

COMBUSTION FLAME VISUAL INSPECTION

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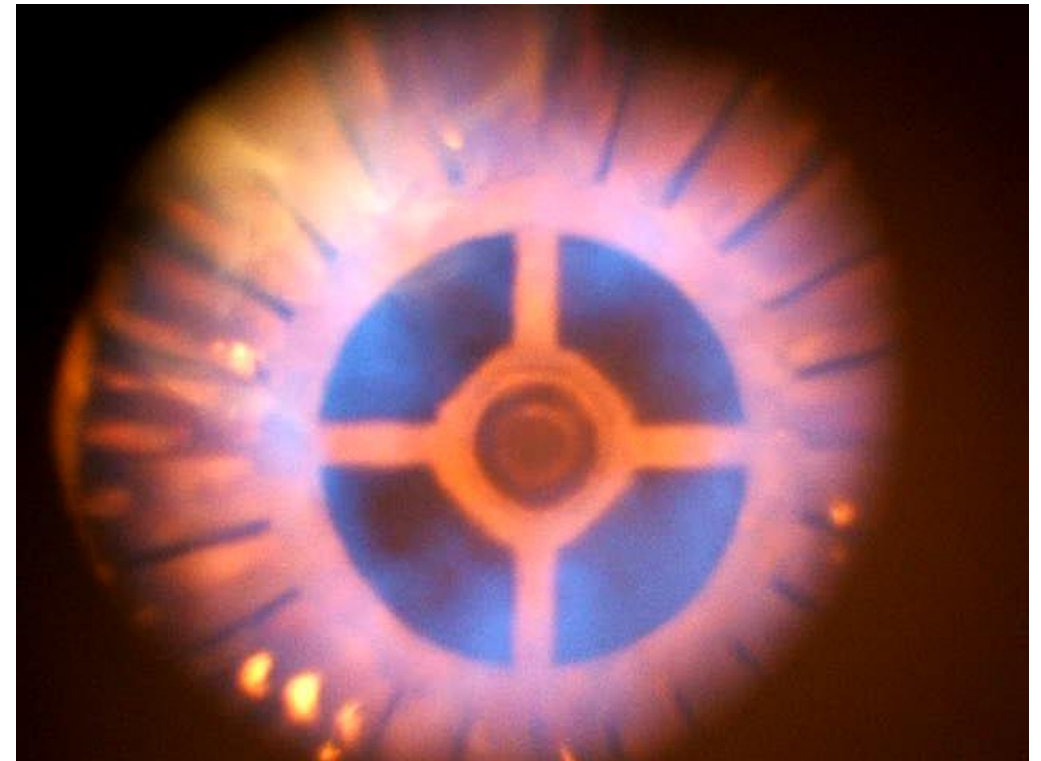
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Combustion Flame Visual Inspection

- The following presentation is an overview of a combustion flame analysis for plant personnel for the inspection of the combustion flame for performance
- The combustion testing and adjustments should always be done with the use of combustion analyzer
- However, a daily visual inspection provides an insight into the combustion performance

