

APPENDIX A1 STRUCTURAL INSPECTION FOR QUAY CRANE QTY 4 UNITS

INSPECTION REPORT

The report shall indicate the detected defects with photographs and sketches is necessary after the inspection. The pictures have to point to the locations and extent and severity of the defects. For example,

- Location - right hand side / left hand side, crane leg number, waterside, landside, north, east, south, west, etc
- Size of defect - crack length in millimeters
- Extent of defect -in toe weld, propagating into base metal, etc

TEST ABBREVIATIONS

Types	Abbreviations
Magnetic Particle Test	MT
Dye Penetrant Test	DPT
Visual Test	VT
Ultrasonic Test	UT

These abbreviations are in accordance with AWS A2.4-76, "Symbols for Non-Destructive Testing."

TEST TYPES

MAGNETIC PARTICLE

The test surface must be free of loose rust scale, moisture, and painted surfaces must be cleaned at all points of electrode contact. Grinding, brushing, or blasting does not affect results of this method of testing in most instances.

A magnetic field can be applied to the test material by using

1. a permanent magnet
2. a yoke - an electromagnetic device
3. passing a high current through the tested structure

DYE-PENETRANT

The test surface must be thoroughly cleaned and dried. This can be achieved using chemical solvents, vapor degreasing or other mechanical means such as grinding, blasting or wire-brushing.

One of the following types of penetrants should be used in conjunction with proper procedures to get satisfactory results:

- 1) Water soluble penetrant
- 2) Post emulsifiable penetrant
- 3) Solvent removable penetrant

VISUAL

Dirt and grease must be removed from the test surface (eg. with the help of a degreasing spray and wiping the surface).

The inspector is recommended to keep a look out for signs of cracked paint and corrosion on the suspected cracks.

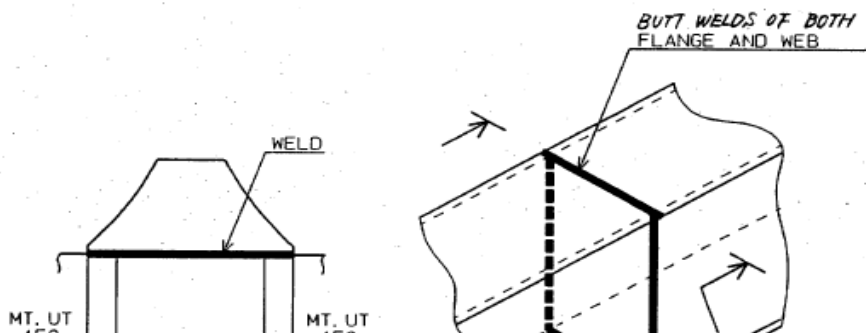
ULTRASONIC

Testing should be done by a person trained in using UT equipment.

