


INTER PLANT STANDARD IN STEEL INDUSTRY		
 IPSS	CODE OF PRACTICE FOR REVAMPING OF EOT CRANES	IPSS:3-02-014-18
	Corresponding IS does not exist	Formally : IPSS:3-02-014-03

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 2003. 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 Inter Plant Standardization for steel industry primarily aims at achieving rationalisation and standardization of procedure. For effective control it is advisable to follow strictly the procedure mentioned in the standard and not to make any deviations as per convenience.
- 0.3 This standard is intended to provide the criteria for selection of crane for revamping and standard revamping procedure.

1. SCOPE

- 1.1 This Inter Plant Standard deals with general purpose double box type bridge girder EOT cranes and is divided into two parts.
 Part – A : Covers procedure for selection of crane for revamping and
 Part – B : Covers the standard practice for crane revamping.
- 1.2 The application of this standard requires
- (i) Visual inspection of crane structure condition.
 - (ii) Measurement of camber & bowing of bridge girders.
 - (iii) Measurement of plate thickness of critical structural members.
 - (iv) Measurement of vibration level of cabin, bridge girder.
 - (v) Study of records of inspection of important structural member and repair done earlier.
 - (vi) Span as well as the level of the LT rails of the crane should be checked periodically.
 - (vii) Checking of LT wheel alignment.
- 1.3 Based on above study, the condition of crane structures are categorised in the following categories.

- Category – 3 General defects in structure.
 e.g. cracks in weld, failure of weld joints.
 ----- Recommendation - In situ repair.
- Category – 2 Major structural defects in the crane structures.
 e.g. cracks & distortion of structures of End girder, trolley,
 failure of bridge girder, End girder joints and LT wheel bracket
 failure.
 ----- Recommendation - Revamping of crane.
- Category – 1 Serious defects in crane structures.
 e.g. cracks perpendicular to line of stress in Bridge girders
 which are fatigue cracks and serious sources of danger.
 Buckling of compression member of girder (top flange) due to
 over stress resulting in short wave kink in the flange.
 ----- Recommendation - Revamping along with replacement of
 the bridge girder.

1.4 This standard does not cover new cranes under construction / yet to be commissioned since they are governed by respective clauses of design / statutory code / indent specification.

2. **REVAMPING**

- a) Revamping implies process of giving new lease of life to the crane which cannot be revitalized by normal periodic repair.
- b) Normal periodic repair / capital repair are done in-situ whereas during revamping the crane is taken out of circuit normally by lowering and the job is done in Engineering Shop / suitable place and original geometry of the equipment is restored back within norms.
- c) Revamping of crane is done when repeated structural repair does not improve condition of crane structures.
- d) While structural revamping of crane is being carried out, all mechanical and electrical defects shall also be attended to.
- e) Modification like conversion of angle trolley line to Festoon cable system for ATL (Auxiliary Trolley Line). Extension of girder platform to facilitate layout of panels, etc for ease maintenance shall be taken up during revamping.
- f) Modifications are also carried out to enhance the performance and maintainability of the crane.
- g) Revamping cost advantage :

$$\text{Cost advantage} = (\text{CN} / \text{LN} - \text{CR} / \text{LR}) \times \text{LR}$$

Where CR = Cost of revamped equipment in Rs.

 LR = Life of revamped equipment in years.(Generally 70% of LN)

CN = cost of new equipment in Rs.

LN = life of new equipment in years.

PART – A

CRITERIA FOR SELECTION OF CRANE FOR REVAMPING :

Following criteria are applied for selection of crane for revamping :

a) Frequency of failure and downtime of crane :

Crane shall be taken for revamping :

- When the availability of particular crane comes down to 50 to 60% of availability of the similar type of crane;
- Repeated repairs do not improve the availability of the crane
- Frequent LT /CT wheel changing is happening due to structural deformation.

b) Designed life of crane structures : As per IS 4137-1985, given below :

	Running time in a year	Total designed life of crane
Class-I	1000 hours	30 years
Class-II	2000 to 3000 hours	30 years
Class-III	Over 3000 hours	20 years
Class-IV	Over 4000 hours	20 years

When a crane has worked for its designed life in its class, it shall be taken up for revamping.

c) Deflection of Bridge girder

When the deflection of Bridge girder exceeds $1/900$ of span by applying safe working load with trolley in the centre without taking impact factor into consideration, crane shall be taken up for revamping.

d) Camber in Bridge girder

For new Bridge girder, camber is kept at 1 mm / metre of span, and negative camber shall not be allowed. If any crane has developed negative camber, crane shall be put down for revamping. However, based on practical experience for negative camber up to 12 mm in bridge span of more than 20 mtr, the packing plate can be provided below the trolley / CT rails.

e) Bowing of girder

Bowing of girder shall be limited to span/2000 mm as per IPSS:2-02-002-01 (first revision). If bowing is between 20-40 mm for any Bridge girder, the crane shall be put down for revamping and girders shall be interchanged by providing platform at the other face of the girder. For bowing more than 40 mm, girder shall be replaced.

f) Cracks in Bridge Girder structures

If Bridge Girder is developing cracks, crane shall be lowered and girder shall be changed.

g) Failure of Bridge an End girder connections

h) Condition of trolley structure

When the condition of the trolley structure does not improve even after having regular maintenance/repair, trolley shall be replaced.

i) Condition of equipment foundations.

j) Modifications in Mechanical & Electrical systems for improvement in the performance and maintainability of the crane.

k) Electrical failure in panels or cable faults caused by long usage of the crane.

l) Introduction of new features like AFE drives with squirrel cage induction motors etc. (whichever feasible with existing set up) for enhancing the performance.

