Data Sheet
D-NO-SMA_2

Analytical Instruments
Smart Analyzer 90
Type SMA

- Oxygen Only or Optional Oxygen and Combustibles
- Rugged Industrial Design
- Easy Installation and Start-up
- Highly Accurate Sensors
- Simplified In-house Maintenance
- Diagnostics and Alarming
- Patented Close Coupled Sample System
- Process Temperature Measurement
- Standard Combustion Efficiency Calculation
- Automatic Sensor Calibration-Standard
- Calibration Verification
- Distinctive Operator Interface
- Optional Filter Blowback
- High Temperature Operating Range
- Optional Dual Filtration System
- Probe & Cable Length Options
- Inherent Flashback Protection

Type SMA
Smart Analyzer 90

SMA Smart Analyzer 90

The Type SMA Smart Analyzer 90 is a combustion analyzer. It continuously samples and analyzes industrial flue gases. The Type SMA1 Smart Analyzer 90 monitors oxygen O_2 only. The Type SMA2 Smart Analyzer 90 monitors both O_2 and carbon monoxide equivalent (CO_e).

Product Overview

The Type SMA Smart Analyzer 90 is a microprocessor based industrial grade combustion analyzer that continuously samples and analyzes industrial flue gases. The analyzer is designed for use on gas, oil or coal fired combustion processes. Typical applications include those found in the utility and petrochemical industries. The Type SMA1 analyzer monitors the oxygen (O_2) using a single sensor. The Type SMA2 analyzer monitors both the O_2 and the unburned combustibles in terms of carbon monoxide equivalent (CO_e) using two sensors.

The O_2 reading indicates the percent by volume measurement of the net oxygen. Typically, the O_2 reading is the primary indicator for combustion control. The CO_e measurement is often used to optimize combustion control by further trimming the oxygen adjustment.

The analyzer consists of a sensor assembly, probe with filter assembly, microprocessor based electronics assembly and interconnecting cable assembly (see Figure 1). Standard features include automatic and remote initiation of the sensor calibration, inlet /outlet temperature measurements for calculating combustion efficiency, inherent flashback protection, alarms with form C relay contacts outputs and isolated analog outputs.

See Figure 2 and Figure 3 for the outline and clearance requirements of the sensor assembly. See Figure 4 for the outline and clearance requirements of the electronics assembly. See Figure 5 for the analyzer installation overview. Refer to Table 1 for the product specifications. Refer to Table 2 for the product nomenclature.

Theory of Operation

The sensor assembly flange mounts to a duct or process wall so that the probe with filter assembly extends into the flue gas stream. The probe with filter assembly continuously draws in the sample which is then analyzed by the sensor assembly. Electrical outputs from the sensors are fed through the interconnecting flexible cable to the electronics assembly for interpretation.

Sensor Assembly

The Type SMA Smart Analyzer 90 is based on 50 years of proven reliability and expertise in analytical equipment development. These sensors provide a fast, accurate and continuous percent by volume measurement analysis that is not affected by particulates or by temperature fluctuations. The NEMA 4 sensor assembly mounts to a duct or process wall so that the probe with filter assembly protrudes into the flue gas stream. An air powered aspirator creates a suction pressure to draw the process gas through the patented floppy filter. The floppy filter's self-oscillating motion filters the process gas sample and removes particulate buildup from the filter.

The Type SMA analyzer uses a hot gas sample system that measures the flue gas samples on a wet basis by keeping all metal parts at a temperature above dew point. This prevents acidic vapors from condensing on sampling surfaces. Once in the sensor assembly, the incoming gas sample is split between into two separate heated passageways. One passageway diverts the sample to the highly reliable zirconium oxide sensor where the process gases are analyzed for net oxygen content. This patented O_2 sensor contains a built in heater to regulate its own temperature. The other passageway diverts the sample to the catalytic combustibles CO_e sensor where the process gases are analyzed for combustible content. As the sample passes through a preheated mixing chamber, dilution air is added at a fixed rate to ensure a repeatable and reliable combustibles measurement. The diluted sample then flows into the CO_e sensor which consists of two RTD rods. One rod acts as a reference and the other is coated with a catalyst that oxidizes or burns the combustibles on the rod surface. The temperature rise of the catalyzed RTDs (relative to the reference RTD) is a function of the CO_e concentration.