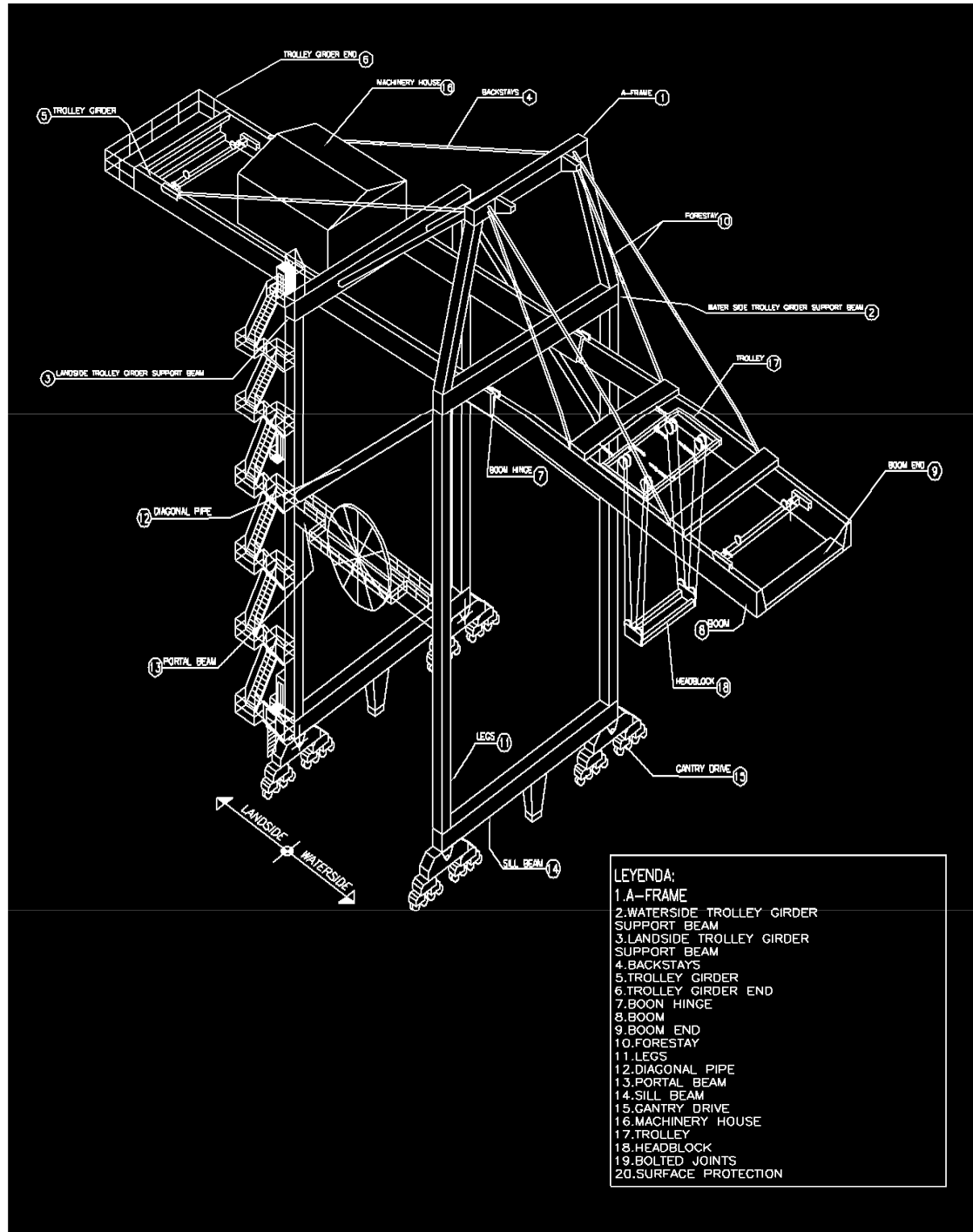
RECOMMENDED NDT AREAS AND ACCEPTANCE CRITERIA

	NDT AREAS FOR WELDS	NDT ACCEPTANCE CRITERIA
VT	WHOLE LENGTH	AWS 1.1-94 9.25.1
MT	WITHIN 150mm OF WELD END (WHOLE LENGTH FOR WELDS OF BOSS)	AWS 1.1-94 9.25.2
UT	WITHIN 150mm OF WELD END	AWS 1.1-94 9.25.3 (Tension)
UT [⊙]	WITHIN 150mm OF WELD END	AWS 1.1-94 8.15.4 (Compression)
UT*	WITHIN 150mm OF WELD END	THE RESULT OF THE INSPECTION SHALL BE EQUAL TO THE ONE OF THE PENETRATION CHECK BY UT THROUGH PAGE 11 TO 43.

REFER TO THE FOLLOWING EXAMPLE



LOCATIONS TO INSPECT



INSPECTION METHODS

In most of the following inspections, only VT is required. Cleaning up the inspection to ensure proper visual inspection can be carried out is part of the required scope. Other NDT methods (predominantly MT / UT) shall be applied if any area shows potential defects.

A camera with power optical zoom is recommended to be used as it can aid the inspector to view or take photos of defects which are on difficult-to-reach areas.

INSPECTION ACCESS

Unless otherwise specified, all inspections shall only be carried out on proper access platforms and walkways. Inaccessible areas shall be inspected using a camera. These areas shall be clearly indicated in the inspection report.

If required, additional access such as temporary platforms/walkways/scaffolds, rope access and mobile crane with man cage will be supplied for the following inspections to be carried out safely.

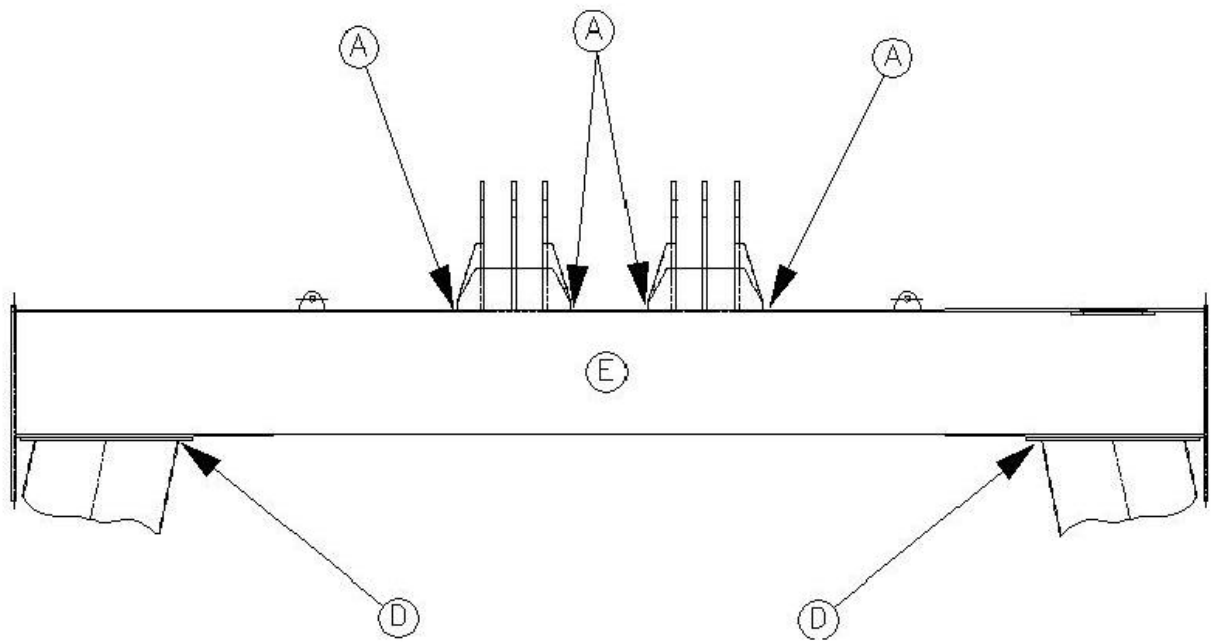
INSPECTION AREAS

1) A-FRAME

ITEM	DESCRIPTION	FCM/NFCM*
A	Connection of Boom Sheave block	FCM
B	Backstay connections, in particular the welding at the ends of insert plates	FCM
C	Forestay connections, in particular the welding at the ends of insert plates	FCM
D	Visual inspection of welds between legs and top beam, from walkway	NFCM
E	Structural Inspection of Top Beam	
E1	External visual check of all welds visible from normal walkway	FCM
E2	Inspection of internal structures for corrosion (will require access, manholes opened)	FCM

