INTER PLANT STANDARD – STEEL INDUSTRY		
IPSS	**SPECIFICATION FOR VIBRATION MEASURING SYSTEM FOR LOW SPEED MACHINES** *(Second Revision)*	**IPSS:2-07-027-11**
	Corresponding IS does not exist	Formerly: IPSS:2-07-027-97 (First Revision)

0. FOREWORD

0.1 This Interplant Standard (Second Revision) has been prepared by the Standards Committee on Computerization & Automation, IPSS 2:7, and was adopted in March 2011.

0.2 Inter Plant Standards on design parameters primarily aim at achieving rationalization and unification of parts and assemblies of process and auxiliary equipment used in steel plants and these are intended to provide guidance to the steel plant engineers, consultants and manufacturers in their design activities.This standard was first published in 1988. The Second revision has been carried out to update the standard after reviewing from implementation point of view.

1. SCOPE

1.1 This Inter Plant Standard considers only the line vibration sensors and its associated electronics for non critical low speed rotating machines. The following elements form the total vibration measurement system:

a) Vibration sensor
b) Connecting cable
c) Conditioning electronics & monitor

2. VIBRATION SENSOR

2.1 For measuring and monitoring the vibration, mainly three types of sensors are used. These are:

2.1.1 *Proximity Based Transducer* – It measures vibration in terms of displacement and it is non contact type. It works on eddy current principle. The proximitor is main electronic which converts signal from probe to electrical signal, which is further processed by monitor circuit.

2.1.2 *Velocity Transducer* – Based mainly on:

i) Piezo electric
ii) Seismic principle

a) *Piezo velocity transducer* – It consist of a Piezo electric crystal at its core with an on-board hybrid circuit.

b) *Seismic velocity transducer* – It works on the inertial mass – moving case principle. The transducer contains a magnet which is fixed to the transducer case and surrounded by the inertial mass coil mounted on the case on springs. The magnet vibrates in harmony with the machine case and induces a voltage in the coil which is proportional to machine housing velocity.

It is suitable for measuring frequency range upto 1.5 KHz and speed of rotation upto 60,000 rpm.

2.1.3 *Acceleration Vibration Transducer* – It uses a piezo electric crystal situated between accelerometer base and an inertial reference mass. When it is mounted on machine casing, vibration causes a compression or tension force to act on crystal and crystal acts as precision spring to oppose the same. The crystal thus generates a displaced electric charge. An integral amplifier converts the charge to a voltage output.

It can be used from frequency range below 1 Hz to 20 KHz. It is best recommended for absolute case vibration.

For absolute shaft vibration, the dual proble, proximity probe along with seismoprobe is recommended.

2.2 Technical Specification for Vibration Transducer

2.2.1 Proximity Probe & Proximitor

Mechanical Data

a)	Probe Dia	:	5 mm, 8 mm or as specified
b)	Mounting	:	Optional
c)	Material	:	Titanium base stainless steel case or cast aluminium case
d)	Accuracy	:	$\pm$ 0.02% or better
e)	Type of protection	:	IP 55 or as per application

f)	Sensor construction	:	Thread type – M 10x1 or as per application
g)	Environmental condition		
	Operating temperature	:	0 – 200°C
	Storage temperature	:	-30° to 200°C
	Humidity	:	95% RH or better
	Temperature influence	:	± 0.02% of FSED/°C
j)	Shock resistance	:	a) Housing: 2000 g axial, 500 g radial b) Core: 5000 g max.

Electrical Data

a)	Power supply	:	12 to 36 V dc, ± 5% max
b)	Output	:	100 mV/mills Minimum
c)	Frequency range	:	0 – 10 KHz ± 5%
d)	Sensitivity	:	4 mV/micro meter or better
e)	Admissible load	:	≥ 2 KOhm for voltage output ≥ 750 Ohm for current output
f)	Lead wire length	:	300 mtrs from proximitor to monitor with no degradation of signal
g)	Junction box	:	IP 65 enclosure with necessary connectors

2.2.2 Velocity Vibration Transducer

Mechanical Data

a)	Mounting	(i) Orientation	:	Optional
		(ii) Base	:	¼ - 28 UNC stud or to be specified
b)	Material		:	Titanium base stainless steel case or cast aluminium case
c)	Accuracy		:	± 0.02% or better
d)	Type of protection		:	IP 55 or as per application

e) Environmental condition

Operating temperature	:	0 – 200°C
Storage temperature	:	-30° to 200°C
Humidity	:	95% RH or better

f) Shock resistance : 50 g peak

Electrical Data

a) Power supply : 12 to 36 V dc, ± 5% max

b) Output : 100 mV/mills Minimum

c) Frequency range : 5 Hz – 5 KHz ± 5% for piezo electric
0 – 1 KHz for seismic

d) Sensitivity : 4 mV/mm/sec at 100 Hz
20 mV/mm/sec at 100 Hz

e) Lead wire length : 300 mtrs from probe to monitor with no degradation of signal

f) Junction box : IP 65 enclosure with necessary connectors

2.2.3 *Acceleration Vibration Transducer*

Mechanical Data

a) Mounting (i) Orientation : Optional
(ii) Base : ¼ - 28 UNC stud or to be specified

b) Material : Titanium base stainless steel case or cast aluminium case

c) Accuracy : ± 0.02% or better

d) Type of protection : IP 55 or better as per application

e) Environmental condition

Operating temperature	:	0 – 200°C
Storage temperature	:	-30° to 200°C
Humidity	:	95% RH or better