After the process gas is analyzed by the sensors, it is combined with the aspirating air and is sent back into the duct through the aspirator exhaust filter. Electrical outputs from the sensors are fed through the interconnecting flexible cable to the electronics assembly for interpretation.

Electronic Assembly

The NEMA 4 electronics assembly provides the microprocessor based architecture and overall intelligence necessary to monitor sensor calibrations, field input/output (I/O) signals and the operator interface. The electronics assembly controls the flange manifold and CO_e block temperature. The low level analog signals received from the O_2 and CO_e sensors are amplified and converted into four to 20 milliamp or one to five VDC outputs.

The field I/O signals consist of both analog and digital formats. Four analog outputs are available for process O_2 process CO_e inlet/outlet temperature and combustion efficiency. Six digital form C alarm contacts are available for process O_2 process CO_e process temperature, combustion efficiency, analyzer fault and calibration in progress. The electronics accepts two thermocouple inputs for combustion inlet air temperature and flue gas outlet temperature. Four digital inputs are available for remote calibration, remote blowback, remote zero gas and remote span gas.

The operator interface consists of a highly visible vacuum fluorescent display with two lines of 40 characters each. Setup options such as output ranges, alarm limits, calibration data and efficiency information are adjusted using the keypad. Modification of system parameters is security code protected with a three character user definable password.

Automatic Sensor Calibration (Standard)

The Type SMA analyzer contains an automatic sensor calibration feature which uses test gases of known concentrations to calibrate both sensors and ensure continual accuracy. Solenoids required to route calibration gases to the sensor assembly are incorporated into the electronics assembly.

Zirconium oxide O_2 sensors analyze flue gas samples by measuring the partial pressure of the oxygen in the sample with respect to the partial pressure of the oxygen in an air reference. If the duct or process pressure changes, the partial pressure of oxygen also changes. The sensor changes are automatically compensated for during each sensor calibration.

The automatic sensor calibration can be selected to occur as frequently as desired and at any time of the day using an internal timer. The automatic sensor calibration can also be initiated manually using the operator interface or remotely through contact inputs.