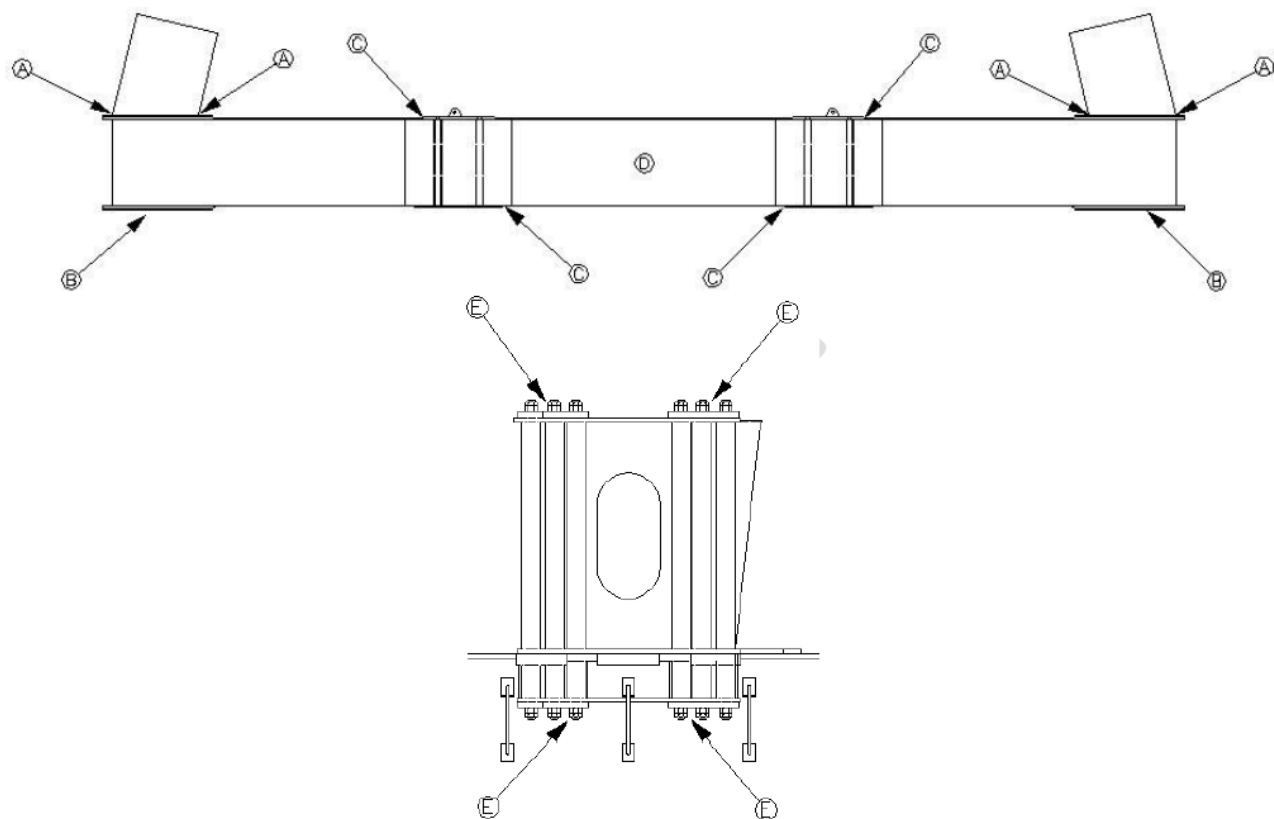
*FCM = Fracture Critical Member

*NFCM = Non-fracture critical member



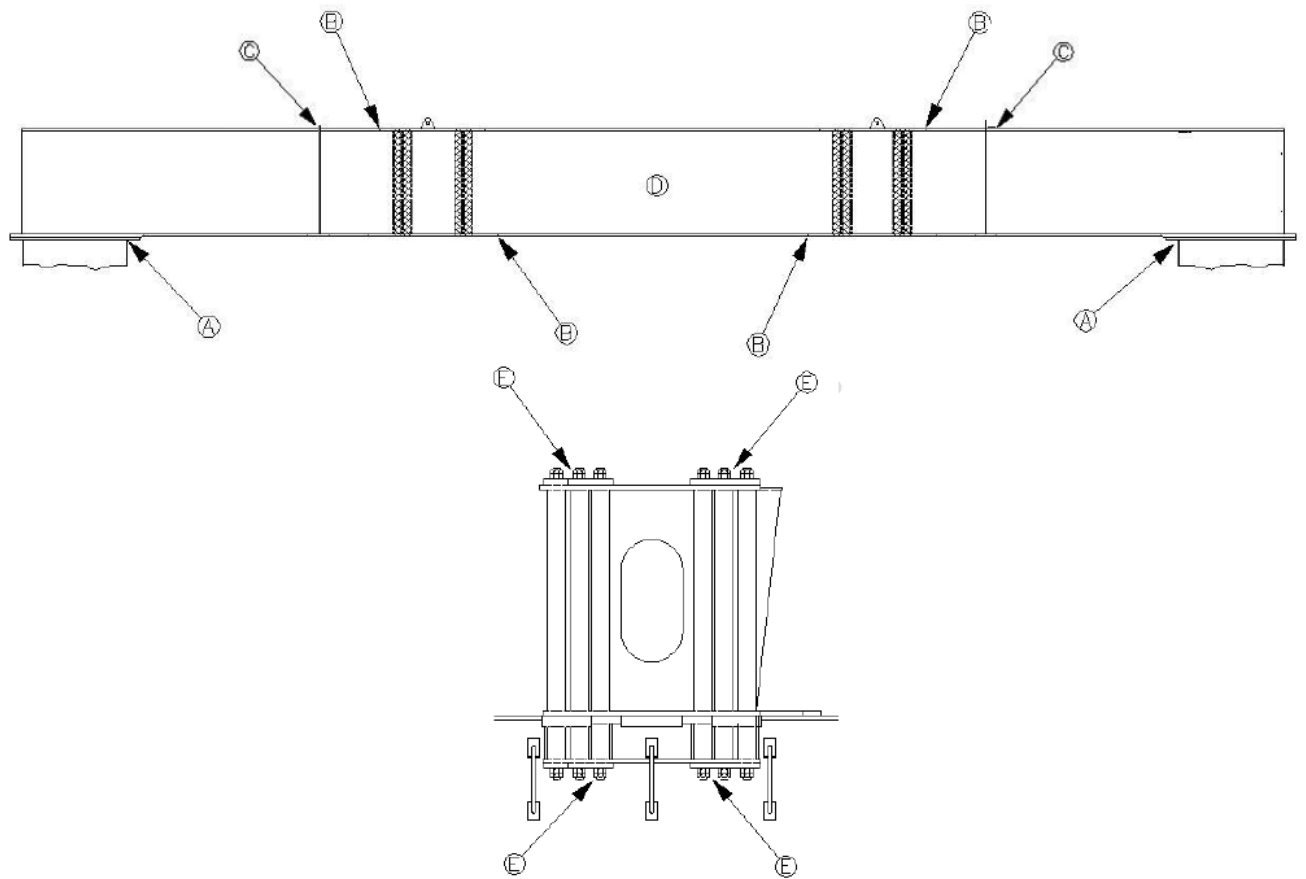
2) WATERSIDE TROLLEY GIRDER SUPPORT BEAM (TGSB)

