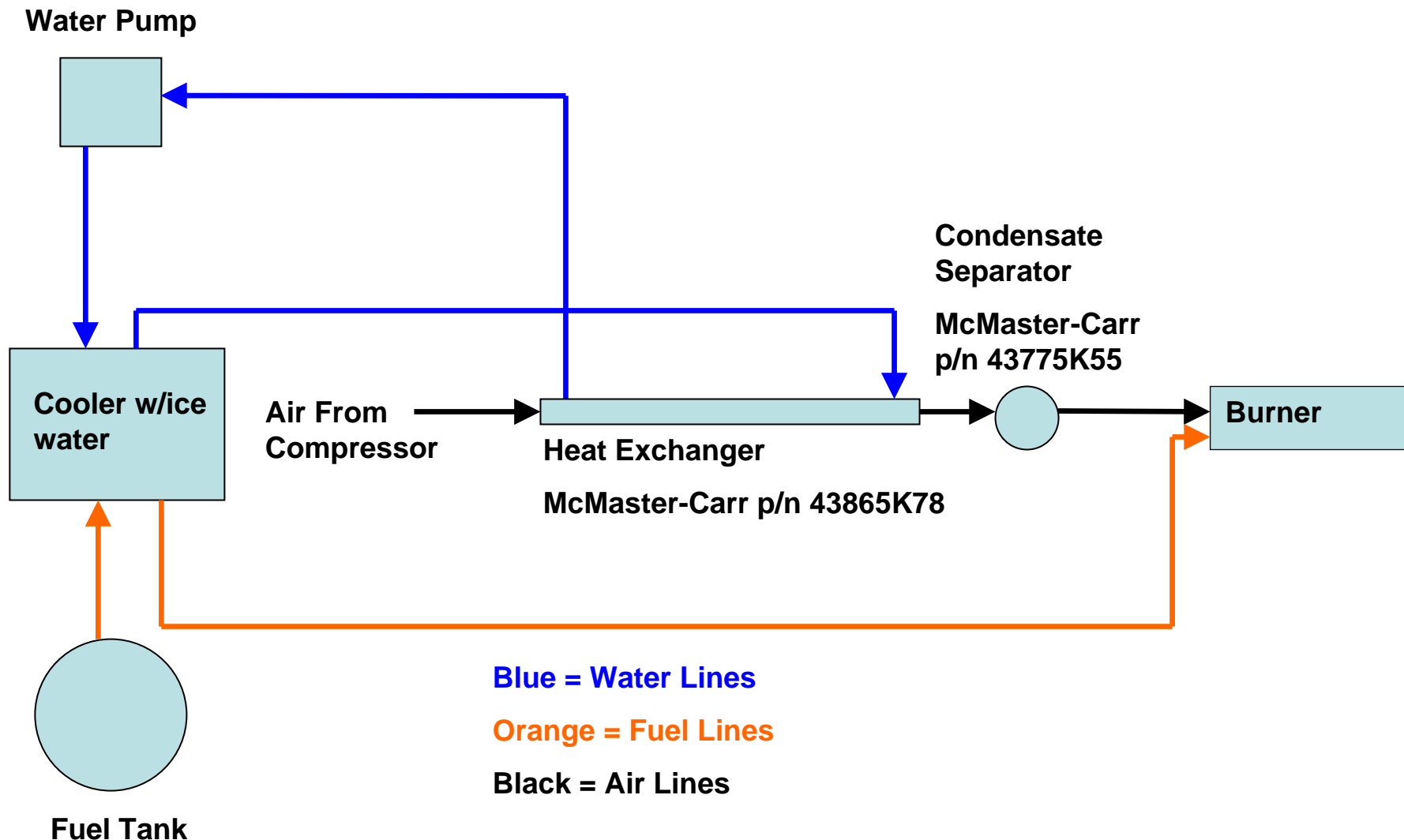




# NexGen Burner

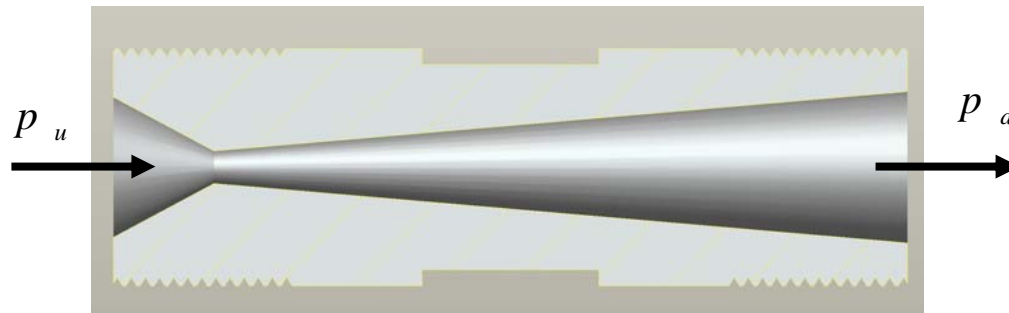


# Heat Exchange System

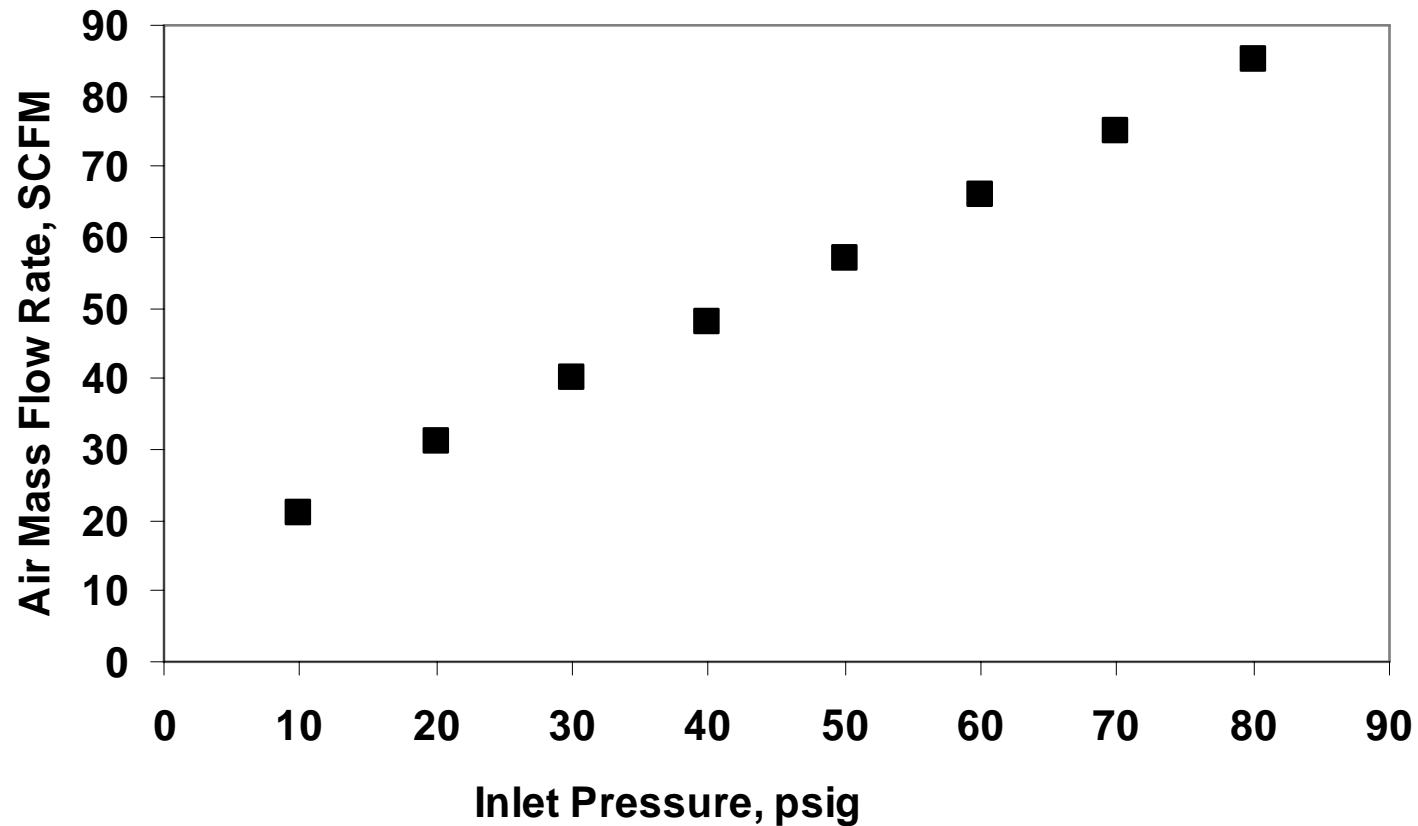


# NexGen Components – Air Delivery

- **Critical Flow Venturi (Sonic Choke)**
  - Applied fluid dynamics
    - Converging-Diverging nozzle theory derived from:
      - Continuity (conservation of mass)
      - Equation of State (ideal gas)
      - Isentropic Flow Relations (2<sup>nd</sup> Law of Thermodynamics – Reversible Flow)
    - Flow is motivated by a pressure difference between the upstream converging section and the downstream diverging section
    - Increasing the pressure ratio ( $P_u/P_d$ ) increases the mass flow rate through the nozzle
    - At a certain pressure ratio, the gas velocity at the throat will be equal to the speed of sound, Mach 1
    - Further increases in the pressure ratio will not increase the mass flow rate, and the flow is said to be choked
  - The details of the sonic choke chosen for the NexGen burner are
    - Fox Valve, Inc. of Dover, NJ
    - p/n 612021-8
    - Design point – 80 SCFM at 75 psig inlet pressure
    - Construction – 1” pipe, 304 stainless steel, male NPT ends