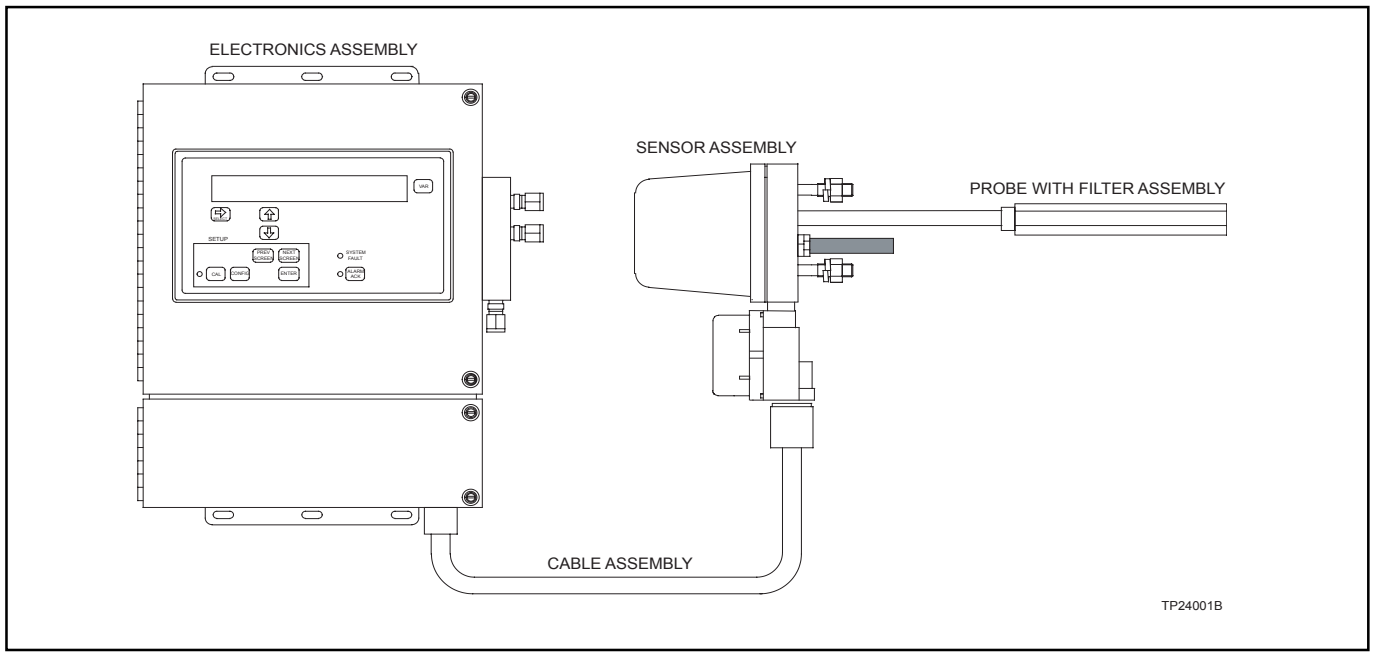

Figure 1 - Smart Analyzer Assembly with Standard Probe

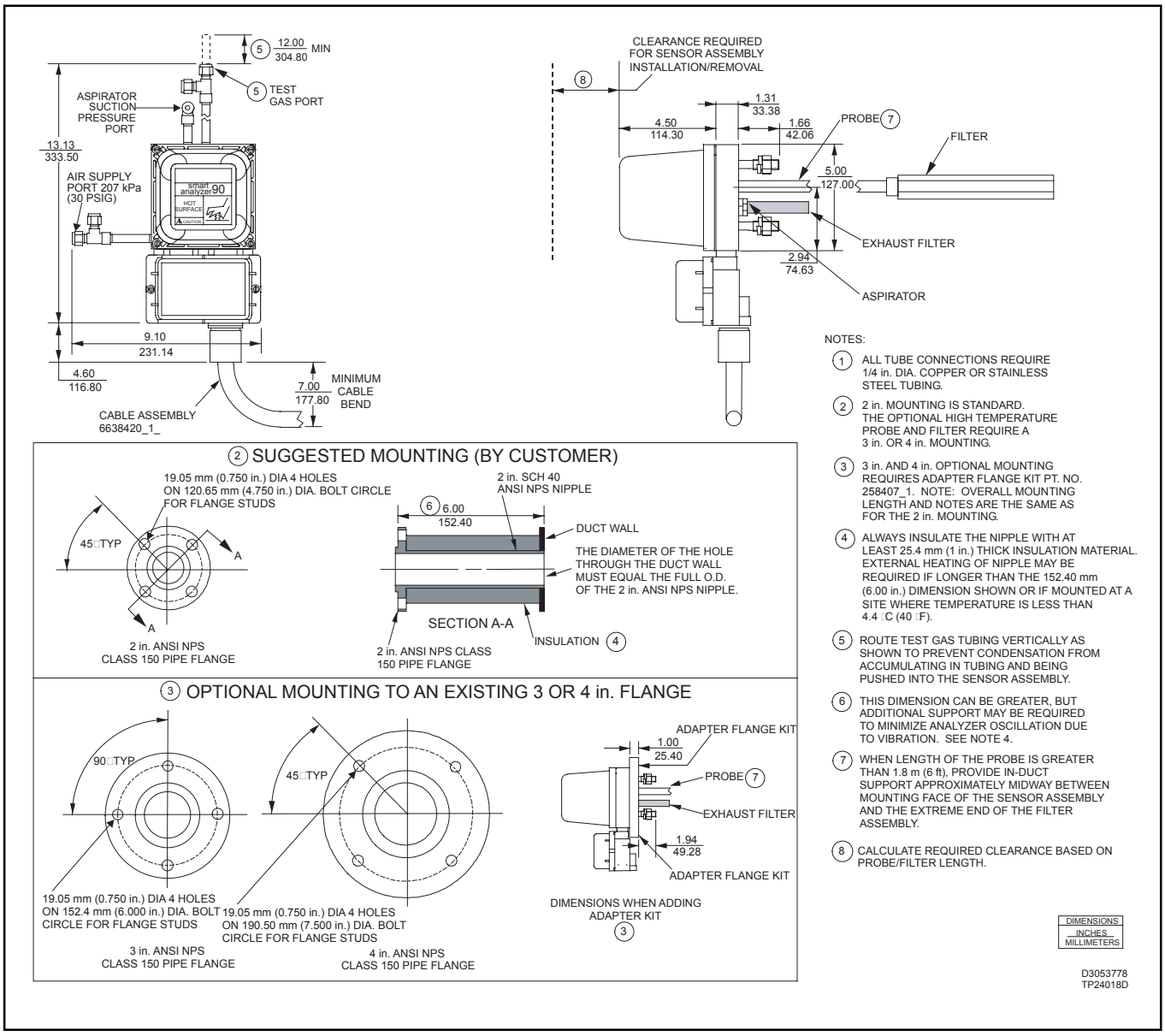

Figure 2 - Outline and Clearance Requirements (Sensor Assembly)

