POWER AND COMBUSTION APPLICATION GUIDE

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The Challenge

Kurz introduced its revolutionary power-plant focused product line in late 1993. Our highly refined and ruggedly engineered product was designed to satisfy customer requirements for utility stack mass flow measurement applications in Continuous Emissions Monitoring systems, or CEM's.

Stack mass flow measurement, as specified by the Clean Air Act of 1990, was a new frontier for most companies. Kurz Instruments, with over 20 years' experience in the industrial utility mass flow markets, possessed application experience in stacks and other similarly demanding measurement environments throughout the world.

Our experience in stacks expanded our horizons and we benefitted immensely. Kurz recognized that stack mass flow measurement is the most difficult and challenging of mass flow instrument applications. Temperature, corrosive gases, cyclonic flow and uneven velocity profiles combine to create a formidable measurement situation. We viewed this as a challenge, one we had to address.

This challenge demanded an engineering solution. The technology that evolved has rapidly become the standard for control measurements in power plants and power houses throughout the world.

The Solution

As the technological innovator in the thermal mass flow measurement market we have always led the way in product development and refinement. Our latest state-of-the-art design encompasses theory, common sense, user input, and fundamentally sound engineering to create a product that is unparalleled for difficult applications.

This product differs greatly from the Kurz product of years past. Kurz introduced the first thermal sensor for industrial applications in the 1970's. The original ceramic sensor was transformed into the first MetalClad™ sensor then evolved into the first "Dual-Sting" sensor of the late 1980's. Threaded and of 316L construction, the sensor performed well in moderately difficult environments. This product was not, however, the solution to the CEM challenge.

Through 1990, Kurz also used analog or EPROM based linearizers for its equipment. Permanently matched with the sensors, non-programmable at site and only factory calibratable, the earlier Kurz electronics did not possess the flexibility to satisfy the accelerated demands of the Power market.

The new Kurz product line, engineered first in 1993 and constantly improved since, features a significantly improved sensor, microprocessor based electronics and numerous hardware and software features that ensure maximum accuracy, dependability and on-line time.

The features include:

- Alloy C-276 sensor-standard

- All welded sensor and probe
- Equipment in service to 1100°F
- Rigorous burn-in process of both sensors and electronics
- Programmable Microprocessor based ADAM Flow Computer
- On-site calibration capability
- Calibration (VTM) for absolute accuracy over wide temperature bands of 500°C
- Exclusive Flow Perfect™ software for ease of in-situ calibration and sensor redundancy
- Unequaled dependability

Simply put, the Kurz product offered today is designed and manufactured for the most rugged applications. We are proud to offer a solution to your demanding process and monitoring requirements.

No other manufacturer has evolved their product to meet all the challenges presented by demanding combustion control applications. Kurz Instruments again leads the way by providing solutions to customers' application needs.

The Results

The Kurz Series 4500 Multi-Point Mass Flow Monitoring System is in use in hundred of stacks, ducts, and pipelines with phenomenal success.

In Stacks

Kurz Instruments has over 50 systems in operation for CAAA reporting. With over 80% of thermal systems in operation being Kurz', we are the recognized leader in the market that sparked the creation of our successful product design. Kurz' record is one we are proud of:

- 100% certification record
- 96% of system exceed annual RATA standards, 4% semi-annual
- 100% reliability in corrosive environments with Alloy C-276
- Only one installation required purging (due to residue from tire/coal fuel mixture)
- Superb annual RATA results. Typical systems 1-3% repeatable after one year of operation.

In Ducts

Kurz' products are in use in hundreds of primary, secondary and recirculated air ducts. Applications includes primary air into pulverizer mills, secondary air into cyclones, and total airflow into boilers. Customers cite:

- Improved control through superb accuracy and repeatability
- Lowered emissions
- Increased on-line time
- Improved safety
- Decreased maintenance

The Future

With the conclusion of Title IV implementation, most utilities are turning their attention toward emissions reduction projects. Kurz offers the ideal system to help you meet and exceed your most demanding requirements.

The Kurz system is unique. Tried and proven in the most difficult stack applications, Kurz stands alone. Tried and proven in primary air applications, Kurz stands alone. Tried and proven in secondary and recirculated air applications, Kurz stands alone--UNMATCHED.

Our sensor/flow computer package is suited for the hot, turbulent and dirty environment associated with boiler and pulverizer process flows. We offer you the best technology available to satisfy your demanding flow measurement needs.

No_x Reduction

The clean Air Act requires utilities to take steps to reduce NO_x emissions through the use of best available technology. "Low-NO_x" and "NO_x reduction" projects are ongoing and emerging in utilities nationwide.

The typical NO_x reduction project focuses on the use of Low NO_x burners for improved combustion efficiency at lowered temperatures, thereby decreasing the flomation of harmful Nitrous Oxides. Kurz proposes the use of vastly improved combustion air-flow measurement instrumentation as an alternative to, or as a supplement to Lo-NO_x burner upgrades.