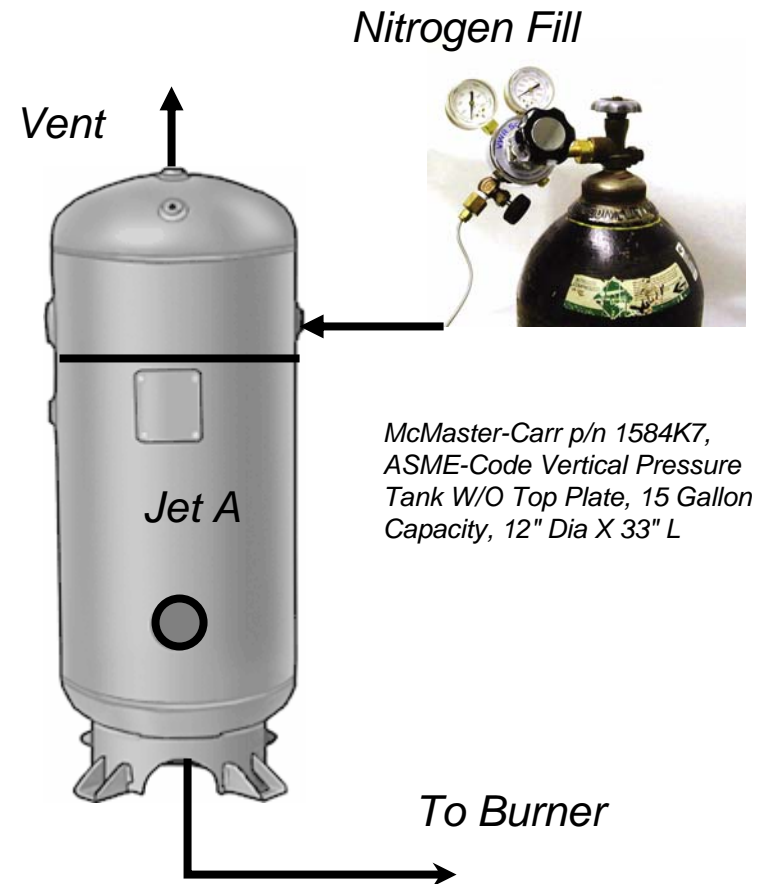


# Sonic Choke Calibration



# NexGen Components – Fuel Delivery

- **Fuel will be provided by a pressurized fuel tank**
  - Headspace gas pressure controlled with a precision regulator
  - Fuel pressure can be measured at the back of the burner for an accurate reading nearest to the fuel nozzle
  - *\*Note: equivalent results have been obtained using a mechanical fuel pump to achieve the same pressure*



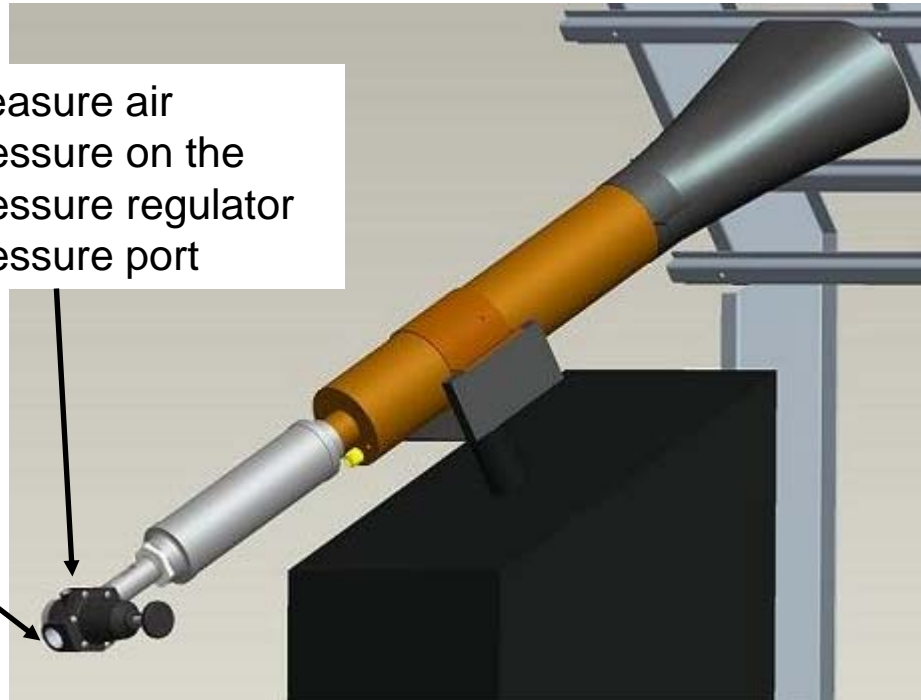
# Measurement of Burner Inlet Parameters

- **It is critical that all inlet parameters are measured accurately and in a consistent manner**
  - For the NexGen burner, since the burner construction and components are more standardized, flame output will be consistent for given inlet conditions
- **For standardization, all NexGen burners must measure inlet conditions at the same location**
  - To get an accurate measurement of the conditions entering the burner, the measurements are made nearest to the burner inlet

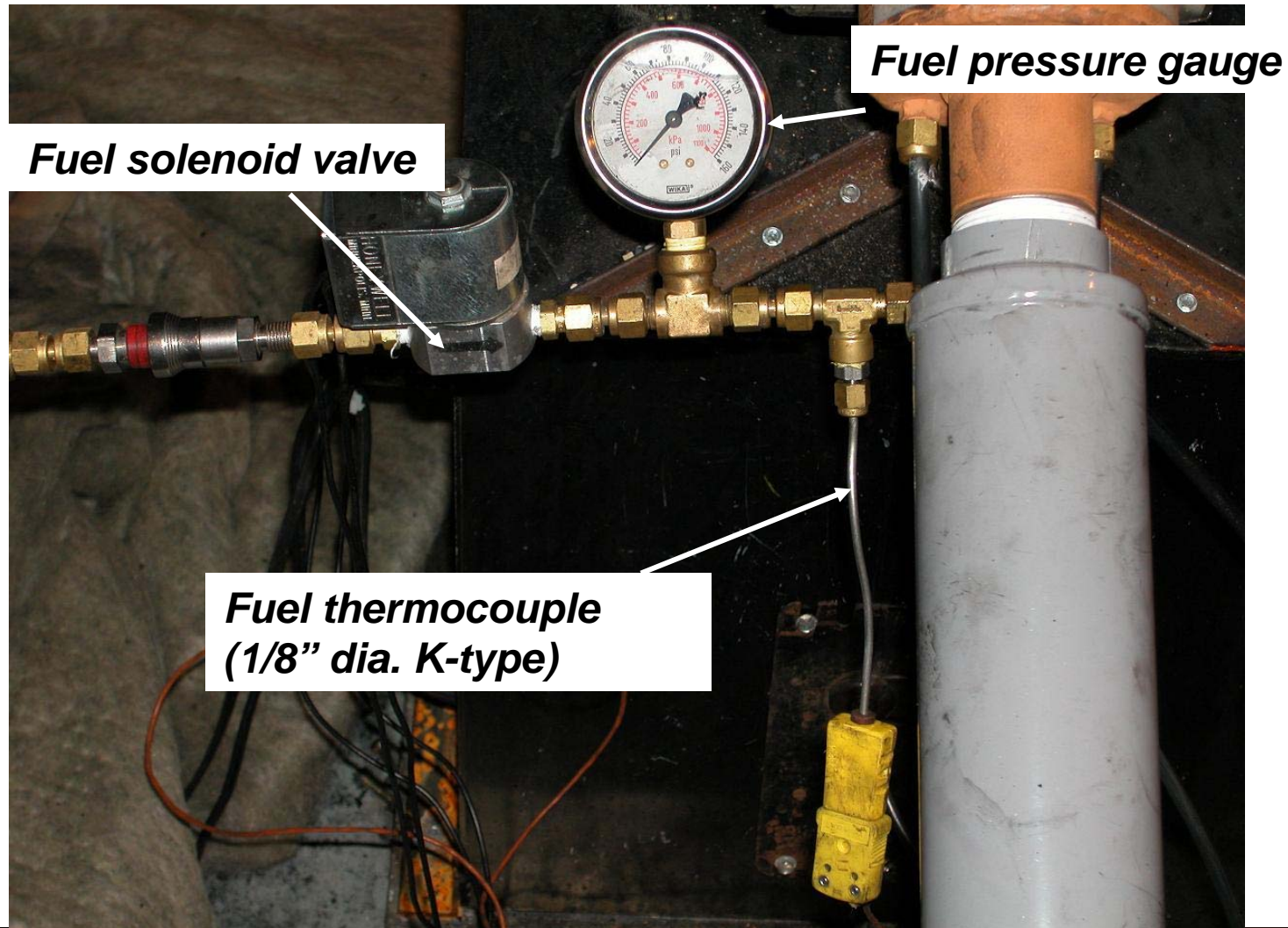
# Air Measurement

Measure air temperature just upstream of the pressure regulator with a 1/8" K-type thermocouple