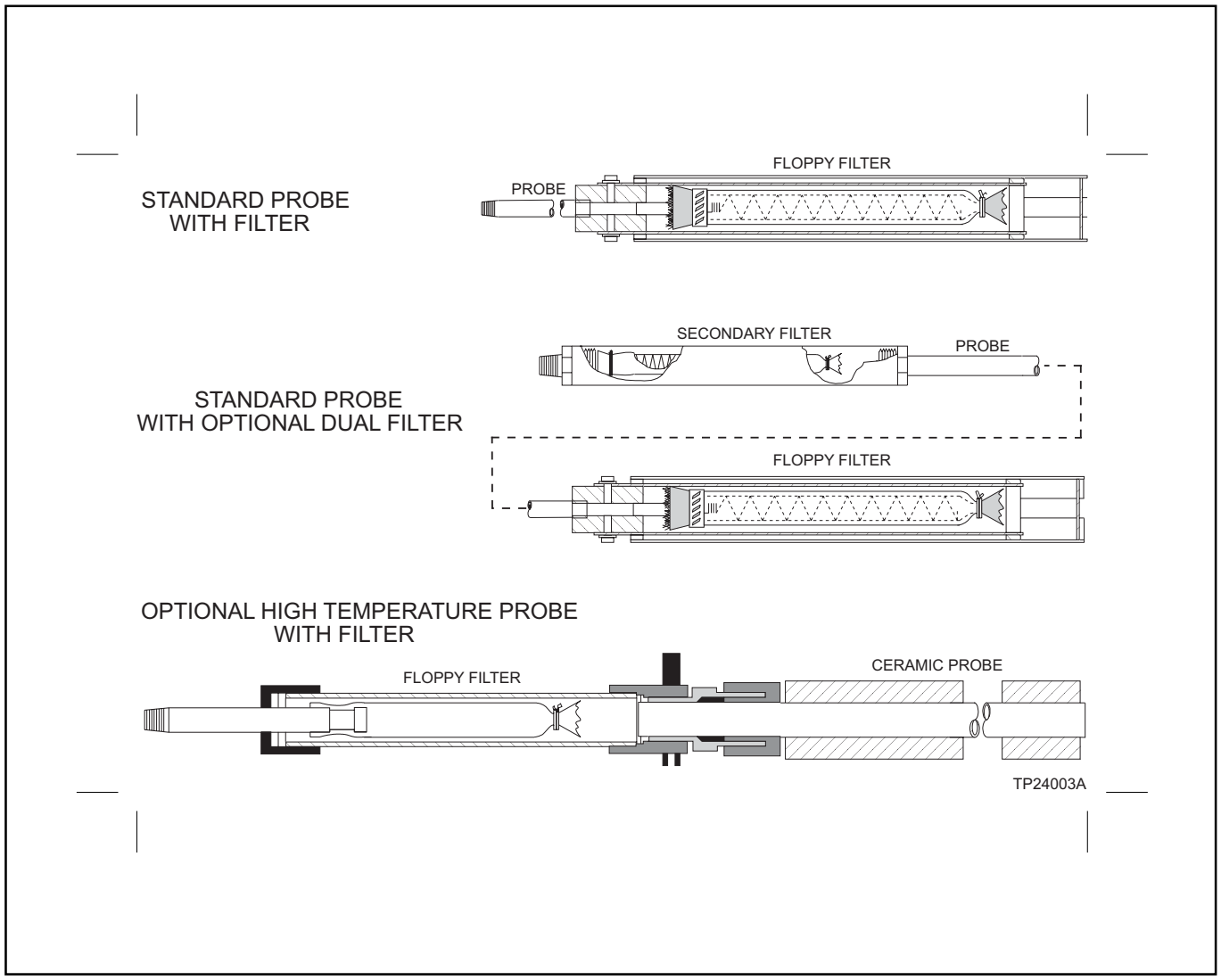

Figure 3 - Standard and High Temperature Probe