PART – B

STANDARD REVAMPING PRACTICES FOR DOUBLE BOX TYPE BRIDGE GIRDER EOT CRANE

Standard steps of revamping procedure are as follows :

A) PREPARATION OF DETAILED DEFECT LIST

Detailed defect list is to be prepared under following heads Structural, Mechanical, Electrical :

I) **STRUCTURAL** : Repair, replacement, modification of the following :

- a) Bridge girder
- b) End girder
- c) Trolley
- d) Operator's cabin
- e) Side platform
- f) Electrical structures like bus bar, etc

II) **MECHANICAL** : Repair, overhauling, replacement of the following :

- a) Hoist reducer
- b) Hoist drum
- c) Bridge reducer
- d) Trolley reducer
- e) Bridge wheels
- f) Trolley wheels

- g) Trolley rails
 - h) Alignment of equipment
 - i) Brake assembly
 - j) Pulleys & buffer etc.
- III) ELECTRICAL : Repair, revisioning, replacement, modification of electrical equipment / accessories of the following :
- a) Motors
 - b) Panels
 - c) Resistance boxes
 - d) Cables
 - e) Limit switches
 - f) Lights
 - g) Bus bar/trailing cable
 - h) Controllers
 - i) Anti collision device.

B) PREPARATION OF DRAWINGS

Drawings shall be done as per requirement of defect list. For any modification or any improvement, detailed designing shall be done and drawing shall be prepared. Important improvement during revamping are changing of Bridge and End girder side connection to overriding design, change in platform size to accommodate Festoon cable system, change in operator's cabin for operator comfort / better visibility, L-type foundation for bridge drive.

C) DISMANTLING OF CRANES

- a) After shut down, all major parts - motor, trolley, operator cabin, etc shall be dismantled.
- b) By cutting End girder at suitable place, girder shall be lowered with the help of mobile/rail crane.
- c) Bridge girder shall be shifted to suitable place for revamping jobs.

D) ACTIVITIES DURING CRANE REVAMPING

- a) Damaged ends portion of Bridge girder shall be cut by gas cutting
- b) New fabricated bridge portion shall be aligned with old bridge girder
- c) Wheel shall be aligned in new fabricated End girder
- d) End girder shall be placed over elevated bridge rail kept over 600 I-beam
- e) End girder shall be leveled, aligned and kept at designed span of the crane
- f) Bridge girder shall be placed over the End girders
- g) Crane control assembly shall be surveyed and made as per IPSS:2-02-002-18

Deviations in important parameters are :

Wheel base ± 6 mm

Wheel span ± 6 mm upto 40 metre

Wheel diagonal ± 5 bridge (± 3 mm trolley)

Wheel vertical deviation ± 1 mm in 1000 wheel dia.

Wheel skew deviation ± 1 mm in 1000 wheel dia.

Trolley rail level difference ± 4 mm for 2.5 metre trolley gauge.

- h) Erection of trolley rails and its alignment
- i) Welding of bridge piece shall be done by low hydrogen MS electrode, after providing back-up strip in the joint. Weld joint in a girder shall be kept staggered. Tested Welders shall be engaged. Weld quality shall be tested by DP test and ultrasonically.
- j) Old platforms shall be rectified or new platforms shall be erected. Bridge reducers shall be erected and aligned.
- k) Panels, pipes, conduits and trailing cable structure parts shall be erected over platform.
- l) Trolley : All equipment shall be overhauled and erected after repair of equipment foundations.
- m) Operator's cabin : All controllers shall be erected and conduiting/cabling shall be done.

E) ERECTION OF CRANE

- a) Erection of End girder on LT rails and arresting them suitably.
- b) Erection of first bridge over End girder.
- c) Move one bridge and two End girders assembly away to make space for erection of second bridge girder.
- d) Lift second girders, bring earlier assembly below the lifted girder and lower second girder.
- e) Check dimensions by survey, connect End girder and Bridge girder joint firmly.
- f) Erect trolley and operator's cabin
- g) Fixing of hoist rope and pulley blocks
- h) Piping, conduiting, cabling and other electrical jobs.

F) LOAD TESTING & COMMISSIONING OF CRANE (Ref. IPSS:2-02-008-18)

- a) Check control and power circuit, set all limit switches.
- b) Record no-load and load current of all mechanisms.
- c) Check bridge girder deflection at the middle at rated load.
- d) Check for permanent set of Bridge girder at 125% of rated load.

- e) Record hoisting and lowering speed of hook, bridge travel and trolley travel speed at a rated load.
- f) Check all limit switches.

G) PAINTING AND HANDING OVER OF CRANE

Crane shall be painted as per IPSS:1-07-064-03. All reports of survey of control assembly, load test and ultrasonic weld test are compiled and handed over to the user department at the time of handing over of the Crane.