To date, some plants have managed to meet their reduction requirements by using improved measurement and control systems without the use of expensive new burners.

Primary Air Flow Into Mills

This ideal Kurz application is gaining increasing interest in numerous steam plants, power plants and

generation facilities. Accurate flow measurement into pulverizers offers numerous advantages and cost savings.

Unburned Carbon Reduction

Lo-NO_x burners often increase the total unburned carbon content of fuel while lowering NO_x. Accurate primary airflow measurement is the most effective way of combating this. Accurate measurement ensures the transport of properly sized particles into the boiler, allowing complete combustion to occur. Skewed measurement and falsely high flow rates from clogged measurement devices can lead to the transport of large particles that never fully burn.

Efficiency Improvements

Proper fuel-to-air ratio control using accurate measurement of combined hot and tempering air into the pulverizer also impacts the burn. Improvement in measurement accuracy and repeatability improve boiler efficiency.

Ash Disposal

Reduction of unburned carbons ensures the grade of ash. More and more coal burning facilities find their ash carbon content on the rise due to the introduction of Lo-NO_x burners. This often results in difficulties in selling or disposing of combustion by-products.

Spillage and Reject Rate

Fuel wasted due to improper primary air measurement also adds to lost production dollars. Low air flows often result in incomplete transport of ground coal. This may result in fuel waste, re-processing of fuel and improper-air mixtures. These factors often lead to lower heat rates and decreased efficiency.

Energy and Equipment Cost Savings

Better control of primary air can also lead to savings in energy and equipment wear and tear. Unwarranted high air flow due to inaccurate measurement requires excess horsepower. Heightened velocities can result in accelerated wear of transport lines--particularly when working with highly abrasive coal grades.

Temperature Control

Better control of tempering and hot air inlets using separate measurement system has its advantages, too. Hot/Cold measurement allows accurate temperature mixing and control to account for fuel moisture content changes. Temperature control also provides numerous safety advantages.

Reduced Mill Fire Frequency

Mill fires and explosions are detrimental in numerous ways. They endanger lives, threaten capital equipment, and can potentially result in boiler shutdown. Mill fires are expensive. Production time is lost and equipment can be damaged. Total control of primary air inlet velocities and temperatures helps avert explosive hazards. Proper velocity control ensures ground coal does not deposit in the mill or in lines.

Increased Safety and Decreased Outages

Deposits create hazardous situations. Proper measurement of the hot/cold mix allows the use of more sophisticated control schemes that prevent the influx of overly hot air into the mill--another cause of mill combustion occurrences. Safety and decreased outages often warrant better control.

Low Sulphur Coal

Many plants have switched or are switching to Western Low Sulphur coal to reduce sulphur emissions and meet compliance requirements. The high charging rates for this lower BTU content coal requires careful air flow control. Moisture content can be as much as four times higher than Eastern coal. This, too, taxes flow measurement for drying control. Bowl mill fires become a higher threat.

Reduced Maintenance

A growing concern among power and steam producers is manpower intensive maintenance. This issue becomes more prevalent as workforce reductions continue in the face of increased productivity demands.
Kurz FD and FDT sensors are proven to be maintenance free from clogging and fouling in blown mill applications. Users often find existing non-Kurz equipment to be maintenance intensive, each duct requiring up to two hours a week maintenance.

Reduced Emissions

Finally, there is the benefit of reduced emissions. Accurate and repeatable measurements lead to improved fuel-to-air ratio control and emissions reduction.

THE TRADITIONAL APPROACH

Efficiency and Results Engineers have wrestled with differential pressure measurements systems on primary air ducts for over 50 years. The most common bowl mills have single-point Pitot tubes or multi-point “jamb” tubes located after the hot/tempering mix point. Existing measurement devices are often found in the run immediately prior to the entry to the mill, often either directly before or after the damper.

Operators are often frustrated with instrumentation drift resulting from particulate accumulation in the insertion devices. Clogging often becomes so severe that units routinely cleaned with compressed air must be removed and bored clean.

The instruments, even when maintained, often provide sketchy information. Undependable repeatability coupled with 15-30% accuracy and low turn-down ratios built little operator confidence. The units are often disconnected or simply ignored.

PRIMARY AIR MEASUREMENT--OUR APPROACH

Kurz offers you the flexibility to configure a system to meet your exacting needs. We work with you to determine the optimal number of sensors, mounting location and measurement approach.

We typically recommend one of the following approaches:

- Measure primary air flow after the mix for total primary air flow.
- Or, install elements separately on the tempering and hot air ducts for three outputs--namely, hot, tempering, and total.

Post Mix

- Typically a 4-9 point array depending on duct size, straight run and desired accuracy.
- ADAM provides an output representative of total flow into the pulverizer.
- May combine multiple ducts into a single ADAM with multiple outputs.