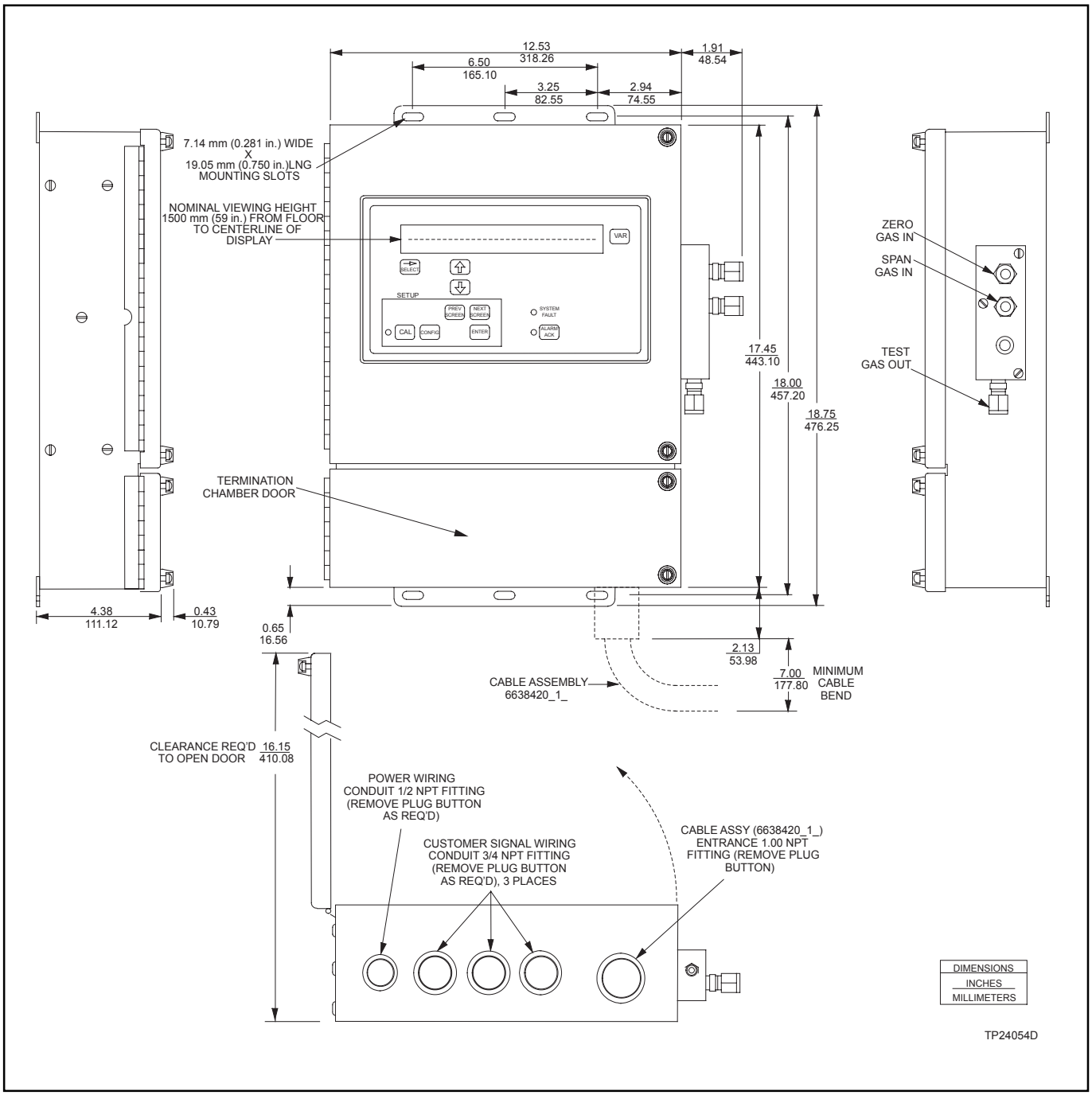

Figure 4 - Outline and Clearance Requirements (Electronics Assembly)

