INTER PLANT STANDARD IN STEEL INDUSTRY		
IPSS	**CODE OF PRACTICE FOR INSPECTION OF INDUSTRIAL BUILDING STEEL STRUCTURES**	**IPSS:3-02-015-18**
	Corresponding IS does not exist	Formally : IPSS:3-02-015-07

0. FOREWORD

0.1 Interplant standardization in steel industry was initiated under the aegis of the Indian Standards Institution (ISI) and the Steel Authority of India Limited (SAIL). This IPSS was prepared by the standard committee on Operation and Maintenance, IPSS 3:2 and firstly published in 2007. Lastly, this has been revised by the standard committee in July 2018 with the active participation of the representatives from major Indian steel plants and leading consultants.

0.2 This Inter Plant Standard primarily aims at achieving rationalisation and standardization of inspection procedure for building steel structures. For effective control on the inspection of structures, it is advisable to follow strictly the procedure mentioned in the standard and not to make deviations as per convenience.

0.3 This standard has been prepared to fulfil the needs of inspection of building steel structures which have been in service for many years in hostile atmosphere of steel plant.

1. SCOPE

1.1 This Inter plant standard covers visual inspection of structure condition, measurement of section thickness in critical cases and measurement of deviation/Level by survey and vibration Level of structure members in select cases.

1.2 It also gives the procedure for visual inspection of important structural members, for preparation of records of condition of health of structures and for their maintenance/repair planning.

1.3 In this standard, inspection procedures cover mainly Group-B steel structure (Ref. IS 12843:1989).

Group- A : Rail & Road Bridges – Not covered in this standard.

Group-B : Steel structure having special characteristics and subjected to dynamic loading like Under crane girder, Supporting columns.

Group-C : Steel structure not subjected to dynamic loading, stairs, etc.

1.4 The procedure in this standard shall help in categorizing of structural defects in three categories namely :

ALERT – general defect which may deteriorate in near future

ALARM – major defects which may result in serious consequences and

EMERGENCY – defects to be attended without any loss of time.

1.5 This standard does not cover tests on new structure under construction / yet to be commissioned since they are governed by respective clauses of design / statutory code / indent specifications.

2. GENERAL

2.1 Structural damage identification starts with the identification and marking of highly stressed part of structural member. In this marked area, defect identification activity shall be concentrated.

2.2 Structural cracks observed shall be classified as linear and non-linear. Defect is linear when the structure remains linear elastic i.e. without any change in geometry even after the damage. Non-linear damage is because of formation of fatigue crack and changes in geometry of the member which is more serious damage.

2.3 Damage identification method are classified in three Levels :

Level – 1 : Determination of Level and geometrical location without much cleaning of the structure.

Level – 2 : Quantification of severity of damage and categorization of defect as per the severity.

Level – 3 : Prediction of service life of the structure.

2.4 Procedure for inspection of important building steel structure like Columns, Galleries, Under crane girders & Roof trusses are detailed in the following four parts, viz Part-A, B, C & D.

2.4.1 Part-A COLUMN

It is recommended that visual inspection of Level 1 for all column members of entire plant shall be done once in a year. For columns where serious defects or more number of defects observed inspection of Level – 2 shall be carried out.

The Inspection of Level-1 shall cover visual inspection of the following :

a) Condition of external surface of structures

b) Condition of supports

c) Status of painting and identification marks of the columns

d) Painting condition, particularly up to 1 metre from the ground.

e) Approachability and maintainability of critical structures

f) Problem, if any because of steam and air lines, electrical lines, etc.

g) Leakage observation. Leakages from water or steam lines are major cause of damage of columns

h) Condition of RCC Footings and protection provided from objects hitting it. Condition of protective lining / encasement of hot metal area.

The Inspection of Level – 2 shall cover the following :

a) Quantification of critical defects observed during Level-1 inspection

b) Categorization of defects depending on the severity.

Inspection Check List Condition of column and its connections for defect categorization :

[Ref: IS 7215-1995 “Tolerance of fabrication of steel structures – group B (structures subjected to dynamic loading)]

REFERENCE CLAUSE		PHYSICAL CHECK	LIMIT	DEFECT CATEGORY
A 1	Deviation in straightness	In lateral and longitudinal direction 1 mm/m length of column.	Above 10 mm Above 20 mm	Alarm Emergency
A 2	Level at base	Vibration from datum	Above 5 mm/Sec	Alarm
A 3	Packing plates	Multiple packing plates	Max. 2 numbers	Alert
A 4	Bracing	Check for deformation at nodal points	Above 3 mm	Alarm
A 5	Gable & wind girder	Check End connection, clearance, overhung sheeting, clearance between wind girder and crane platform	If any defect observed	Alert
A 6	Louver	Check connection with column, rain water splashing inside building	If any defect observed	Alert
A 7	Level of column on Opposite rows	Level below truss	More than 9 mm	Alarm
A 8	Stair case	Check condition	If any defect	Alert

REFERENCE CLAUSE		PHYSICAL CHECK	LIMIT	DEFECT CATEGORY
	brackets		observed	
A 9	Crack in web	Check location and size	If existing	Alarm
A 10	Crack in flange	Check location and size	If observed	Alarm
A 11	Damage / missing footings	Check damage	-do-	Alert
A 12	Corrosion near base	Check thickness	Reduction above 3 mm	Alarm
A-13	Distortion	Check for column length 1 mm/m	Above 10 mm	Alarm
A-14	Out of verticality of column	For column up to 30 m For column above 30m	Above 20 mm Above 25 mm	Alarm Alarm

2.4.2 **Part-B CONVEYOR GALLERIES** :

Conveyor galleries are important structures working under adverse conditions. Galleries many times are covered under debris, muck, etc and subjected to water leakage causing heavy corrosion.