ITEM	DESCRIPTION	FCM/NFCM
A	Connection of A frame legs	FCM
B	Connection to waterside legs	FCM
C	Connection to trolley girder	FCM
D	TGSB structure	
D1	Overall structure	FCM
D2	Inspection of internal structures for corrosion	NFCM
E	Trolley Girder Connection overall structure	FCM



3) LANDSIDE TROLLEY GIRDER SUPPORT BEAM (TGSB)

ITEM	DESCRIPTION	FCM/NFCM
A	Connection to landside legs	FCM
B	Connection to trolley girder	FCM
C	Connection to any tie beams or similar	FCM
D	TGSB structure	
D1	Overall structure	FCM
D2	Inspection of internal structures for corrosion	NFCM
E	Trolley Girder Connection overall structure	FCM

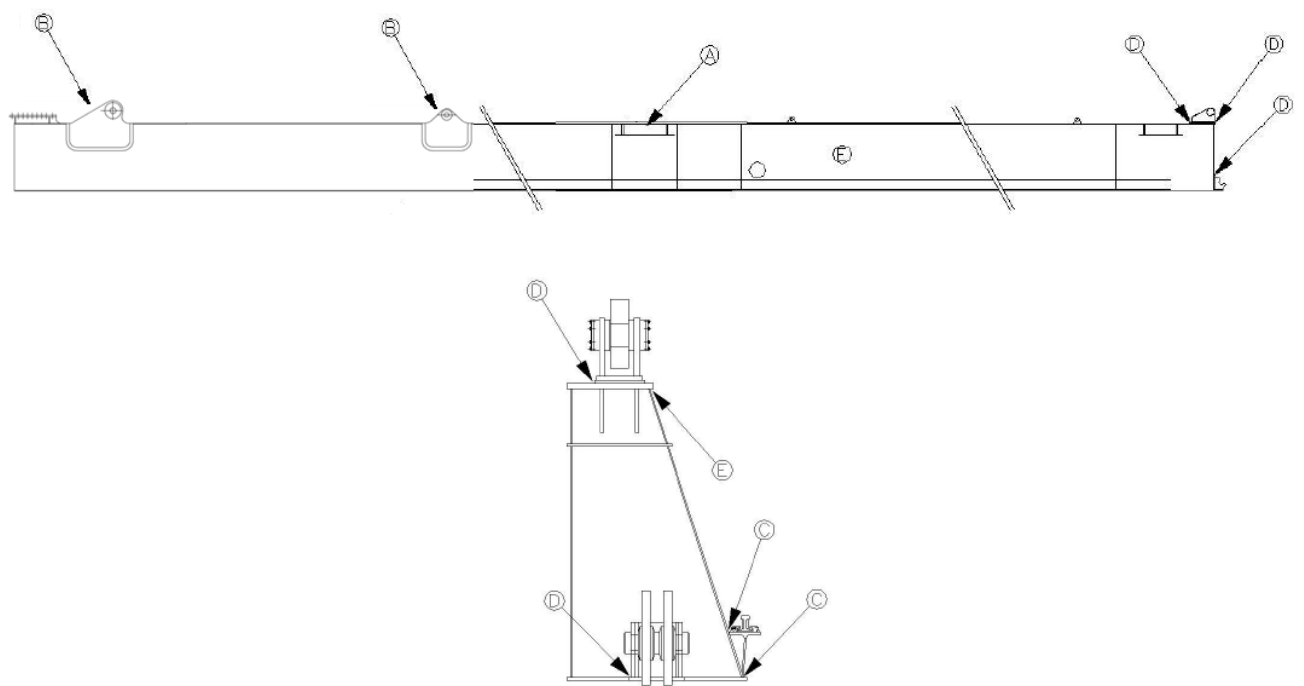


4) BACKSTAYS

ITEM	DESCRIPTION	FCM/ NFCM
A	Detailed inspections of the ends top and bottom. In particular the welding at the ends of the insert plates.	FCM
B	Visual inspection for the full length, concentration on any welded joints, or attachments welded butt joints.	FCM

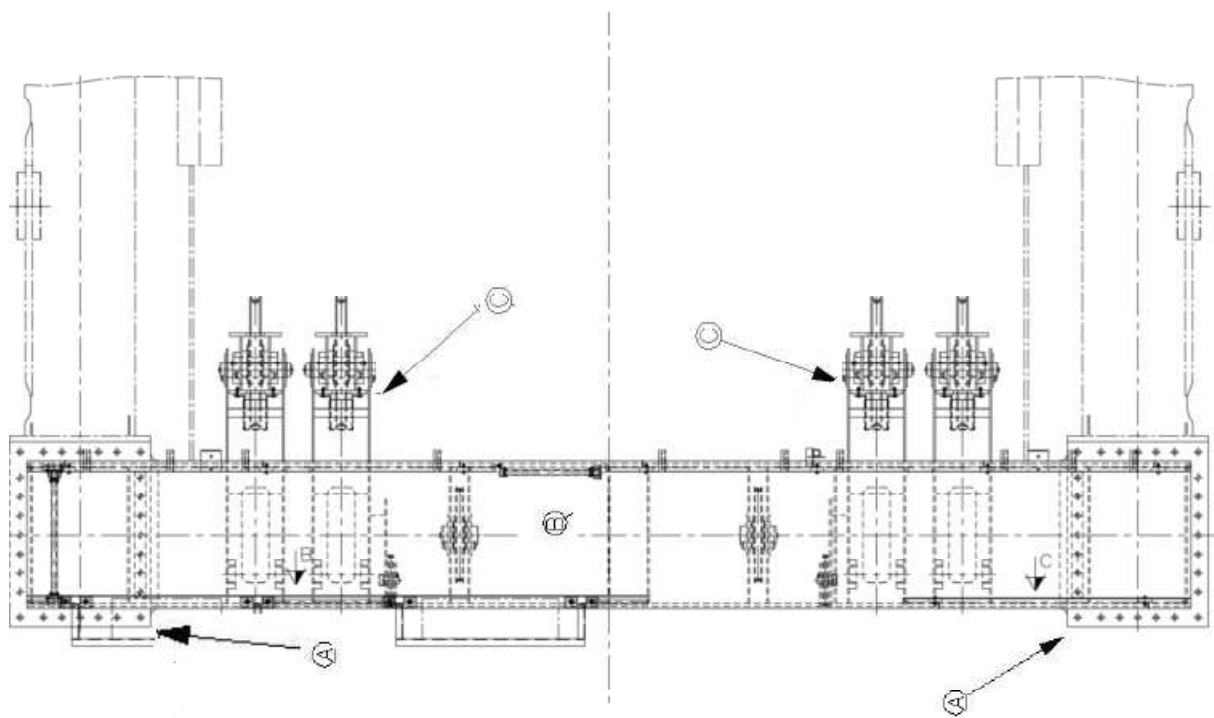
5) TROLLEY GIRDER (TWIN BOX CONSTRUCTION)