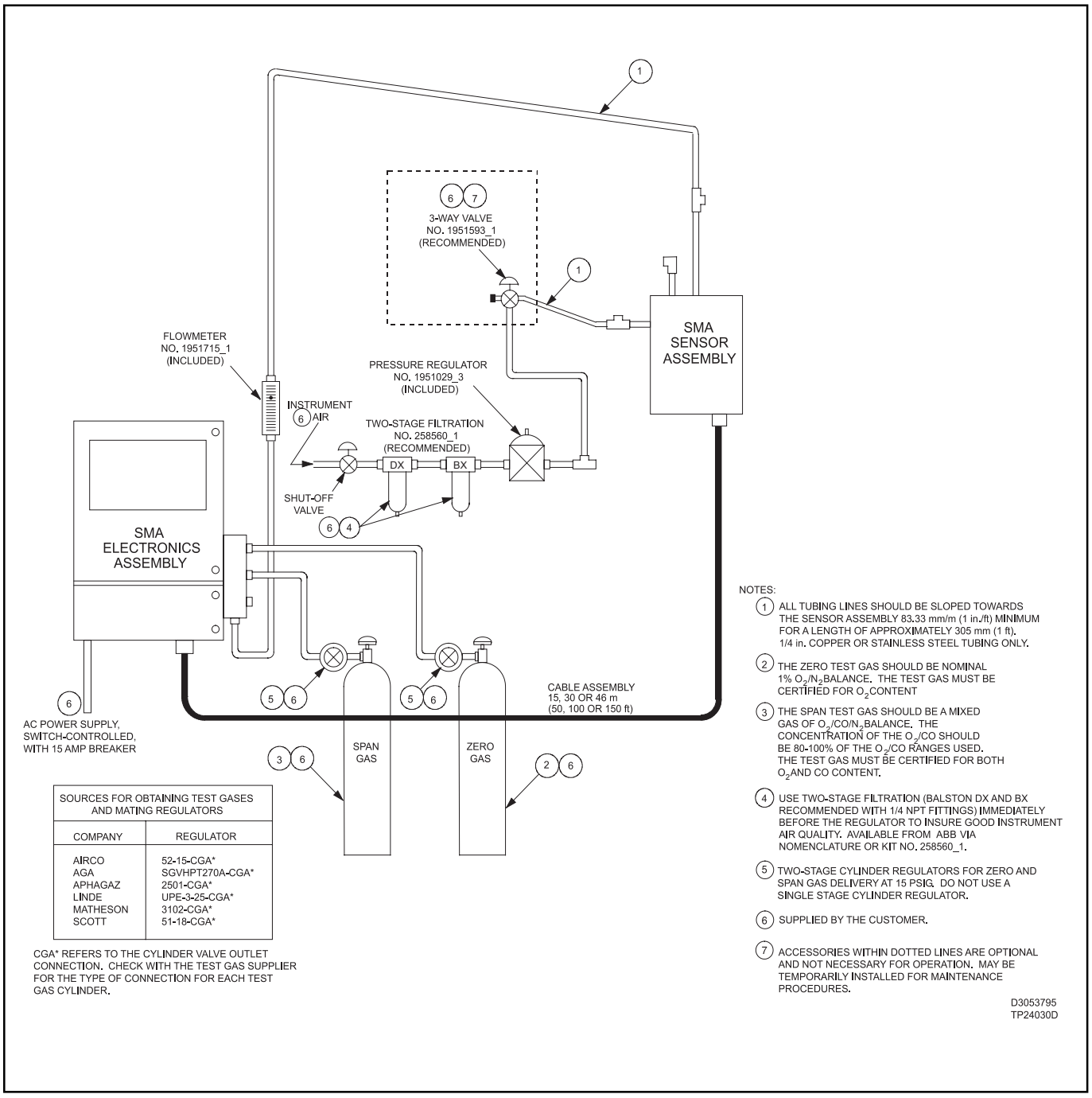

Figure 5 - Analyzer Installation Overview

ENGINEERING SPECIFICATIONS

Variable Analog Output Ranges

O_2 span	Minimum 0 to 5% Maximum 0 to 25%
CO_e span	Minimum 0 to 200 ppm (0.00 to 0.02%) Maximum 0 to 20000 ppm (0.00 to 2.00%)
Temperature Zero	-46º to 1371ºC (-50º to 2500ºF)
Temperature span	Minimum 260ºC (500ºF) Maximum 1649ºC (3000ºF)

Display Screen Accuracy

O_2	± 2.5% or reading (0.1 to 25.0%)
CO_e	± 20 ppm (from 200 to 1000 ppm) ± 2% of span (from 1000 to 20000 ppm)
Temperature (Thermocouple type: E, J, K or T)	± 3.3ºC (±6.0ºF)
(Thermocouple type: R or S)	± 5.5ºC (±10ºF) (from 538º to 1649ºC [1000º to 3000ºF]) ± 11.1ºC (± 20ºF) (from -46º to 538ºC [-50º to 1000ºF])

Analog Output Accuracy

O_2	± 2.5% of measured value (1 to 5 VDC or 4 to 20 mA)
CO_e	± 20 ppm _____ x 100% of span (from 200 to 1000 ppm) ± 2% of span (from 1000 to 20000 ppm)
Temperature (Thermocouple type: E,J,K or T)	± 1.5% of span
(Thermocouple type: R or S)	± 1.5% of span (from 538º to 1649ºC [1000º to 3000ºF]) ± 4.5% of span (from 260º to 538ºC [500º to 1000ºF])

Measurement Errors Due to Flue Gas Variables

CO_2	None
Water Vapor	None
Particulate	None

Sensor Response Time to 63% of Span

O_2	<3.5 secs
CO_e	<13 secs

Power Supply Requirements

Supply voltage	105 to 128 VAC, 47 to 63 Hz or 211 to 257 VAC, 47 to 63 Hz
Power (during startup)	730 W
Power (operating)	310 W