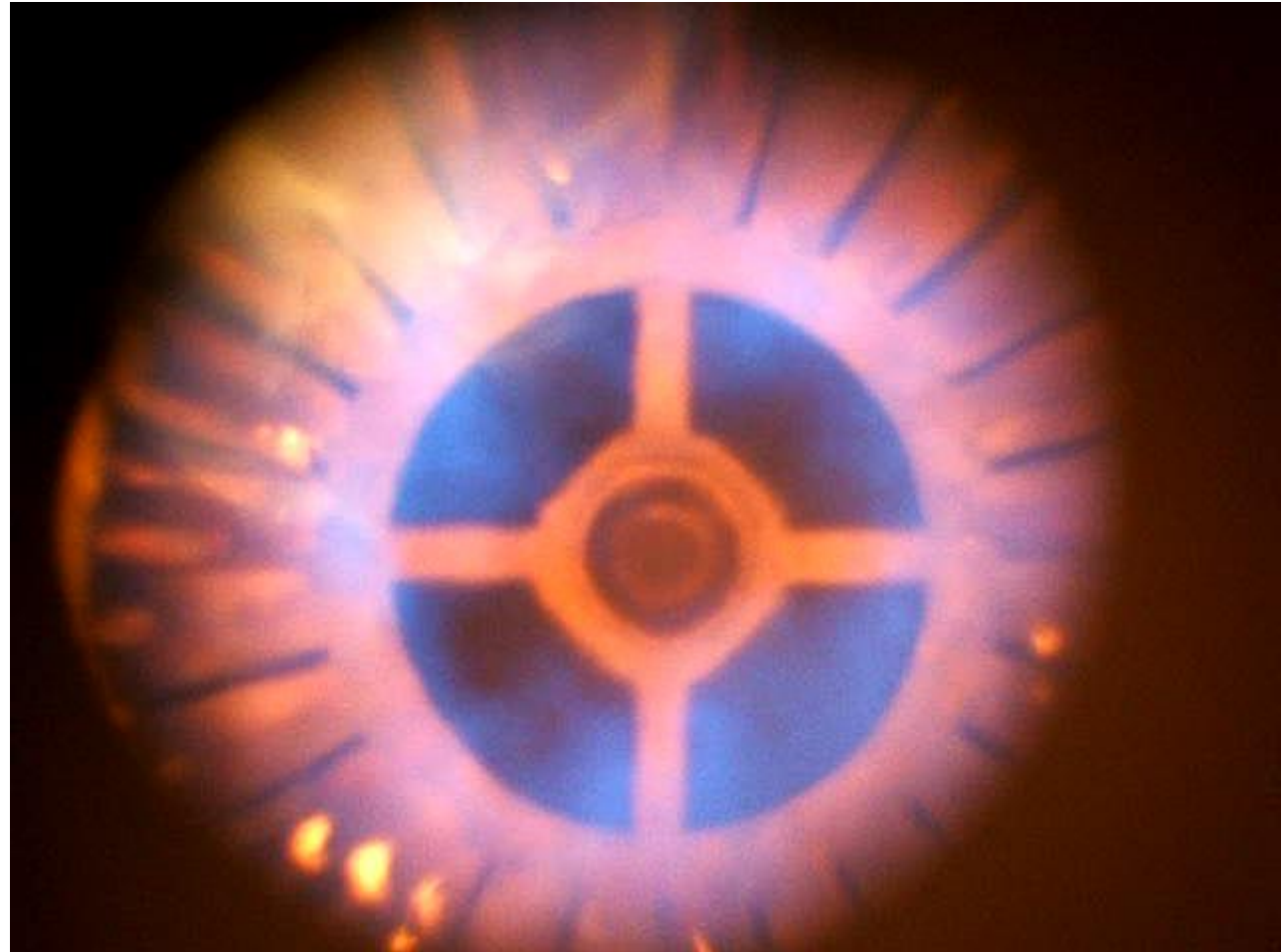
What is a Good Flame Geometry

- › Burner throat has a bright red/yellow color (indicating a high temperature) that is distributed through out the burner throat
- › No dark spots in the burner throat area
- › Flame front is in the correct position