ITEM	DESCRIPTION	FCM/ NFCM
A	Detailed inspection of connection areas; Support Beams, end tie and machinery house	FCM
B	Backstay Connection	FCM
C	Trolley rail beam connection. Full length, particular attention to internal diaphragm locations	NFCM
D	Boom Hinge Area. Viewed whilst boom in both down and raised positions	FCM
E	Trolley Girder Structure	
E1	External from Trolley	FCM
E2	Inspection of internal structures for corrosion, where manholes exist. Particular attention to any welded joints between plates	NFCM



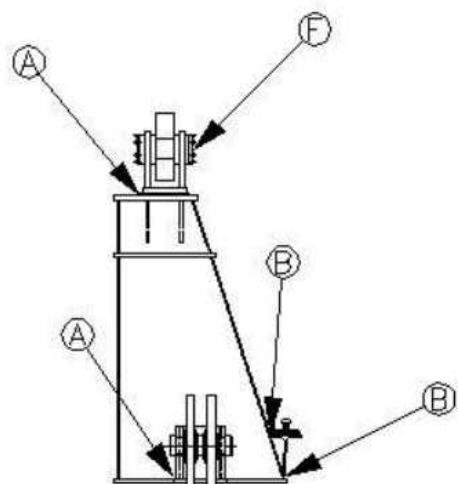
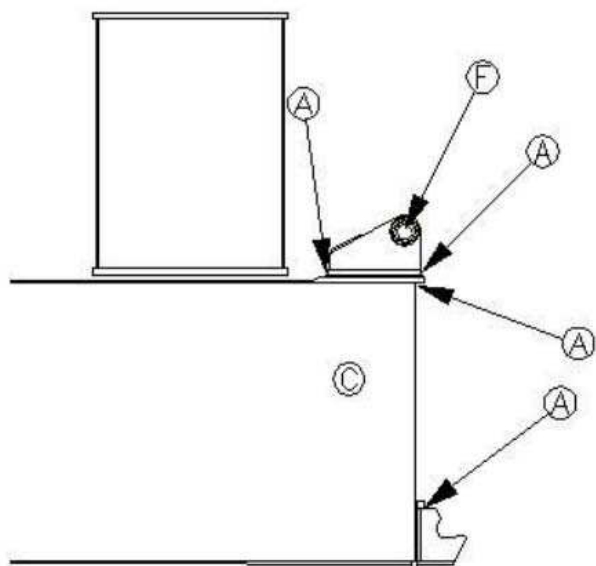
6) TROLLEY GIRDER END

ITEM	DESCRIPTION	FCM/ NFCM
A	Examination of the connections to the girder	NFCM
B	Examination of the structure	
B1	External	NFCM
B2	Inspection of internal structures for corrosion. Internal examination will only be undertaken if there is safe access and sufficient internal space	NFCM
C	Examination of the rope sheave anchors and supporting structure	NFCM



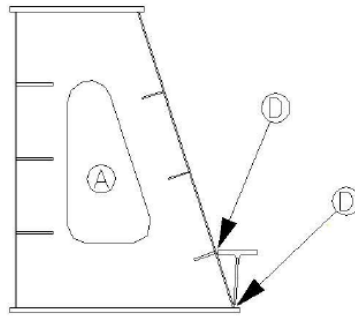
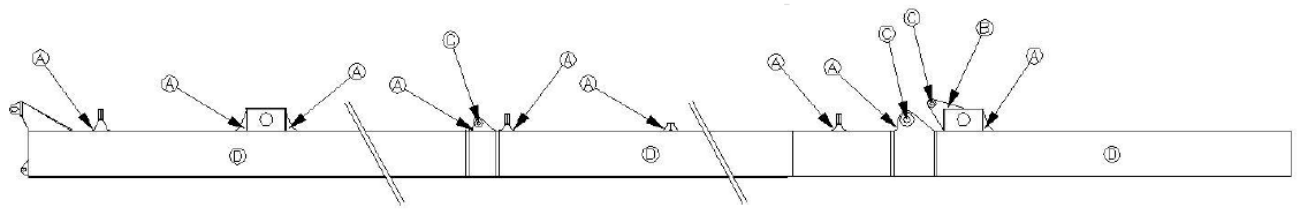
7) BOOM HINGE (TWIN BOX CONSTRUCTION)

ITEM	DESCRIPTION	FCM/NFCM
A	Inspection of the Hinge area welds	FCM
B	Examination of the rail, bolting and support	NFCM
C	Internal examination of the hinge support structure on the Girder and Boom for corrosion	FCM
D	Hinge Pin Connection (when wear has been observed on pin connection)	FCM