Pre-Mix

- Install a 4-6 point array in the hot air duct.
- Install 2-4 point array in tempering air line.
- ADAM provides output for any combination of HOT, COLD, and TOTAL.
- ADAM can support numerous bowl mills--up to 22 sensor inputs and eight outputs.

ADVANTAGES

- Repeatability and accuracy. Through in-situ calibration and Flow Perfect™ software, the system provides unmatched performance. 1-3% accuracy is routine for a Kurz 4500 system in large diameter stacks. Proper system design allows us to do as well or better.
- Adaptability to cyclonic conditions. The Kurz sensor is unaffected by turbulent and cyclonic flow to ±20° rotation. We require no straighteners or duct modifications.
- VTM calibration. Absolute accuracy over a 500°C range. This exclusive feature provides the user mass flow compensated readings over wide temperature bands that occur due to mixing of hot and tempering air before the mill.
- No clogging, fouling, or maintenance.
- Survivability. Rated to 500°C, Kurz sensors have survived mill fires with no damage to the

sensors.

- Calibration ease. Flow Perfect™ allows the user to perform an initial in-situ system calibration for optimal accuracy. We only recommend occasional electronic input-output calibrations for QA purposes.
- Parts interchangeability. All sensors are compatible with any ADAM field data entry.
- Programmability. Simple keypad programming to adjust outputs, set alarm parameters or modify system configurations.

LARGE DUCT MEASUREMENTS: TOTAL AIR, SECONDARY AIR, BY-PASS AIR AND RECIRCULATED AIR

Boiler performance demands accurate and repeatable measurement of all flows into the process. Numerous generating stations, when searching for areas to improve, look to upgrading their air measurement systems. Benefits realized often include NO_x reduction, increased boiler efficiency, increased boiler safety and reduced maintenance and operating costs.

LARGE DUCTS--THE TRADITIONAL APPROACH

Most boilers were constructed years ago using venturis or air foils as the primary measurement devices for total and secondary air. Piezo rings are also often found on FD fan inlets as a general indicator of flow into the system.

All these devices are severely limited in turndown, accuracy and repeatability. Since they are not direct mass flow measurement instruments, they require temperature and pressure compensation and port clogging, particularly in coal fired plants, leads to drift and unreliable output.

As processes change, venturis and foils are often more a hindrance than a help. Their limited turn down may make them useless in ranges of lower flow. Increased flow requirements often result in plants installing oversized fans to account for the significant pressure drop assumed by foils and venturis. Simply put, you can realize quicker payback by removing your existing venturis and air foils and replacing them with the accurate and dependable Kurz 4500 system.

COST OF EXISTING EQUIPMENT

To compute energy costs associated with existing pressure drop devices, use the following equation:

Annual Cost = (KWH cost in $) * (.000181) * (Flow Rate in CFM)*
(Pressure Drop in “W.C.”) * (Hours on-line/year)

For example: a 600 MW plant has eight total air ducts leading to their pre-heater. Original air foils remain in the ducts. Due to increased load, flow across the foils is 4" W.C. Duct size is 10' x 10' each.

Sample Calculation:

KWH cost to plant is $0.016
Flow is 3000,000 SCFM
Pressure Drop is 4" W.C.
Operating time is 8200 hr/yr

(.016) (.000181) (300,000) (4.0) (8200) = $27,552.00/yr

And, this does not include wear and tear on fans and costs associated with larger fans.

YOU CAN SAVE TENS OF THOUSANDS OF DOLLARS PER YEAR, PER DUCT, BY REPLACING EXISTING VENTURIES AND AIR DAMS

APPLICATIONS

Total Air Flow

Kurz 4500 systems replace existing venturis, air foils, dams and piezo rings.

Primary Air Flow

As described earlier, Kurz systems are ideally suited for pulverizer and mill inlet flow measurement.

Secondary Air Flow

Kurz 4500 systems perform exceedingly well in temperatures of up to 500°C. Superb repeatability and accuracy allow better control and hence improve performance. Kurz has numerous systems in operation on secondary ducts into cyclone boilers. Advantages offered by Flow Perfect™, VTM, our rugged sensor and ADAM provide unmatched performance.

By-Pass Duct Air Flow

Kurz sensors can be specially modified to provide excellent accuracy of bi-directional flow. Bypass measurement is often required when an FD fan is taken off line and flow is redirected through the bypass from the remaining fan. Kurz' ability to perform in short straight run conditions is often a key advantage.

Re-Circulated Flow

An ideal Kurz measurement since the application includes hot, dirty and turbulent gases--an application others may refuse to touch.

Kurz Instruments, Inc. stands ready to assist you in your pursuit of improved efficiency and operating cost reductions. Kurz products provide unparalled

performance in tough applications.

SMARTER

TOUGHER

FASTER