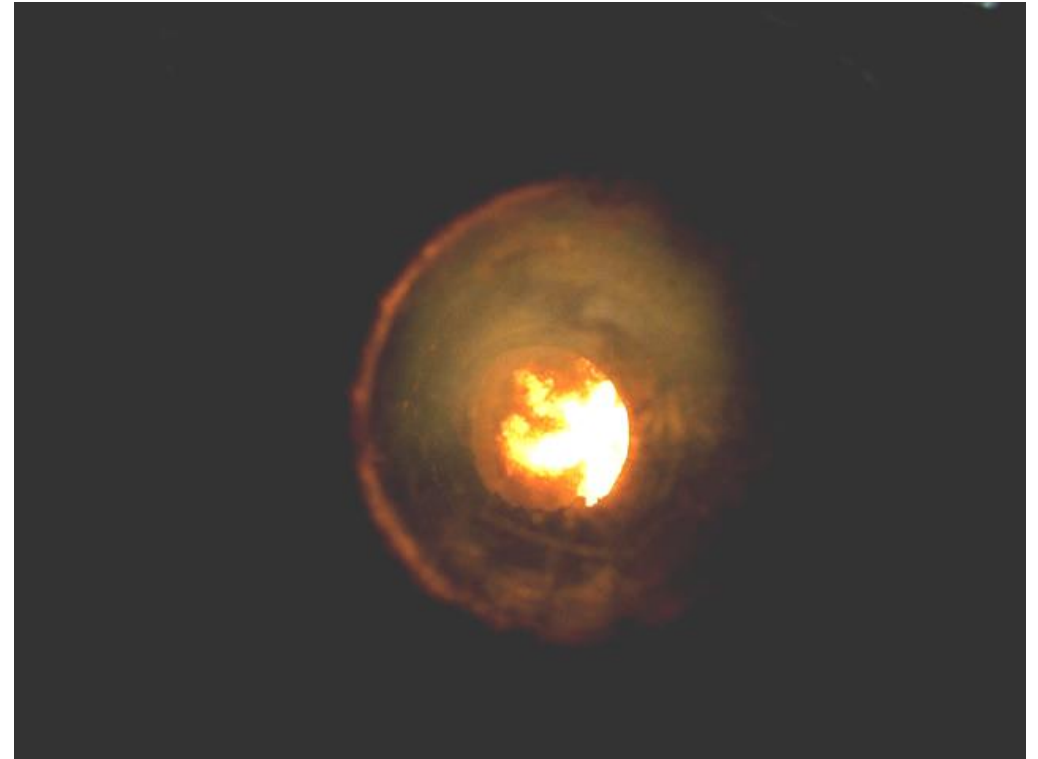
A Good Flame Pattern

- › The flame has a swirl to the operation which is mixing the fuel with the air
- › End Result:
 - Low excess air
 - No carbon monoxide
 - Higher boiler efficiency



A Imperfect Flame

- › The throat does not have a red/orange glow (high temperature) which is an example of the flame front being too far away from the burner throat
- › The burner throat helps the combustion process by providing temperature to support the combustion process



Burner Flame Deficiency

- › Results in high levels of carbon monoxide
- › High levels of excess air



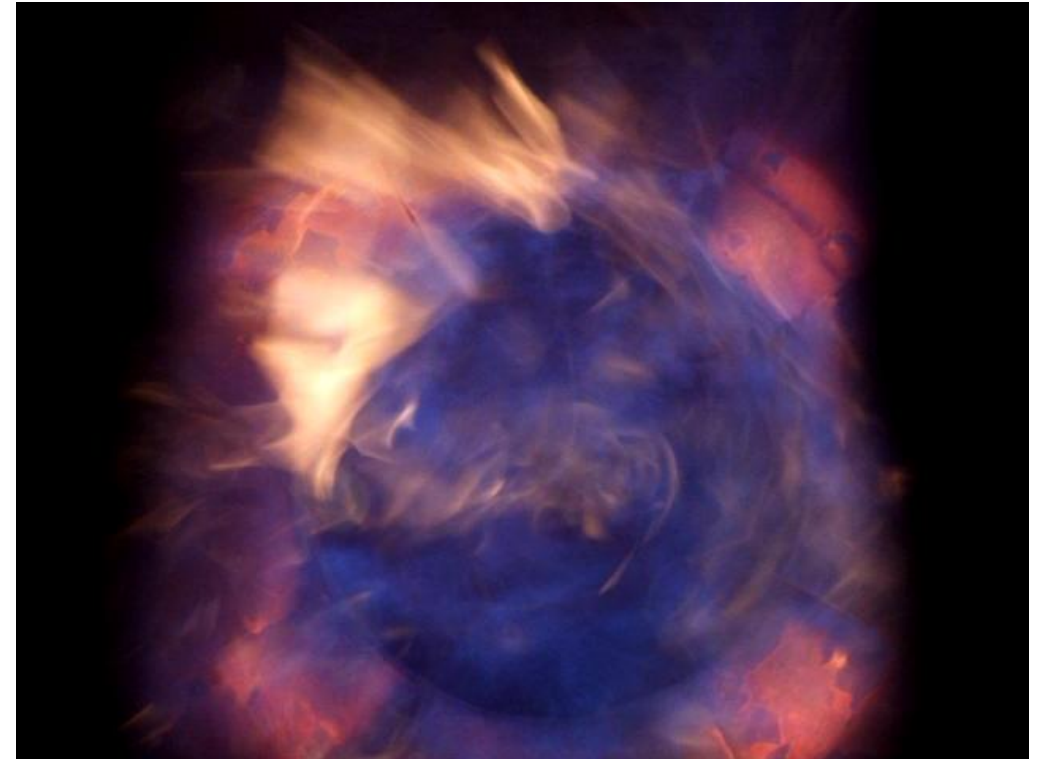
Another Deficient Combustion Flame

- › Burner throat has areas of red/orange, but does not completely cover the entire throat area
- › The results was from poor air flow distribution in the burner
- › Resulting in high levels of carbon monoxide