Measure air pressure on the pressure regulator pressure port



# Fuel Measurement





# Burner Operational Parameters

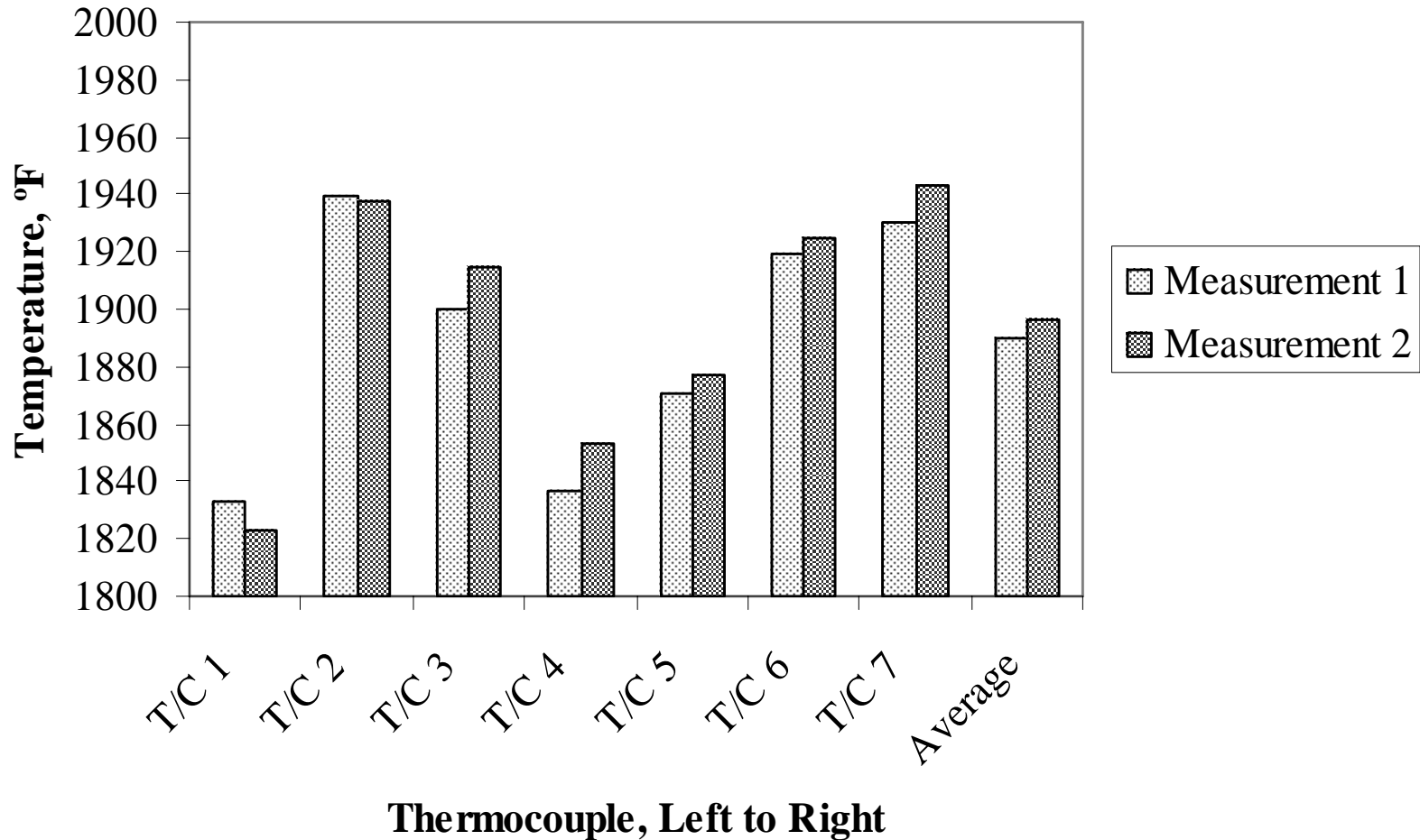
- **Fuel**

- Type: JP8, Jet A or equivalent
- Nozzle: Monarch 5.5 gph 80°PL
- Pressure: 120 psig ( $\pm 2$  psig)
- Temperature: 42°F ( $\pm 10$ °F)
- Flowrate: 6.0 gph ( $\pm 0.3$  gph)

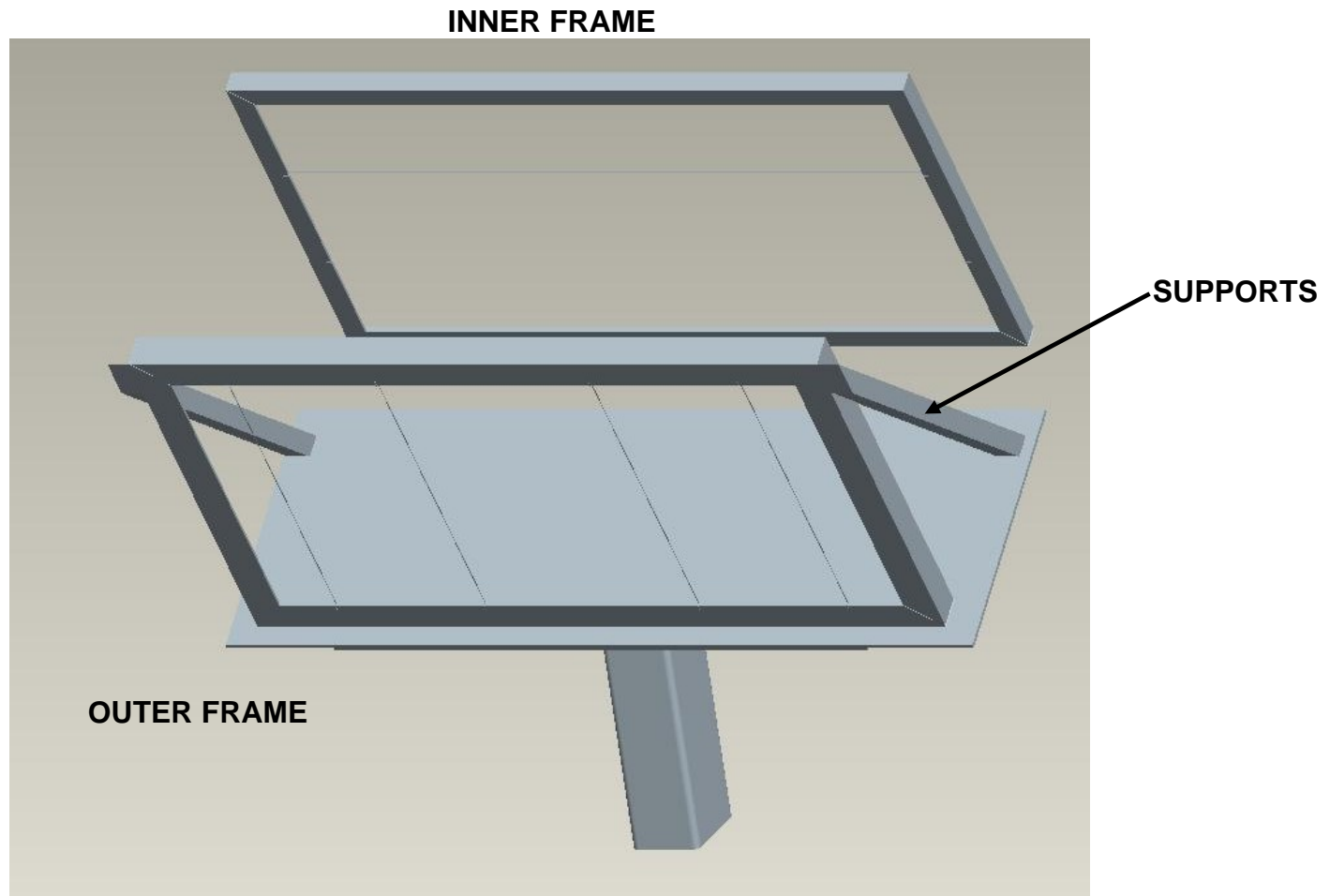
- **Air**

- Pressure: 60 psig ( $\pm 2$  psig)
- Temperature: 50°F ( $\pm 10$ °F)