Air Supply Pressure 107 kPa (± 0.5 psig) at 0.55 scfm

Input Signals

Four digital 120/240 VAC, 50/60 Hz or 24 VDC
- DI1: Remote Calibration
- DI2: Remote blowback
- DI3: Remote zero gas
- DI4: Remote span gas

Two thermocouple Types E,J,K,T,S or R (isolated)
- Inlet temperature
- Outlet temperature

Output Signals

Four Analog[1]	1 to 5 VDC or 4 to 20 mA
AO1: Process O_2	(isolated[2] or non-isolated)
AO2: Process CO_e	
AO3: Inlet/outlet temperature	
AO4: Combustion efficiency	
Six isolated digital[3]	Form C relay contacts rated
DO1: Process O_2	for 2 A at 120/240 VAC,
DO2: Process CO_e	50/60 Hz or 24 VDC
DO3: Process temperature alarm	
DO4: Combustion efficiency alarm	
DO5: Analyzer fault alarm	
DO6: Calibration in progress	

Maximum Analog Output Loading

Voltage Mode	Not <250 kW and not > 600 mH
Current Mode	Not > 600 W and not > 600 mH

Self Monitoring (Default Output)

Digital outputs	Alarm state: NC to COM is open and NO to COM is closed
Analog Outputs	Switch selectable to low or high output Low: 0 VDC to 0 mA High: 6.2 VDC or 25 mA

Probe with Filter Assembly Length

Standard probe with filter	1.55 m (5.08 ft) or 2.46 m (8.08 ft)
Standard probe with optional dual filter	1.75 m (5.75 ft) or 2.67 m (8.75 ft)
High temperature probe with filter	1.57 m (5.13 ft)

Cable

Standard length	15 m (50 ft)
Optional lengths	30 m (100 ft) or 46 m (150 ft)
Minimum bend radius	17.8 cm (7 in.)
Maximum diameter (outside diameter)	1.9 cm (0.75 in.)