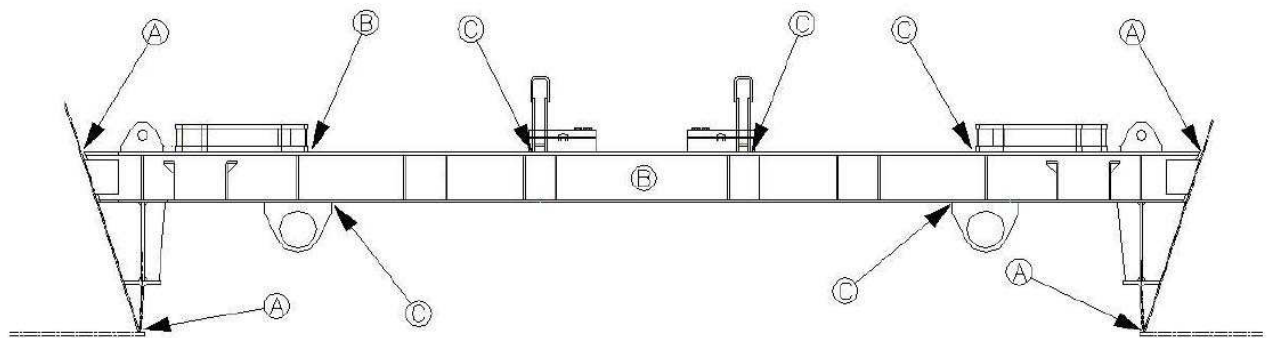
8) BOOM (TWIN BOX CONSTRUCTION)

ITEM	DESCRIPTION	FCM/NFCM
A	Inspection of connection areas; forestays and cross ties.	FCM
B	Examination of the Boom Hoist sheaves and Boom latch connection areas.	FCM
C	Forestay and Sheave pins Connection (when wear has been observed on pin connection)	FCM
D	Boom structure, in particular the rail support beam	
D1	External from Trolley	FCM
D2	Inspection of internal structures for corrosion, where manholes exist. Particular attention to any welded joints between plates	FCM



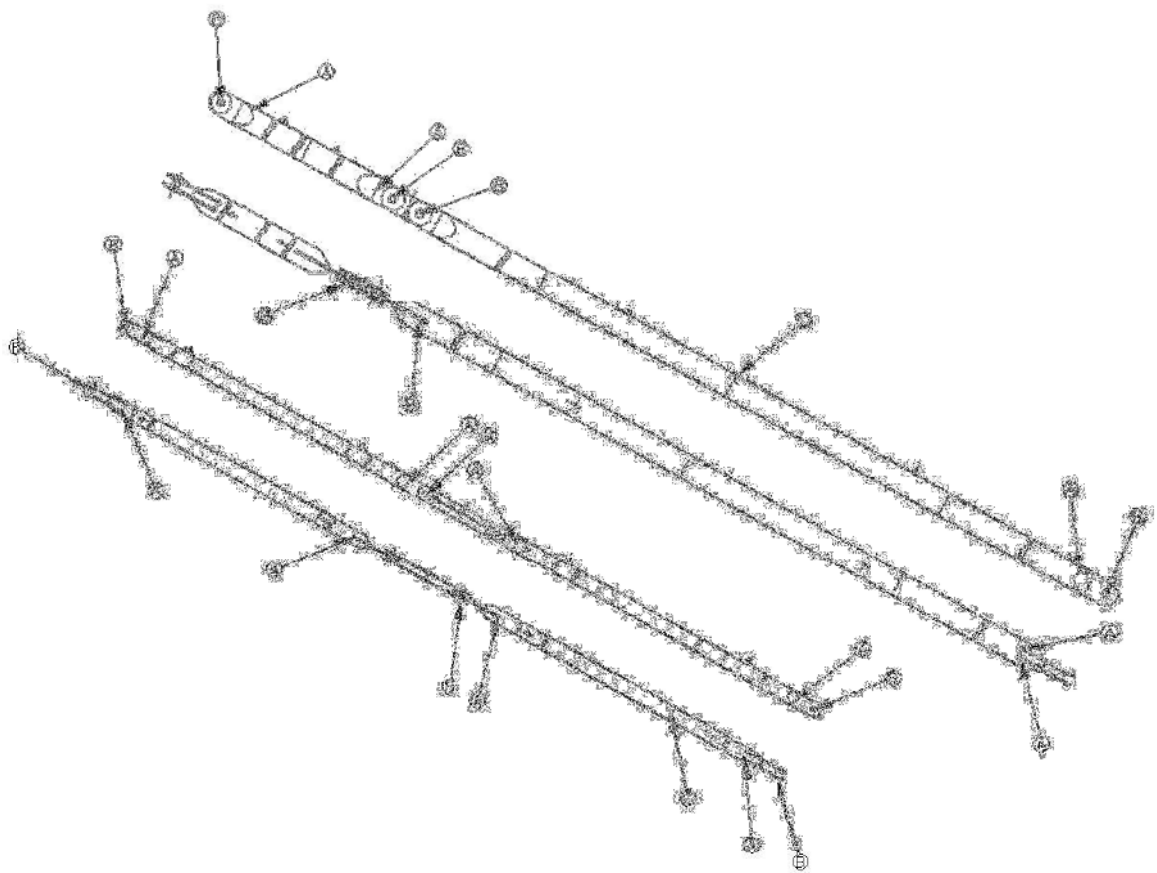
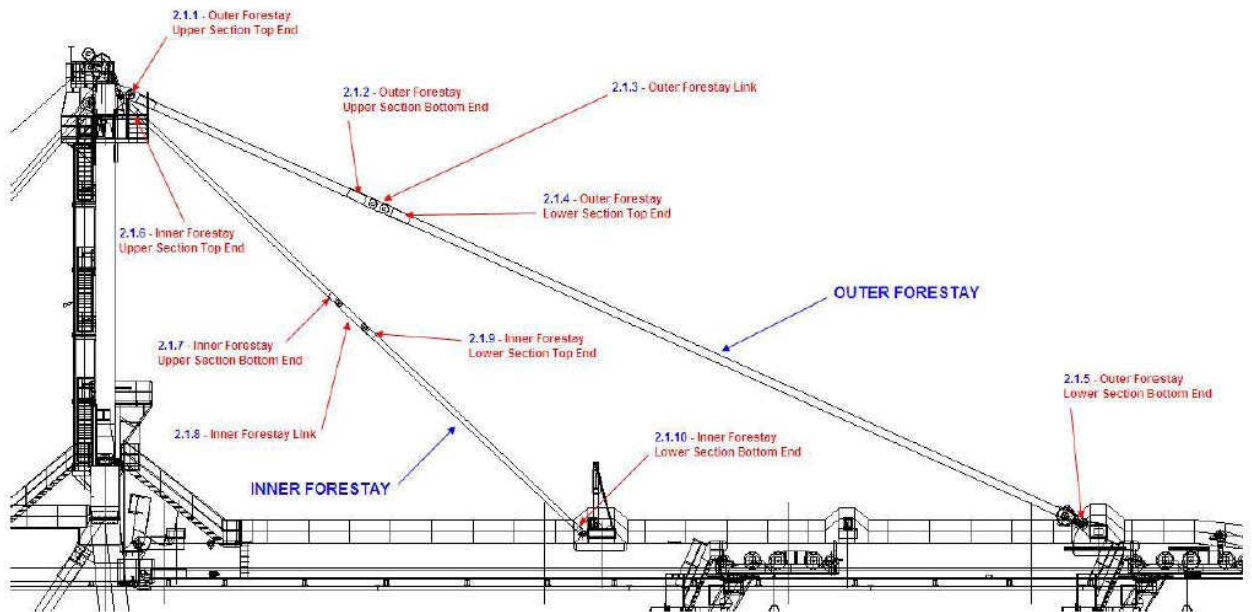
9) BOOM END (TWIN BOX CONSTRUCTION)