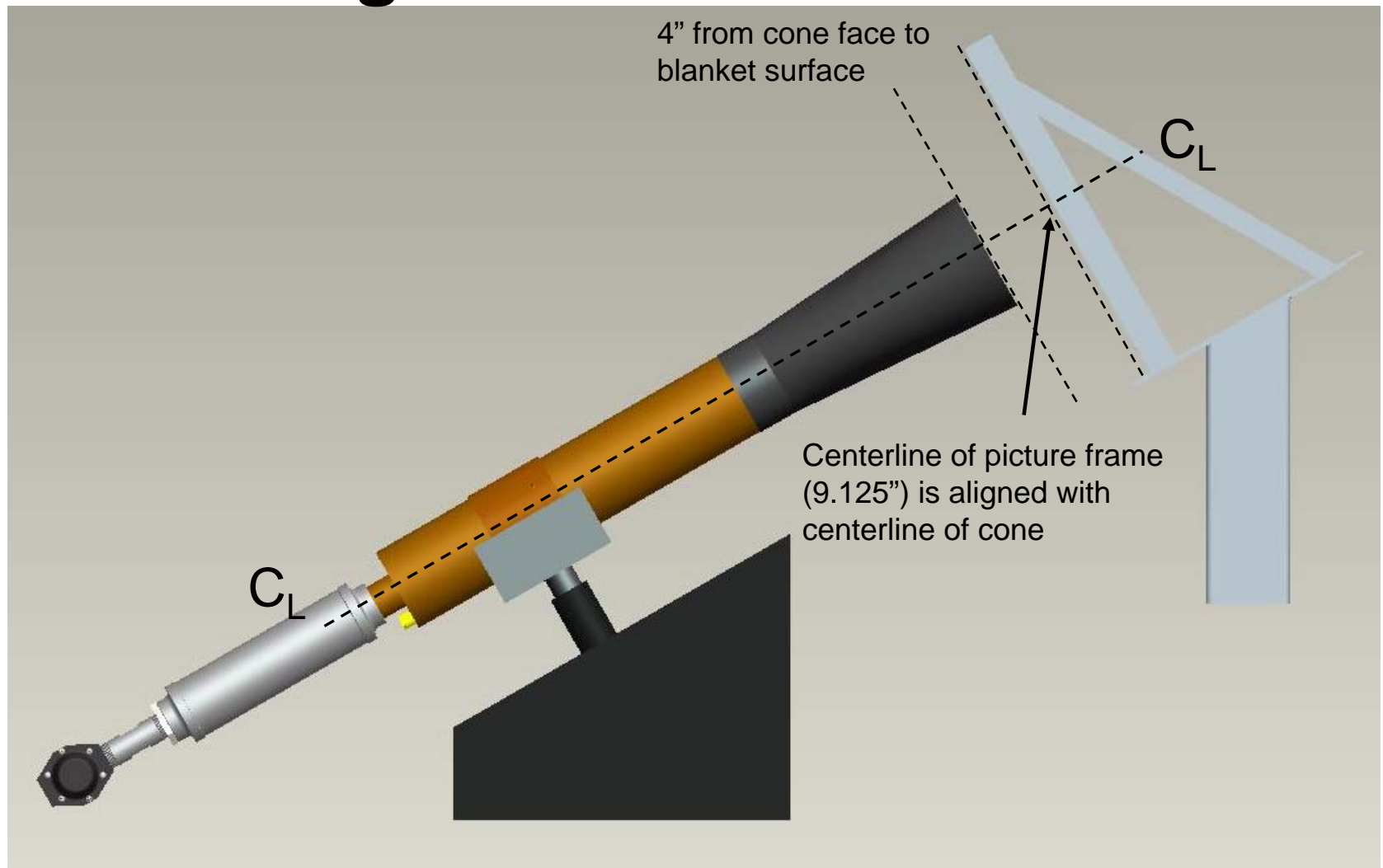
# Flame Temperature Measurement



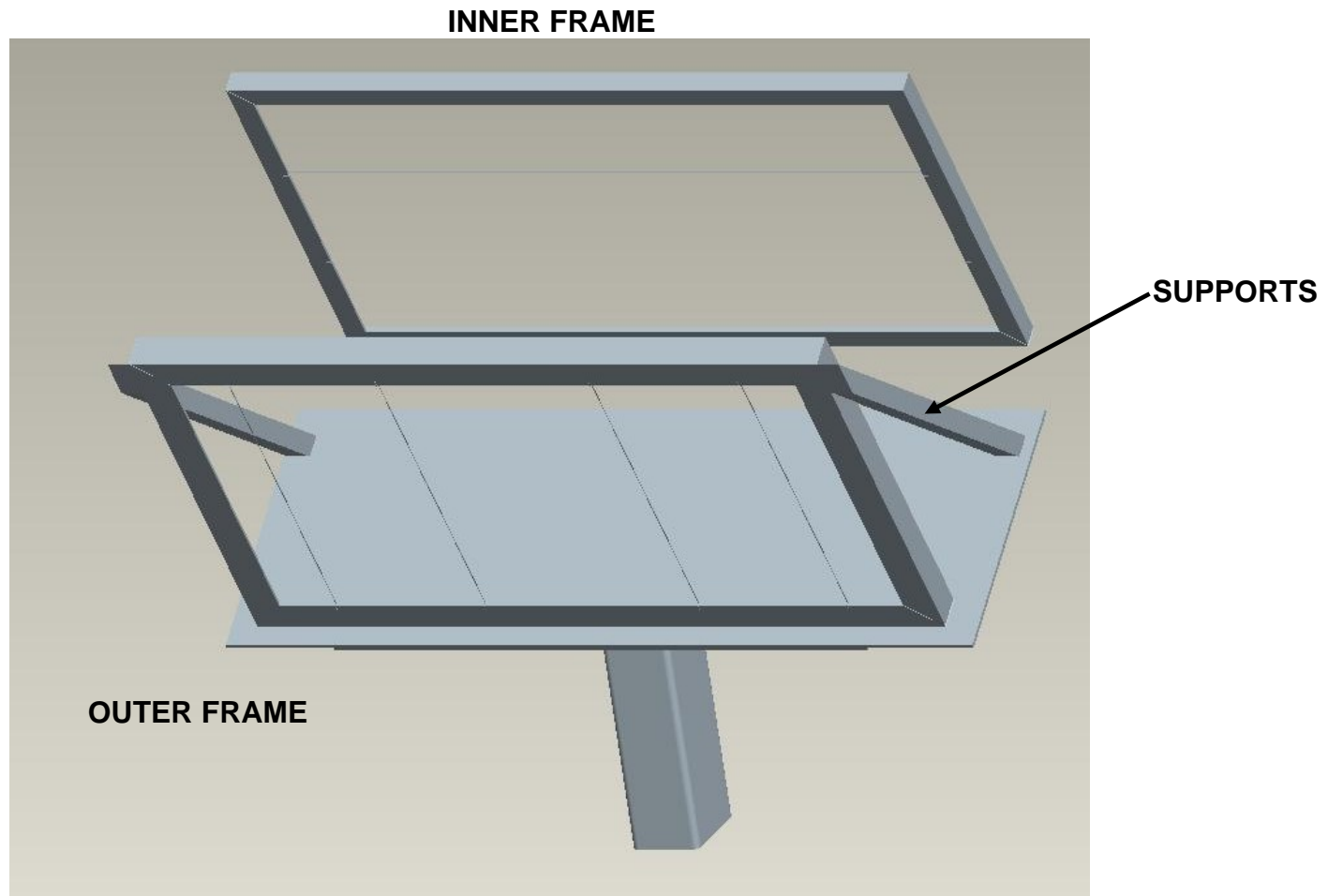
# Picture Frame Blanket Holder



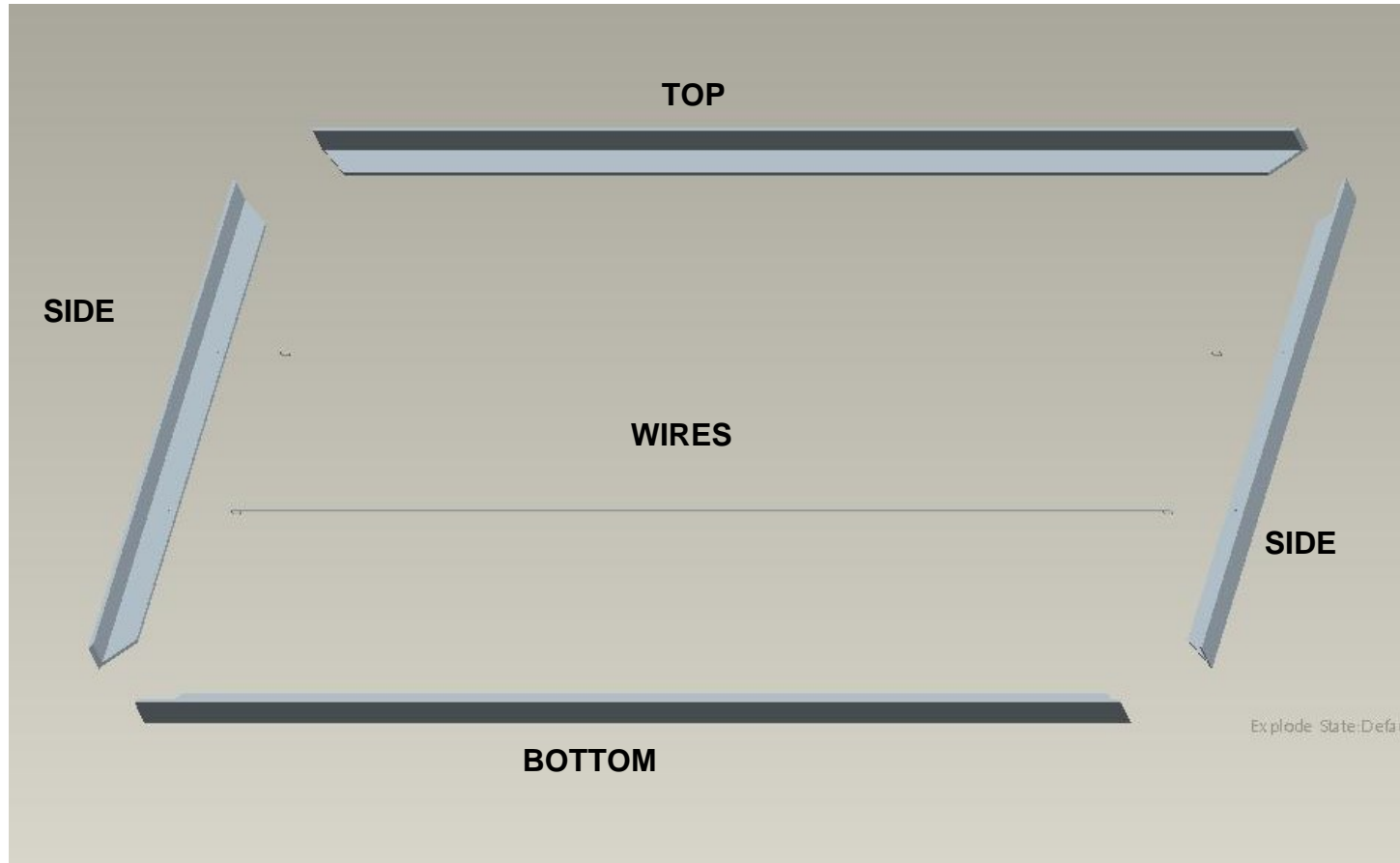
# Frame Alignment



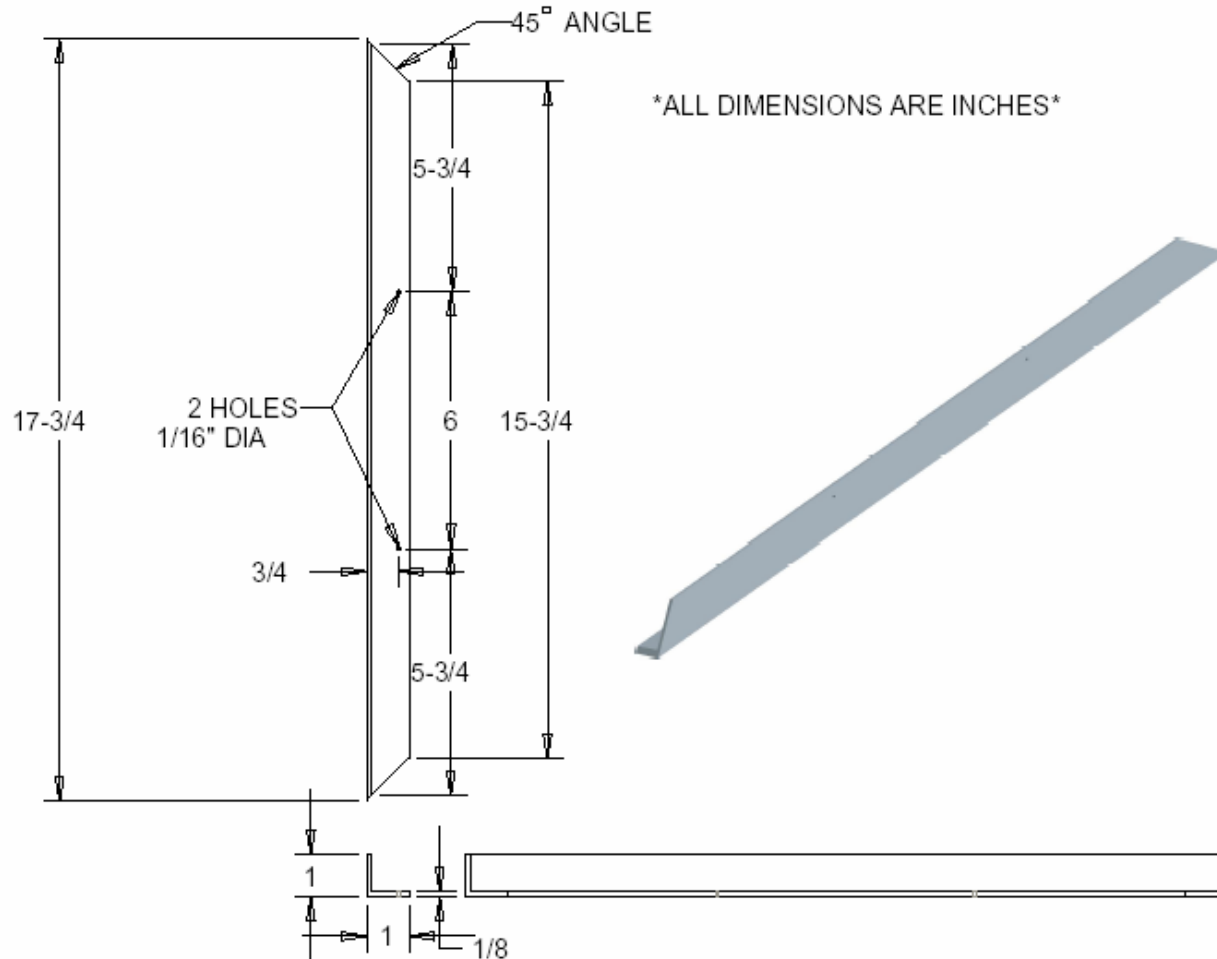