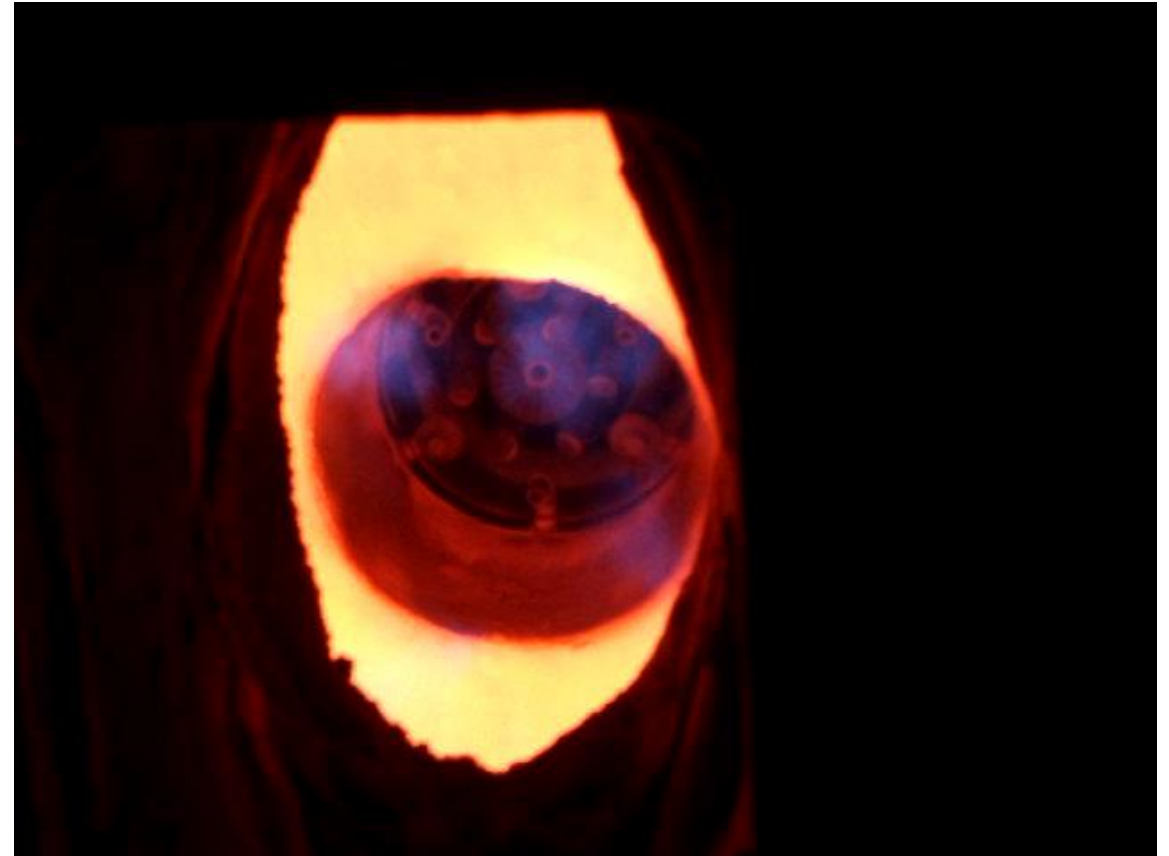
Another Example of Poor Air Flow Mixture

- › Same as the previous slide, the burner is displaying several negative features:
 - Flame front to far away from the burner throat area
 - Air flow mixture is not achieving proper mixture
 - High levels of carbon monoxide
 - High levels of excess air



Proper Combustion Flame Operation

- › Throat area totally has the red/orange color which is the result of the following:
 - Proper air and fuel mixing
 - Flame front is in the correct position
 - Resulting in the following:
 - › Low excess air levels
 - › No carbon monoxide in the combustion process



Proper Combustion Operation

- › Burner throat is red/orange (hot) which means flame front is in correct position
- › Proper swirl operation to achieve air/fuel mixing



Another View of the Combustion Flame

- › Front view

- More difficult to see the total operation



Proper Combustion Efficiency

- › Visual inspection is a key factor in overall boiler efficiency
- › Visual inspection is only one piece of the checking the combustion efficiency
- › Full testing should be performed at least every three months by a qualified person



Our Approach – We Are Part of Your Team

Short Term Impact

- Boiler Deep Dive Analysis
- Optimization engineering
- Reliability
- Steam balancing
- Training

Long Term Impact

- Upgrades
- Process changes
- Adding newer technologies

