INTERPLANT STANDARD - STEEL INDUSTRY		
IPSS	**SPECIFICATION OF SENSOR MEASUREMENTS OF LENGTH OF ROLLED MATERIALS**	**IPSS: 2-07-037-13** ***(First Revision)***
	Corresponding Indian Standard does not exist	Formerly-: **IPSS: 2-07-037-89**

0. FOREWORD

0.1 This Interplant Standard was prepared by the Standards Committee on Computerization & Automation, IPSS 2:7, with the active participation of the representatives of all the steel plants, other concerned organizations and established manufacturers in the field. Originally, the standard was published in 1989. Based on recent developments and technological upgradation, it has been revised and adopted in February, 2013.

0.2 Interplant standards for steel industry primarily aim at achieving rationalization and unification of parts and assemblies used in steel plant equipment and accessories and provides guidance in indenting stores for existing or new installation by individual steel plants. For exercising effective control on inventories, it is advisable to select a fewer number of types from among those mentioned in this standard for the purpose of company standards of individual steel plants. It is not desirable to make deviations in technical requirements.

1. SCOPE

1.1 This Interplant standard applied to the sensors for measurements of length of rolled products and these regular high degree of precision, accuracy and resolution and robust housing to give long term reliable service in normal steel plant atmosphere.

1.2 Measurements of length of rolled product become necessary to determine whether the product remain within marketable tolerances. These data are also required to be fed to control system in the upstream for regulation purposes.

2. MEASUREMENT PRINCIPLE

2.1 ***Length*** – Length of the product is gauged by measuring the speed of material (rod, billet, etc) and computing the time taken to pass a fixed point. The speed of the bloom, billet and rods can be measured by photo-sensors. The speed of flat product will be measured by laser anemometer. For laser anemometer, length is measured by speed integration. For photo-sensor, length computation should be done by a single/board/Micro-processor.

2.2 ***Accuracy*** - Desired accuracy of the sensor will depend upon the application. However, minimum accuracy corresponding to different types will be as given below:

a) Photo sensor based	-	better than 0.5 percent, and
b) Laser anemometer based	-	better than 0.25 percent

Resolution: 0.1 percent of the measured value

2.2.1 Auto calibration system shall be provided in the sensor system itself with simulator to maintain the accuracy and reliability.

2.3 ***Environmental Temperature and Humidity*** – The sensor will function satisfactorily in the maximum temperature of 70ºC and maximum humidity of 100 percent.

2.4 ***Casing*** – The sensor will be encapsulated in hermetically sealed casing.

2.5 ***Stability*** – The sensor output should not be changed by more than 0.1 percent by 10 percent change of power supply or 50ºC Ambient temperature.

2.6 ***Output*** – Output should be 4.20 mA with maximum permissible load of 750 ohm. The measuring system should generate a linear output. The number of isolated outputs necessary shall be minimum three.

2.7 ***Material of the Housing*** – Material of the housing will conform to the use in humid corrosive and dusty atmosphere.

3. STANDARD FEATURES OF PHOTO-SENSOR UNIT - Photo sensor unit will be of 2 types:

a) for detecting hot object, and
b) for detecting cold object

For type (a), photo-sensor will be activated by radiation from the stock body itself. For type (b), photo sensor will be activated by a separate infra-red emitter. In both the types, the photo-sensor will comprise mainly of 2 units, for example, (a) unit installed in the field near the object, (b) electronics unit which should be normally installed separately in a safer location, but also in the field and connected to the head unit of cable, particularly in locations where temperature is likely to shoot up above 70^{o}C.

i) Input – Infra-red radiation, between 0.5 µm and 2.0 µm.
ii) Output – (1) Relay, (2) TTL, and (3) Visual

iii) Relay – Reed relay, single contact, normally open, potential free – both sides terminated at plug.
Contact rating – 15 V dc, 15 VA ac
iv) TTL – 0.5 V, 10 mA
v) Visual – LED mounted on the external surface.
vi) Response – 0.3 m sec for TTL output
2 m sec for relay changeover
vii) Remote test facility – By means of internally mounted infra-red emitting diode (IRED) which can be switched on from external source
viii) Environment – The head of instrument will be mounted in the field and will withstand dust (5 g/m3), vibration (up to f = 5 Hz a = 1 mm) and temperature (0ºC to 70ºC). The system will be unaffected by electrical noise normally prevalent in steel plant.
ix) Power supply available – 220 V $\pm$ 10 %, 50 Hz $\pm$ 2% / 12-30V dc (see IPSS:1-02-020-86)
x) Overall Maximum dimension of the head unit:

Length - 500 mm
Breath – 150 mm, and
Width – 100 mm

xi) Field of view – 1) Minimum 15 deg vertical to the path of the object, and
2) Minimum 8 deg along the path of the object

There should be provision of cutting down the field of view by a mark to a smaller angle if a more defined detection area is required.