# Picture Frame – Component View



# Inner Frame – Exploded View

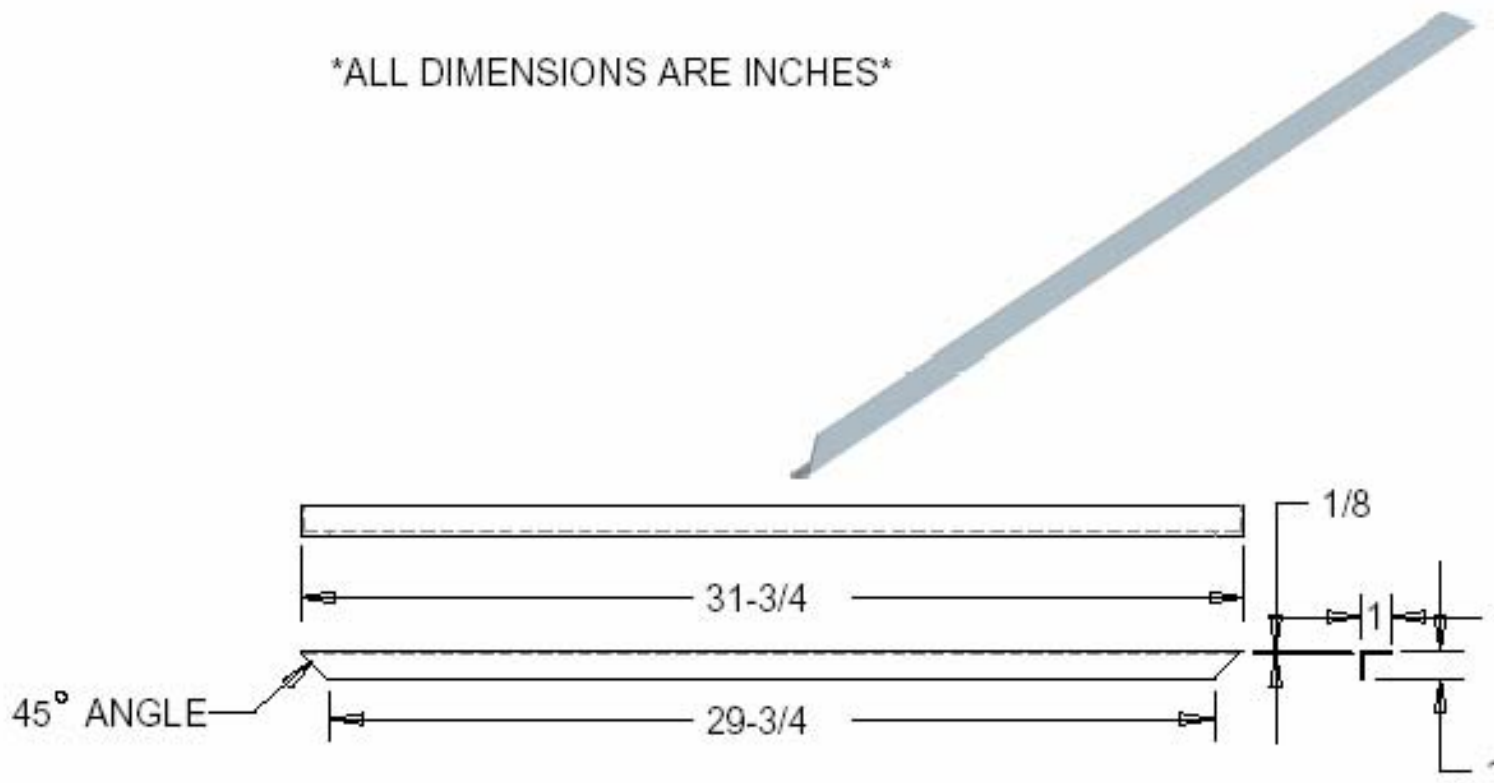


# Inner Frame Components – Sides



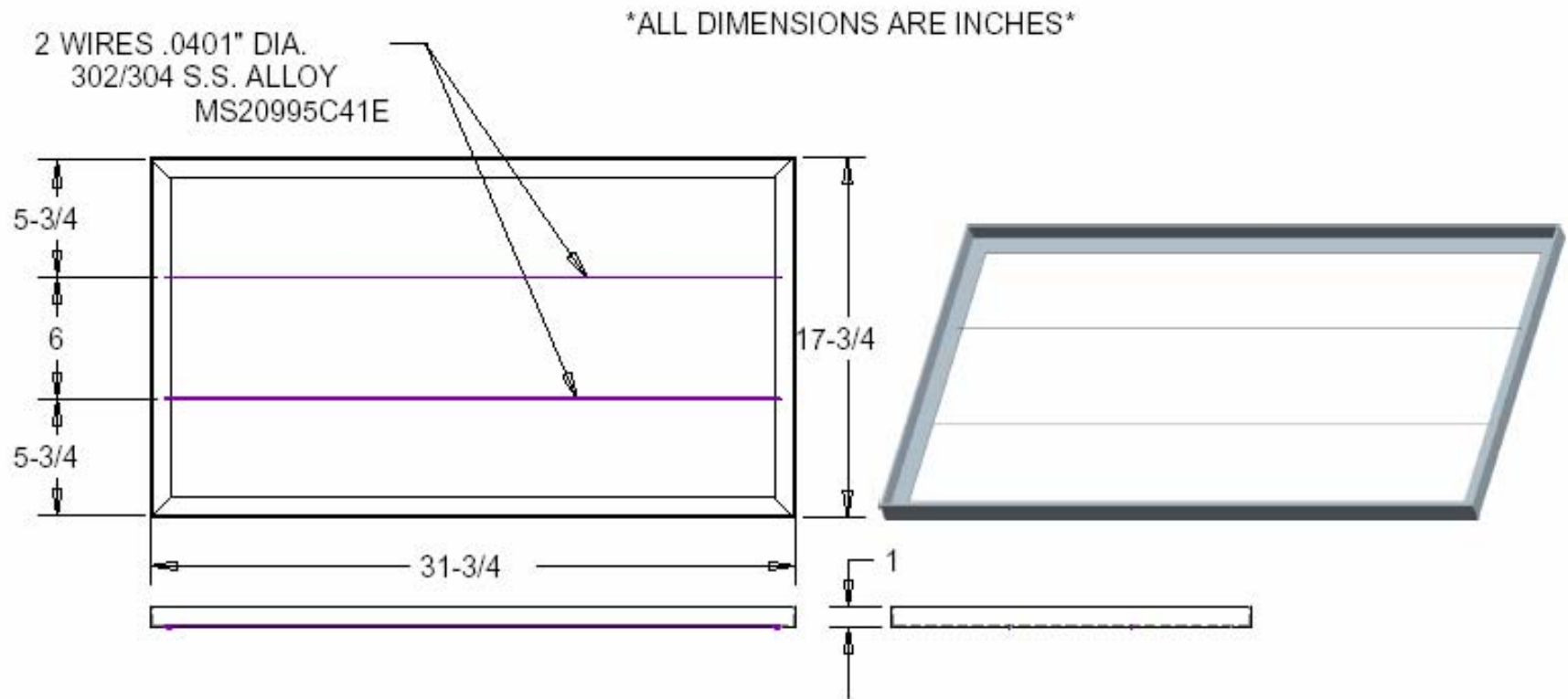
# Inner Frame Components – Top & Bottom

\*ALL DIMENSIONS ARE INCHES\*