ITEM	DESCRIPTION	FCM/ NFCM
A	Examination of the connections to the boom	NFCM
B	Examination of the structure	
B1	External	NFCM
B2	Inspection of internal structures for corrosion. Internal examination will only be undertaken if there is safe access and sufficient internal space	NFCM
C	Examination of the rope sheave anchors and supporting structure	NFCM



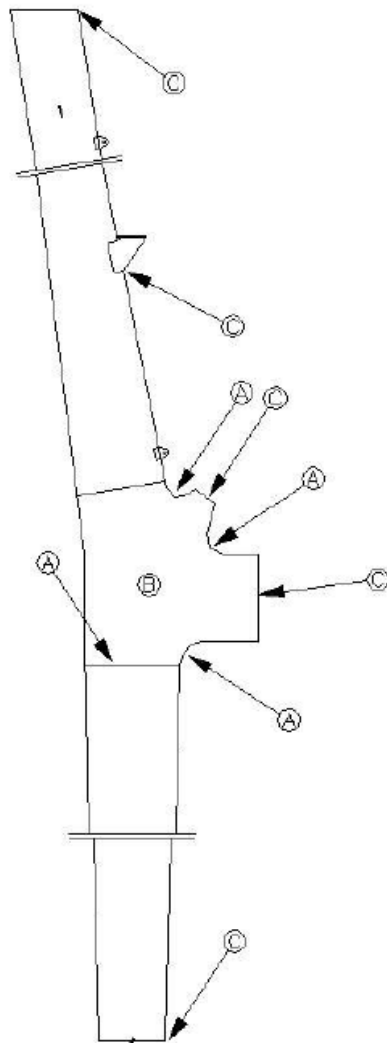
10) FORESTAY

ITEM	DESCRIPTION	FCM/ NFCM
A	Inspections of the ends, top, bottom and centre links, in particular the welding at the ends of the insert plates.	FCM
B	Pins and Bores Connection (when wear has been observed on pin connection)	FCM
C	Inspection of the full length concentrating on any welded joints	FCM