3.1 **Installation of photo sensor vis-à-vis the stock is as follows**:

Hot Stock

	Minimum Mounting Distance (m)		Maximum Mounting Distance (m)	
	400°C	1200 °C	400 °C	1200 °C
Rods	-	-	2	4
Billet	-	1.5	3	5
Blooms	-	2	4	6

Cold Stock
Infra-red source should be red type, vertically installed on a rigid frame

Length of source	100 mm approximately
Diameter of the source	15 mm
Maximum distance from the stock	500 mm

Head distance as given below:

Stock	Maximum mounting distance (m)
Rods	2
Billets	3
Blooms	4
Slabs	3

3.2 **Adjusting the Threshold** – The threshold setting should enable the device to reject levels of infra-red lower than the levels associated with the stock to be detected. By varying the threshold, the sensitivity of the device can be changed. Where background radiation, roll reflections or scale lying on the roller table are liable to give trouble, the threshold can be increased. On the other hand, if the product is surrounded by steam, the threshold can be decreased. Easy changing of threshold should be provided.

3.3 **Mounting of the Head Unit** – A rigid robust mounting stand with guard against the cobbles (as applicable in rolling mill areas) and also against vibration and other environmental conditions provided. The height of the stand shall be adjustable. However, the overall design of the mounting stand shall be as per the conditions.

3.4 **Polarizing Filter** – There should be provision of polarizing filter when the large hot stocks are close and high accuracy of detection is necessary. This cuts out approximately 60 percent of the incident infra-red radiation.

3.5 **Projective Hood** – There should be provision of protective hood to prevent striking by scale or cobbles. The lens inside the hood should be kept clean by blowing instrument air through flexible connecting hose attached to the protective hood. The rate of flow should be approximately 20 litres/min.

3.6 **Water Cooling** – If the temperature of the head unit goes beyond rated operating temperature, it needs to be protected by water cooling. There shall be provision of water cooling jacket with re-circulation facility.

The water pressure shall be 1.5 kg/cm2.

4. STANDARD FEATURES OF LASER SPEED AND LENGTH GAUGE – Following features should be incorporated in the device:

a) Contact less measurement
b) Speed measurement without slip from 0.5 to 50 m/sec.
c) Length measurement by speed integration
d) Measuring error less than $\pm$ 0.1 percent
e) One gauge required over the entire range of measurement
f) Reliable measurement of both cold and hot material

g) High measuring stability regardless of surface condition of the material
h) Resolution: 0.1 percent of the measured value, and
i) Convenience of installation in the plant condition

4.1 Standard specifications for laser head are as follows:

a) Laser type : He/Ne
b) Laser output: 5 mw continuous
c) Wave-length: In the vicinity of red e.g. 0.63 µm
d) Receiver: Solid state, avalanche diode
e) Incident beam diameter : 5-10 mm
f) Incident beam disvergence: 0.125-3 milli-radiation
g) Efficiency percent of laser output: more than 1 percent
h) Exciter:
    i) Continuous discharge lamp
    ii) 100 watt
    iii) Life more than 10000 hours of continuous use
    iv) Air cooled, and
    v) Electrode gap is about 100 mm

4.2 **Optical Cavity Mirrors** – Parallel mirrors for optical cavity should not be used. Spherical mirrors should be used for stability, acceptable beam divergence as well as efficiency.

4.3 **Optical Cavity** – Precise adjustment of optical alignment is to be made at factory. Permanent fixing of the alignment is to be done by appropriate fixtures. No external reflector should be used and laser head should be a compact, sealed, single unit.

4.4 **Output Window** – Partially transmitting lenses with evaporated metal coatings on borosilicate glass should constitute output window. All the lenses and mirrors shall also be made of borosilicate glass. Refractive index:1.49 -1.55

Laser tube – Cylindrical metal tube with highly polished surfaces
Length - 20 cm approximate
Diameter - 2.5 cm approximate

4.5 **Reflective Loss** – To minimize reflection loss, a few microns coating of magnesium fluoride on the surface of the lens should be given.

4.6 **Discharge Electrodes** – Uniform excitation should be achieved with discharge transverse to the cycle axis of laser. Parceled plate electrodes running lengthwise should be provided.

4.7 **Electrode Material** – Zirconium or any other suitable material.

4.8 **Stability of Output Wavelength** – 1 part in 10^8.