The Inspection of Level-1 shall cover visual inspection of the following :

a) The top roller support of gallery

b) Gallery bottom support

c) Super structure of gallery

d) Bottom angle and cross beam support

e) Dust accumulation on roof

f) Sheet conditions

g) Painting condition particularly under side of galleries

h) Vibration of galleries

i) Readiness of fire fighting system.

Check List for Level-2 Inspection:

REFERENCE CLAUSE		PHYSICAL CHECK	LIMIT	DEFECT CATEGORY
B-1	Inclined bracing over support	Check for corrosion, disconnection or deformation	If observed	Emergency
B-2	Portal connection	Check for disconnection	If observed	Emergency
B-3	Top chord and Bottom chord	Check for deformation	Above 10 mm	Alarm
B-4	Diagonal side panel	Check for deformation	Above 10 mm	Alarm
B-5	Vertical of side panel	Check for deformation	Above 10 mm	Alarm
B-6	Bottom beam and top tie	Check for corrosion and connection	If observed	Alarm
B-7	Top support roller	Check for freeness	If found jammed	Alert
B-8	Vibration	Check vibration	Above 7 mm/sec	Emergency
B-9	Gallery column	Check corrosion and bent	If observed	Alarm
B-10	Floor	Check for corrosion	If observed	Alarm

2.4.3 **PART-C UNDER CRANE GIRDER** :

Failure of Under Crane Girders are most common. Shearing of rivets/failure of the welded joints & cracks are observed in girders wherever heavy duty cranes operate over them. As production crane are working over these girders, defect identification and its rectification is of utmost importance.

The Level-1 Visual Inspection shall cover :

a) Crack in web, top & bottom flanges

b) Connection of girder with columns

c) Connection of girder with adjacent girder

d) Sheared or loose rivets/crack/welded joint failure.

e) Walk-way platform connection

f) Dust accumulation on walkway / platform

Inspection Check List for Level-2 Inspection :

REFERENCE CLAUSE		PHYSICAL CHECK	LIMIT	DEFECT CATEGORY
C-1	Girder connection	Check missing or loose bolts	If found	Alert
C-2	Rivets	Check for looseness	Up to 5 %	Alarm
C-3	Walk-way platform	Check for disconnection	If observed	Alert
C-4	Distortion	In girder sweep L/1000	10 mm max.	Alert
C-5	Level difference between correspon-ding ends	Check level across the web	6 mm at column & 12 mm between columns	Alert
C-6	Girder Welded joint	Check for crack	If observed	Alarm
C-7	Girder conditions	Check flanges and webs	If any defect observed	Alarm
C-8	Span	Between girder centre	10 mm for new and 80 mm for old	Alert
C-9	Misalign-ment	Upto 4 m span Over 4 m span	6 mm 8 mm	Alert
C-10	Curvature	Upto 12 m girder	Above 3mm	Alert
C-11	Camber	In vertical plane	Above 2 mm	Alert
C-12	Deviation	In straightness of girder 0.001L in mm	Above 10 mm	Alarm
C-13	Buckling of web	For girder upto 1000 mm For girder above 1000 mm	Above 1 mm Above 2 mm	Alarm Alarm

2.4.4 **PART-D ROOF TRUSSES** :

Roof trusses are important structural member as CGI/MS sheeting is fixed over the truss purlins. Also in many places Telpher beam is supported by the roof trusses. Any rain water leakage over the trusses cause corrosion in trusses. It is also very difficult to inspect trusses due to inaccessibility at such places.

The Level-1 Visual inspection shall cover :

a) Deformed, disconnected structure member including bracings

b) Missing connecting bolts and welded joints

c) Dust or muck accumulation on the truss.

Inspection Check List for Level-2 Inspection :

REFERENCE CLAUSE		PHYSICAL CHECK	LIMIT	DEFECT CATEGORY
D-1	Deformation	Check for sagging or disconnection	If observed	Alarm
D-2	Connection	Check for bolts/cracks in welded joints	If observed	Alarm
D-3	Distortion	L/1000 mm	Above 10 mm	Alarm
D-4	Level at truss ends	For end of same truss up to 10 meter For over 10 meter	Above 5 mm Above 8 mm	Alert Alert
D-5	Purlin location	Lateral shift in location	Above 6 mm	Alert
D-6	Camber at bottom chord	Deviation from designed camber	$\pm$ 3 mm	Alarm
D-7	Bracings	Deviation of axes of member at joint	$\pm$ 3 mm	Alert
D-8	Plumb	From apex or max depth to bottom chord 1/250 of depth	20 mm max	Alarm
D-9	Displacement	Lateral shift L/1500 of span of top chord of truss from super centre	10 mm max	Alarm