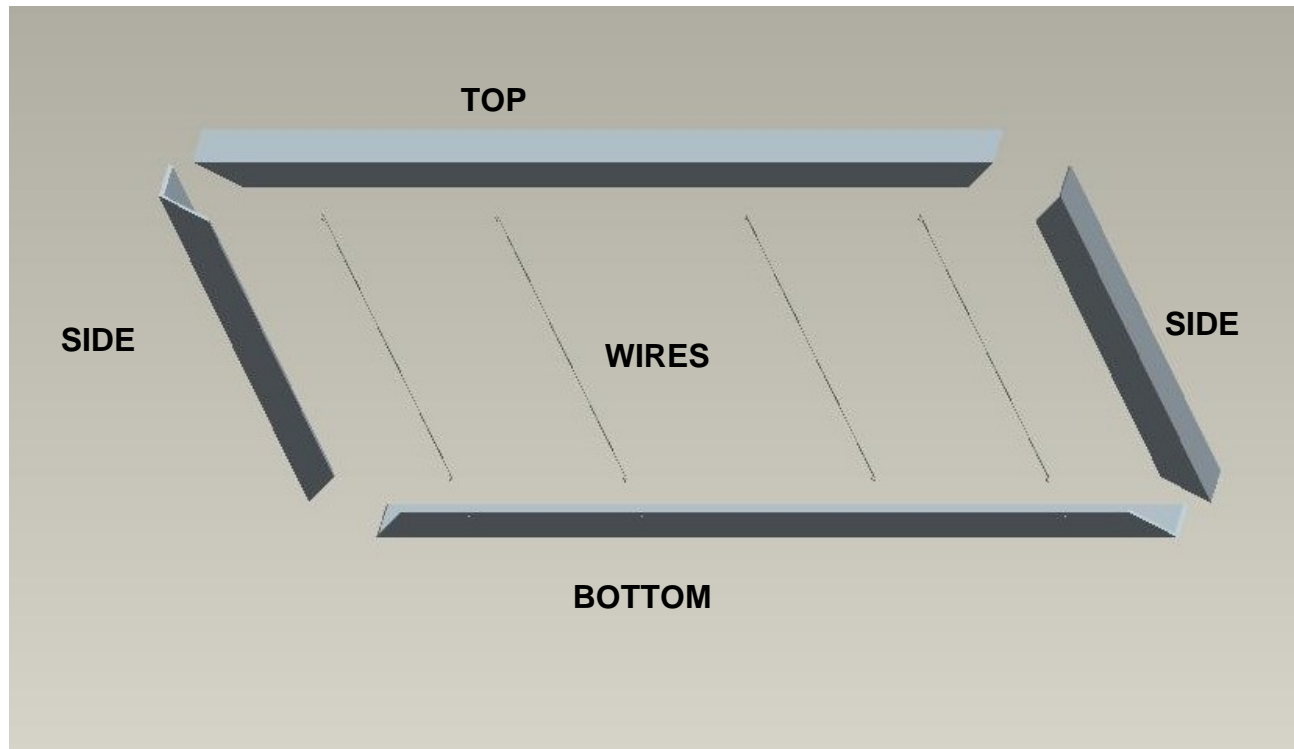




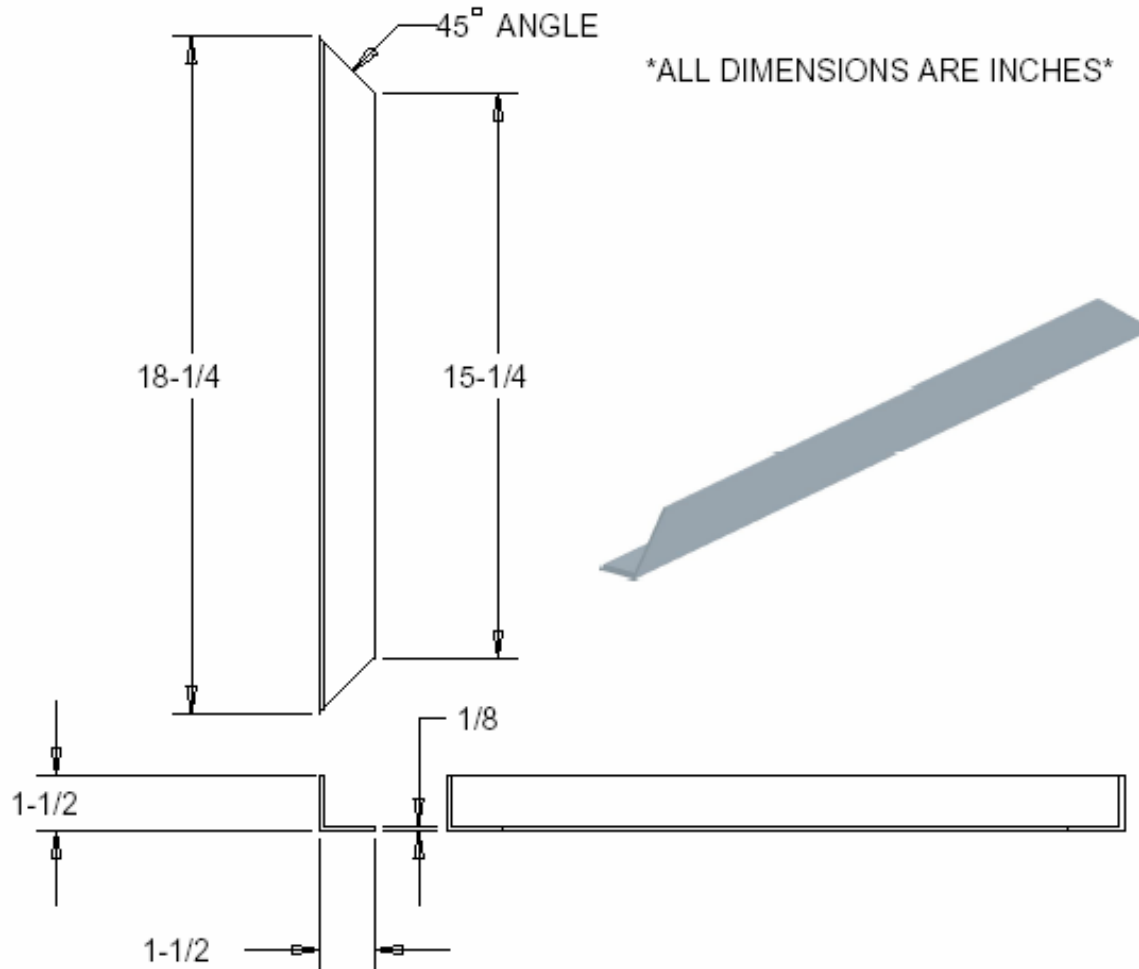
# Inner Frame - Assembled



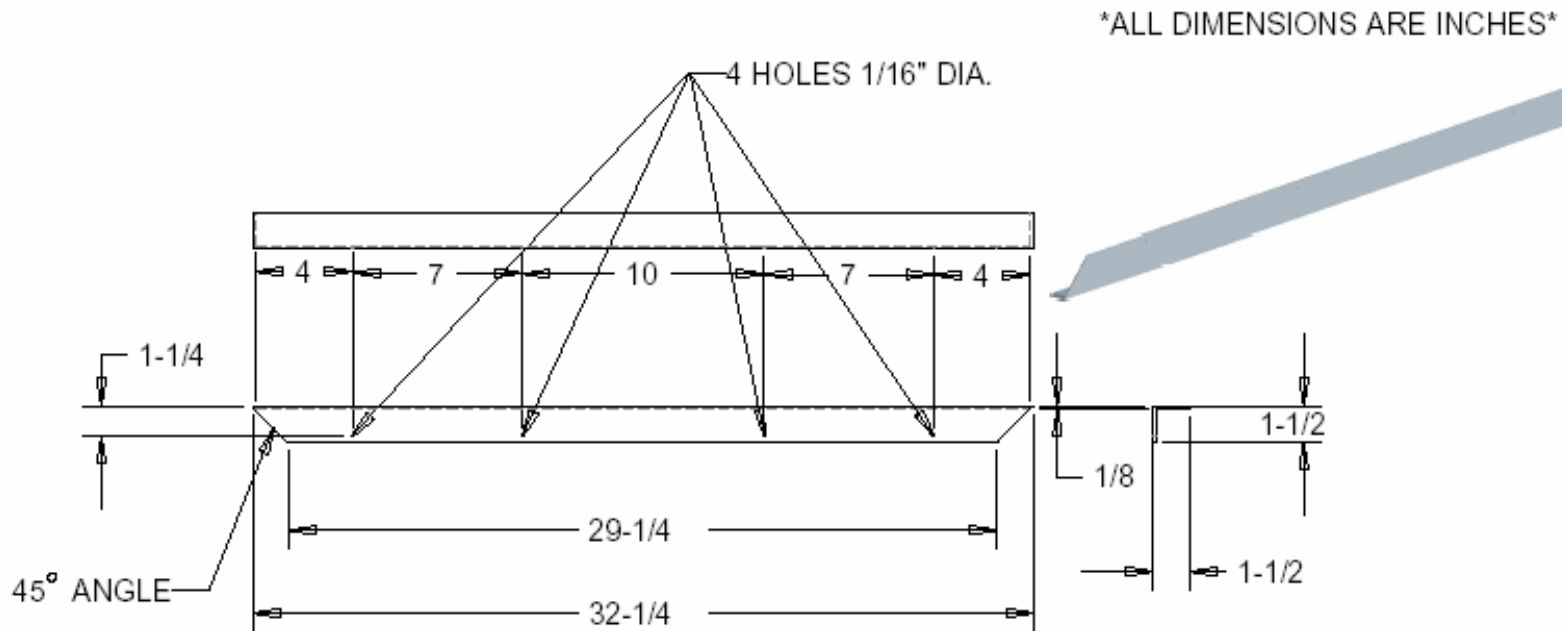
# Outer Frame – Exploded View



# Outer Frame Components - Sides

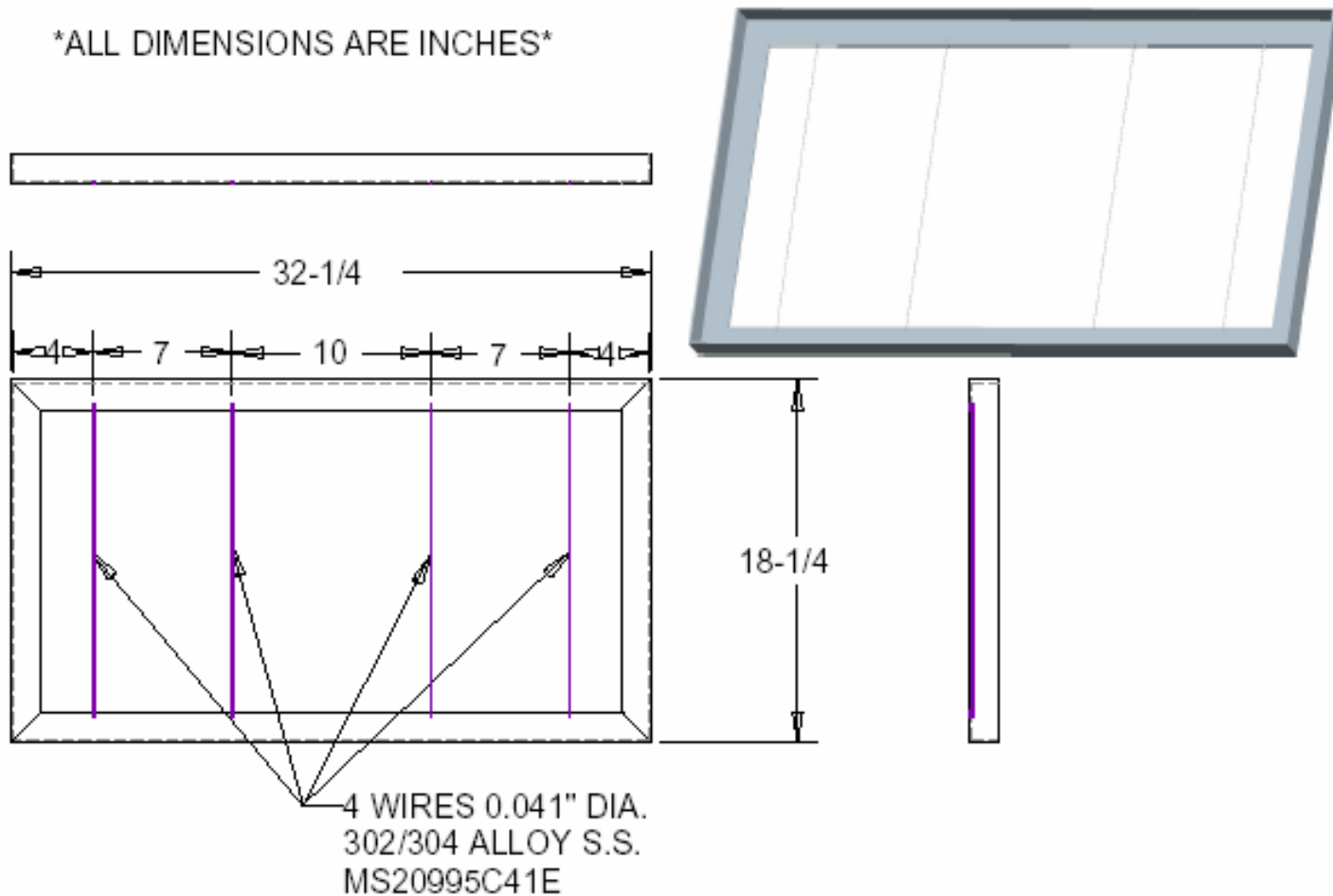