f) Shock resistance : ±5000 g peak

Electrical Data

a) Power supply : 12 to 36 V dc, ± 5% max

b) Output : 100 mV/mills Minimum

c) Frequency range : 10 Hz – 20 KHz ± 5%

d) Sensitivity : 25 mV/g ± 5% at 100 Hz

e) Lead wire length : 300 mtrs from probe to monitor with no degradation of signal

f) Mounted resonant Freq : 20 KHz nominal

g) Impedence : < 50 Ohms case isolated

h) Dynamic output impedence : 1500 Ohms

3. CONNECTING CABLE

3.1 Required for connecting the vibration sensors with electronics and monitors.

3.2 Extension Cable for Proximitor Probe

a) Length : 10 mtrs or more as per applicable

b) Connector : Standard matching with probe connector

c) Armour : Stainless steel (optional)

d) Type : Co-axial / as per manufacturer's recommendation

e) Insulation : PTTE

3.3 Cable for other Transducers

Mechanical Data

a) No. of conductors : As per sensor output 2/4/8 core, each core colour coded

b) Type of conductor : Copper wire tinned
Stranded: 19 x 0.16 mm
Dia: 0.79 mm (22 SWG)

c) Insulation type : Cross linked co-polymer (such as Radox 125). Non-inflammable, halogen free, electromagnetic interference resistive

d) Screen type : Copper wire braid tinned wire dia: 0.07 mm
Insulation: Plastic tape

e) Permissible bending radius for stationary configuration :

Cable dia	Radius
4.5 mm	$\geq$ 10 mm
6.0 mm	$\geq$ 20 mm
8.0 mm	$\geq$ 40 mm

(Approximately 5 times the cable dia for $\geq$ 8.0 mm)

f) Operational temperature : -55 ^{o}C to 200 ^{o}C

g) Max temperature for 5 to 6 hrs : 250 ^{o}C

h) Self extinguishing property : According to IEC 332

j) Length : As per application

k) Socket : Moisture resistant

Electrical Data

a) Resistance per conductor at 20 ^{o}C : 60 Ohms / km or less

b) Voltage rating : 300 / 500 volt dc

c) Test voltage : 3500 volt dc

d) Core to core capacitance : < 200 pf / M

4. CONDITIONING ELECTRONICS & MONITOR

4.1

- For Discrete System - Local Electronics
- For Multiple Measurement, It consists of mainly (i) Rack (ii) System Monitor and (iii) Vibration Monitor.

a)	Type	:	19" rack suitable to accommodate upto 15 nos. module, plug in units		
b)	Height	:	Max 4U		
c)	Width	:	1/8 rack width – 50 mm or 2/8 rack width – 100 mm		
d)	Construction	:	Extruded aluminium frame and heavy duty aluminium structural parts Top & Bottom epoxy modules guide strips		
e)	Connections for external wiring	:	Screw terminals 20,22 or 56 pole connector optionally		
f)	Accuracy class rapture	:	0.5%		
g)	Environmental condition	:	Temperature operating Temperature range Humidity	: : :	0-55 ^{o}C -10 to 85 ^{o}C 95% NC
h)	Power supply	:	240 V ac $\pm$ 15% 47 to 53 Hz, single phase		
j)	Protection against power supply failure (optional)	:	By reservoir capacitors with adequate capacity to withstand voltage interruption upto 250 ms.		
k)	Protection against sparks / bursts in power supply	:	Provision of spark busters		
m)	Standard accesso-ries	:	i) Power supply units for modules ii) Frequency generator unit for calibration iii) Output indicator		
n)	Weight	:	3 kg max (without module)		
p)	Computer interface	:	Provision for RS-232 / RS-485 or other		

interface (optional)

q) Protection : IP 65

4.2 **System Monitor** – This module is to check other modules in rack as well as whole rack system with reference to:

a) Power OK
b) Tripping system OK
c) Alarm system OK

4.2.1 Specification

a)	Input impedence	:	10 KOhm
b)	Output impedence	:	100 Ohm
c)	Indicator	:	LED indication for a) Supply OK b) Tripping system OK c) Alarm system OK d) Data Interface OK
d)	Controls	:	Switches / multi-turn potentiometers to adjust up / down set point for alarm and trip
e)	Terminal connection	:	In rear side for rack inhibit, trip multiply and alarm reset contact
f)	Environmental limit	:	Same as 4.1
g)	Size	:	One rack position
h)	Protection	:	IP 65

4.3 Monitor with Relays

a)	Input	:	Output of the sensors as preferred
b)	Measuring range (frequency)	:	1 Hz to 20 KHz

c)	Input power supply	:	Rack power supply
d)	Output power supply	:	12 to 36 V dc
e)	Output impedance	:	100 Ohm
f)	Sensitivity	:	100 mV/mill
g)	Range	:	As specified
h)	Display	:	Digital display / bargraph display
i)	Output for recorder	:	4-20 mA or as specified dc at 750 Ohms
j)	Adjustable limit	:	0-100%
k)	Accuracy	:	$\pm$ 0.5% of FSD at 25^{o}C
l)	Alarm set point	:	For alert, danger, gap alert
m)	Alarm contacts	:	Potential free contacts, 1A, 240 V ac rating
n)	Alarm indication	:	i) In front panel with LED display for each alarm contacts ii) For power supply OK
o)	Alarm contact rating	:	230 V ac, 1.0 Amp
p)	Size	:	One rack position
q)	Protection	:	IP 65
4.4	Local Electronics (for discrete system)	:	i) Input power supply 230 V ac, 50 Hz ii) Mounting type – Panel / Wall iii) Enclosure – IP 54 iv) Display – Digital process value, v) Output – Contact outputs for Alarm and Trip vi) Output rating – 230 V ac, 3A