Environmental

Sensor assembly	NEMA 4 (indoor/outdoor)
Electronics assembly	NEMA 4 (indoor)

Maximum Probe w/Filter Assembly Temperature

Standard probe with filter	649ºC (1200ºF)
Standard probe with optional dual filter	816ºC (1500ºF)
High temperature probe with filter	1649ºC (3000ºF)

Ambient Temperature Limits

Sensor housing	-18º to 93ºC (0º to 199ºF)
Electronics housing	0º to 60ºC (32º to 140ºF)
Cable	-18º to 93ºC (0º to 199ºF)

Humidity

Sensor assembly	95% RH @ 93ºC (199ºF) non-condensing
Electronics assembly	95% RH @ 60ºC (140ºF)

Weight (Approximate)

Cable assembly	
Standard 15 m (50 ft)	8.6 kg (19 lbs)
Optional 30 m (100 ft)	16.8 kg (37 lbs)
Optional 46 m (150 ft)	24.5 kg (54 lbs)
Sensor assembly	6.4 kg (14 lbs)
Electronics assembly	12.7 kg (28 lbs)

Approvals/Certifications

Factory Mutual	Approved against flashback into duct.
Factory Mutual	Approved for use in Class I, Division 2, groups A,B,C and D and for use in Class II, Division 2, groups F and G.
Canadian Standard Association	Certified for use in ordinary nonhazardous locations.
CE Mark Complaint	EMC Directives 89/336/EEC & 73/23/EEC EMC Standards EN50081-2, EN50082-2 & EN61010-1

Notes:

1. *AO2 (CO_e) defaults to 4 mA or 1.0 VDC when a Type SMA1 analyzer is installed. AO3 (inlet/outlet temperature) and AO4 (combustion efficiency) default to 4mA or 1.0 VDC when these options are not selected.*

2. *Analog outputs can be selected for isolation in pairs. AO1 and AO2 define a pair. AO3 and AO4 define another pair.*

3. *DO2 (process CO_e alarm) defaults to normal state when a Type SMA1 analyzer is installed. DO3 (process temperature alarm) and DO4 combustion efficiency alarm) default to normal state when the efficiency option is not selected.*

SMA Nomenclature

Position	1	2	3	4	5	6	7	8
SMA Smart Analyzer 90	S	M	A					

Measurement

- O_2 only 1
- O_2 and Combustibles (CO_e) 2

Cable Length

- Standard 15 m (50 ft) 1
- Optional 30 m (100 ft) 2
- Optional 46 m (150 ft) 3

Probe with filter

Type	Temp ºC (ºF)	Length m (ft) Probe	Length m (ft) Probe with Filter[1]	
Standard Probe with Filter	649 (1200)	1.22 (4.00)	1.55 (5.08)	1
		2.13 (7.00)	2.46 (8.08)	2
Standard Probe with Optional Dual Filter	816 (1500)	1.22 (4.00)	1.75 (5.75)	3
		2.13 (7.00)	2.67 (8.75)	4
High Temperature Probe with Filter	1649 (3000)	N/A	1.57 (5.13)	5

Blowback

- None 0
- 120 VAC Solenoid 1
- 240 VAC Solenoid 2

Instrument Air Filters

- None 0
- Two Stage Filter 1

NOTE: 1. Length is from end to end with the filter assembled on the probe.

Notes

D-NO-SMA_2

ABB Inc.
125 East County Line Road
Warminster
PA 18974
USA
Tel: +1 215 674 6000
Fax: +1 215 674 7183

ABB Inc.
9716 S. Virginia St. Suite E
Reno,
NV 89511
USA
Tel: +1 775 850 4800
Fax: +1 775 850 4808

ABB Ltd
Oldends Lane, Stonehouse
Gloucestershire,
GL10 3TA
UK
Tel: +44 (0)1453 826661
Fax: +44 (0)1453 829671