# Outer Frame Components – Top & Bottom

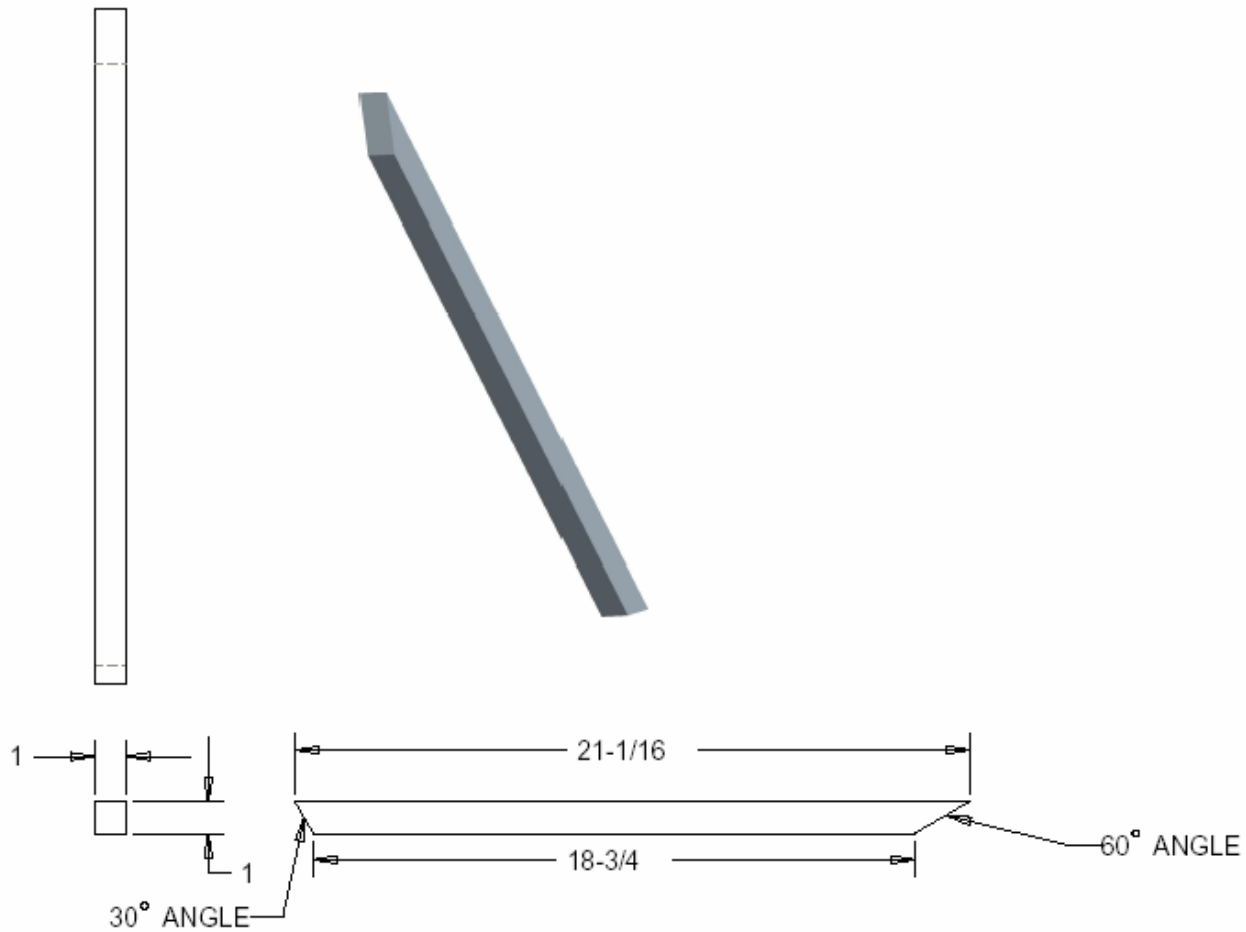


# Outer Frame - Assembled

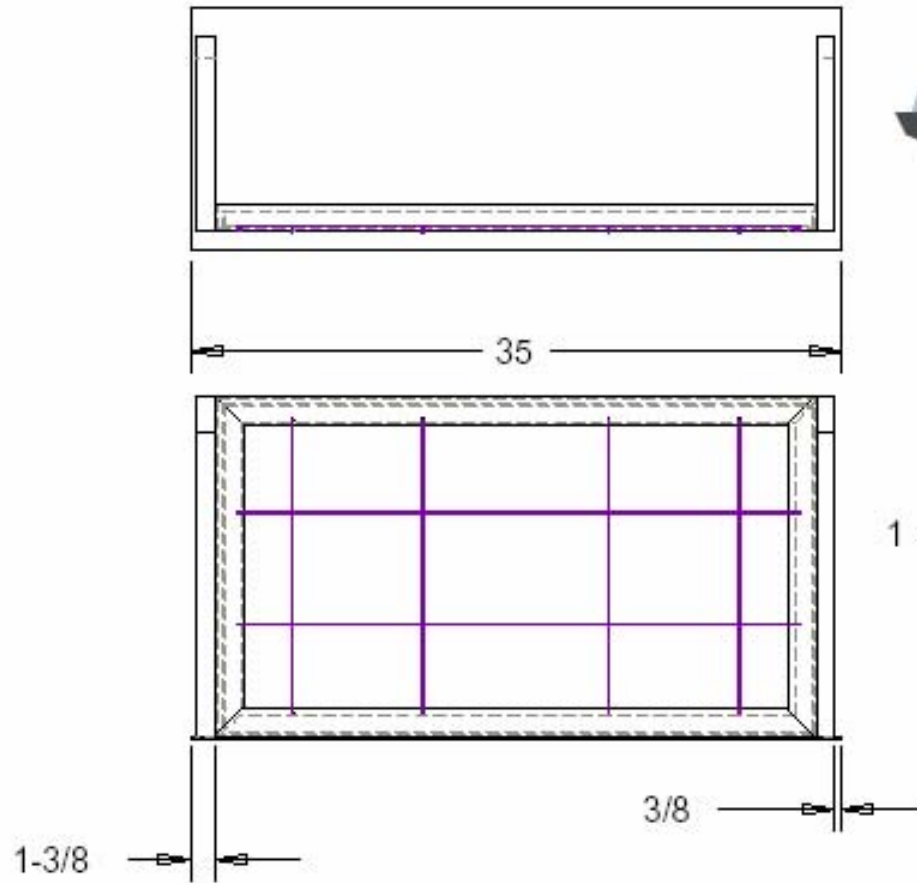
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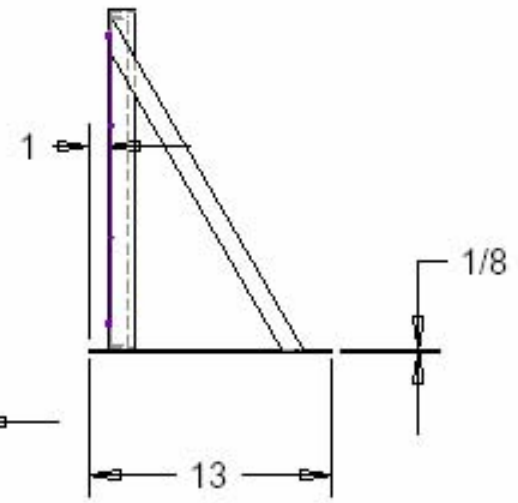
# Supports



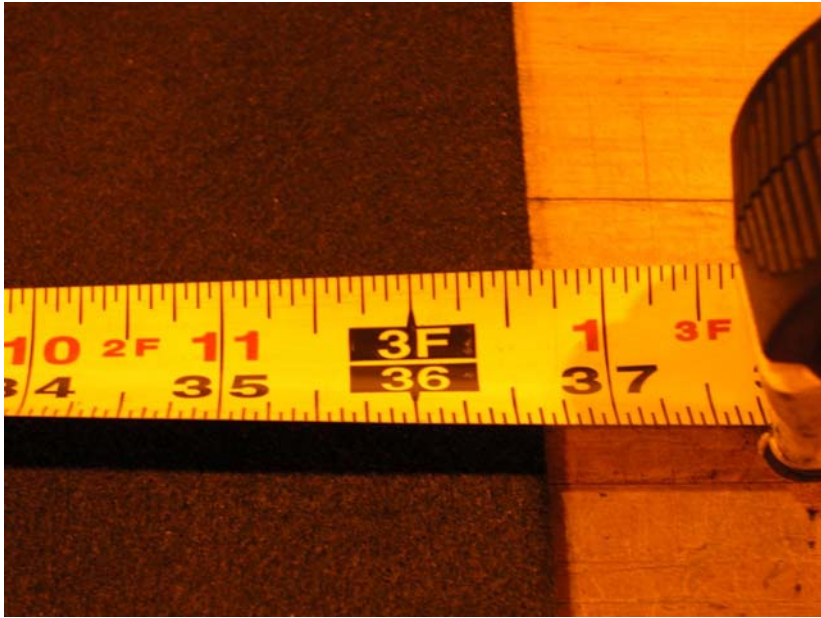
# Frame Assembly



\*ALL DIMENSIONS ARE INCHES\*



# Blanket Preparation

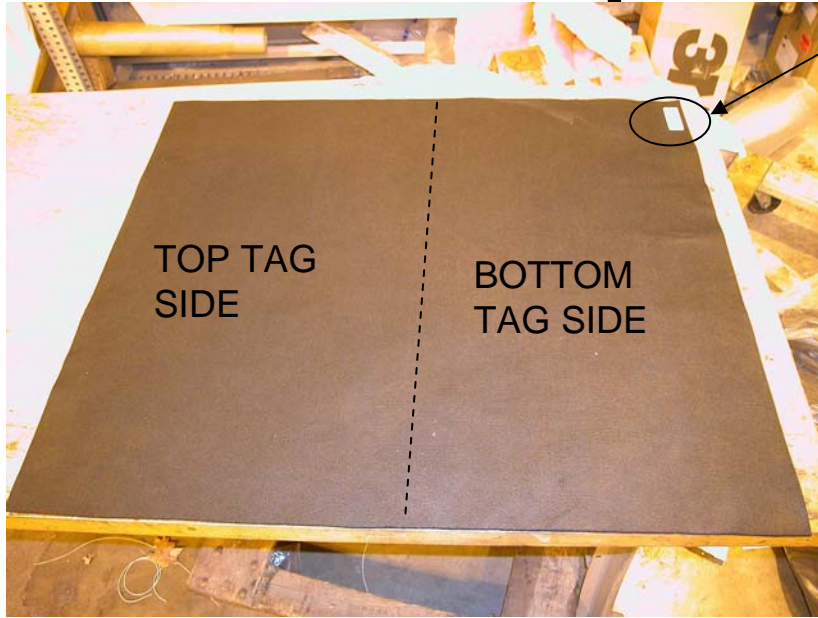


Most blankets are 36”L x 32”W, but some may be longer, like 36 ½”. Just divide the length in 2 and cut there – 18 ¼” in this case.

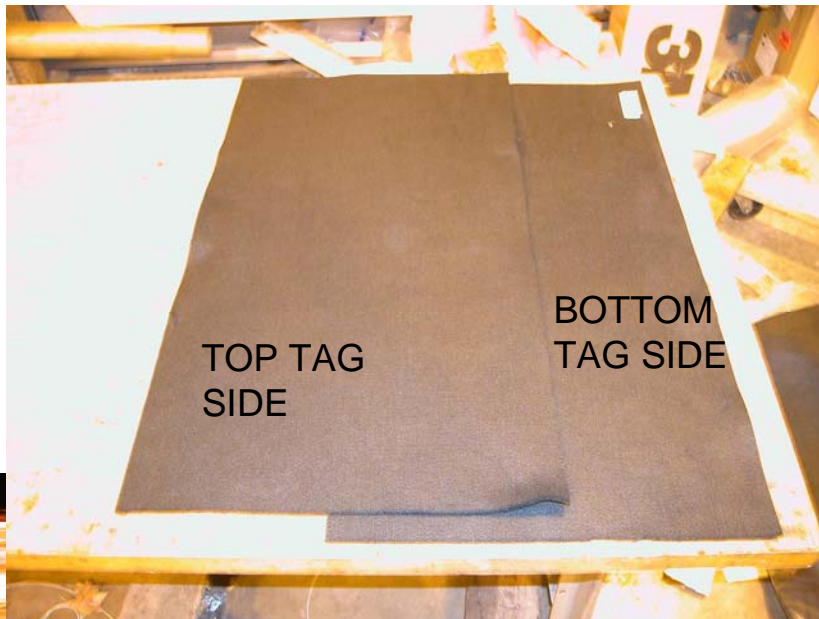
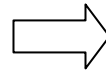




# Blanket Preparation



Tag indicates the "bottom" blanket, and also is the backside – not facing the flame.



On the top blanket, cut edge is installed on the bottom of the frame. On the bottom blanket, the tag gets installed on the bottom of the frame.



# View From Back



# Blanket Installation

Start from the top, align the top edge of the blanket with the inner top edge of the frame

Holding the top in place, work the blanket into the holder from left to right

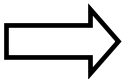


# Blanket Installation

1



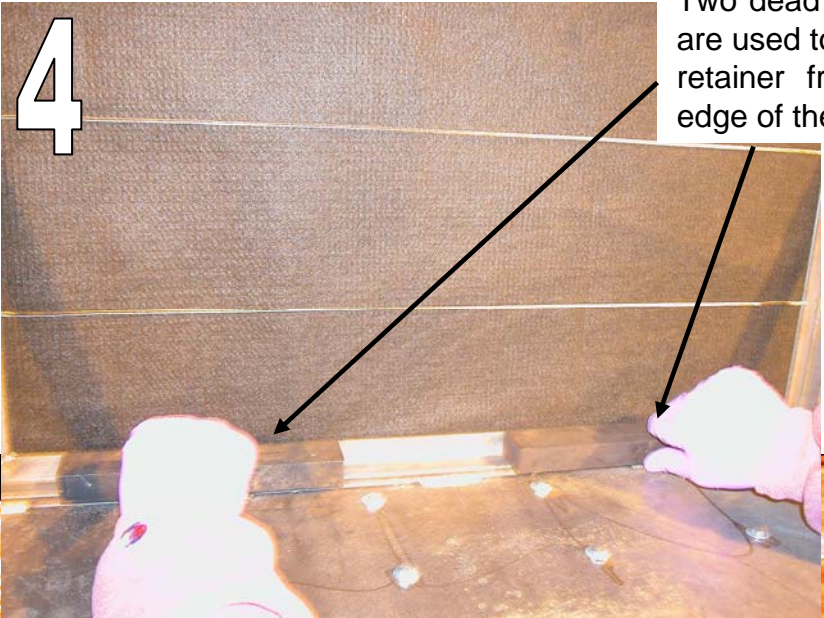
Roll the  
retainer  
frame in  
from the  
bottom to  
the top



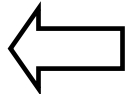
2



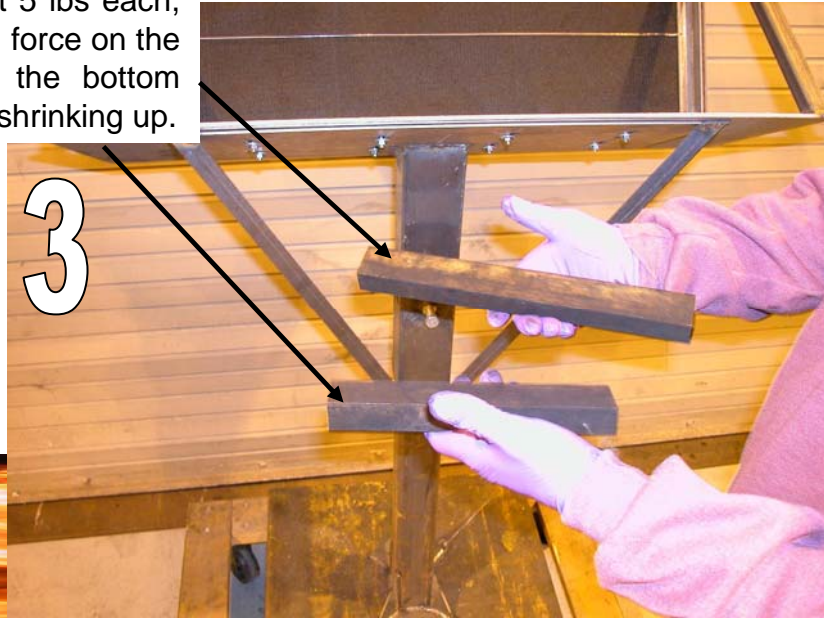
4



Two dead weights, about 5 lbs each, are used to put additional force on the retainer frame to keep the bottom edge of the blanket from shrinking up.



3



# Finished Installation, Front and Back

*If sample is too small, use two more 5 lb. bars on the vertical members of the inner frame to restrain the sample*



# Testing on the Picture Frame

- **Tex Tech<sup>®</sup> Polyacrylonitrile material**
  - 8579R: ~9 oz/yd<sup>2</sup>, burnthrough typically around 180 sec.
  - 8611R: ~16 oz/yd<sup>2</sup>, burnthrough typically around 225 sec.
  - 3M Nextel dot paper: 4 min heat flux ~ 2.8 BTU/ft<sup>2</sup>\*s

# Typical Picture Frame Data

- In order to understand the statistical variation in the PAN material and test method, we can take the average and standard deviation of all picture frame tests every performed
- Data is from all tests – with various degrees of conditioning, including all experimental and trial and error tests
- Data indicates that overall, including all possible influences, the combined effect of the test method and the material amounts to a repeatability of about 7%
- Data shows that regardless of which roll of material is tested, average burnthrough times can be found within a very good standard deviation