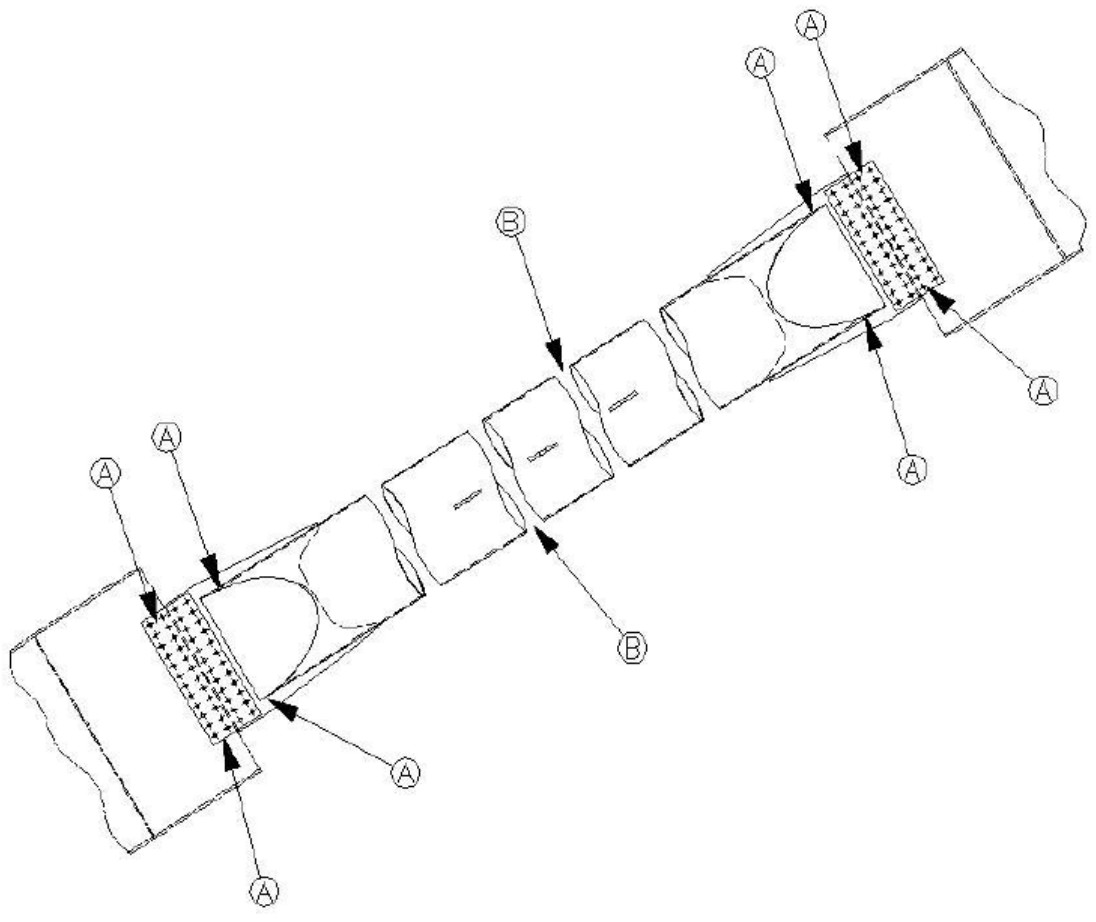
11) LEGS

ITEM	DESCRIPTION	FCM/NFCM
A	Full length external examination. In particular any welded joints (in particular top of lower section)	NFCM
B	Full length internal examination for corrosion. In particular any welded joints (in particular top of lower section)	NFCM
C	Connections to girder support beams, sill beams and leg portals	NFCM



12) DIAGONAL PIPE

ITEM	DESCRIPTION	FCM/ NFCM
A	Inspections of the ends, top and bottom. In particular the welding at the ends of the insert plates	NFCM
B	Visual inspection for the full length, concentration on any welded joints	NFCM
C	External inspection of any pin connection and bores (when wear has been observed on pin connection)	NFCM

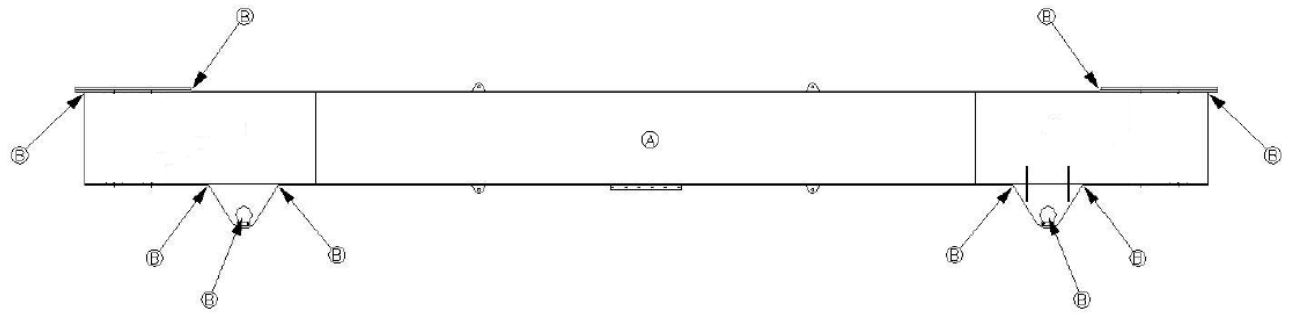


13) PORTAL BEAM

ITEM	DESCRIPTION	FCM/ NFCM
A	External Structure	NFCM
B	Inspection of Internal Structure for corrosion	NFCM
C	Examination of the connections to the legs	NFCM

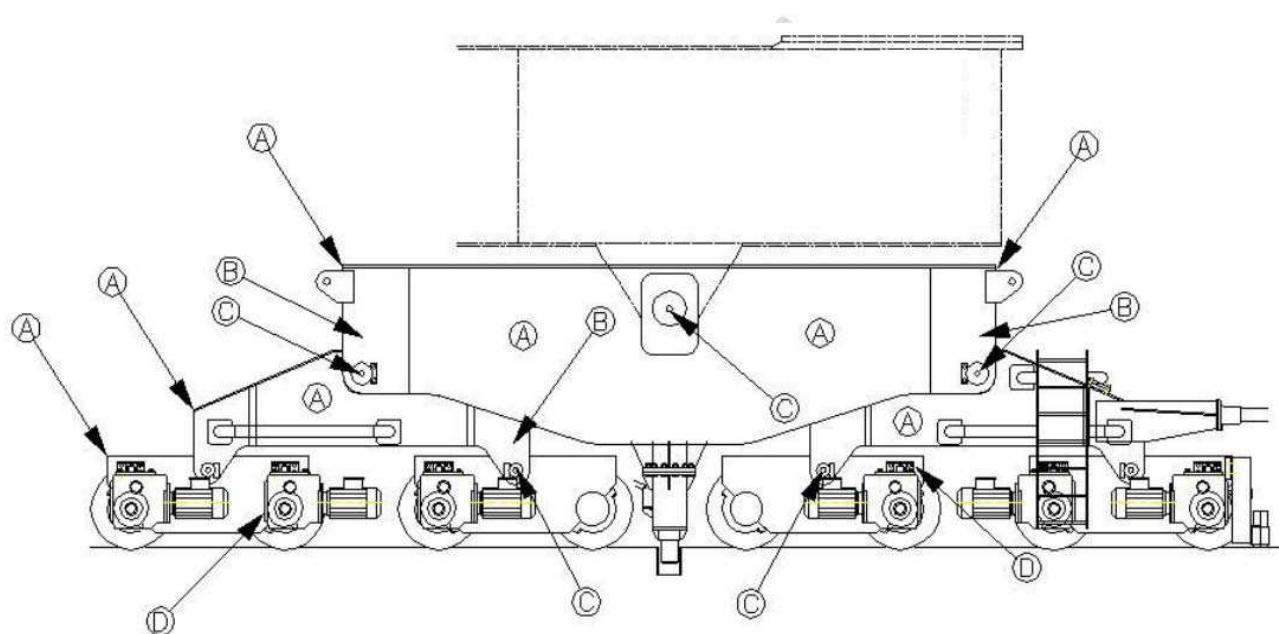
14) SILL BEAM

ITEM	DESCRIPTION	FCM/ NFCM
A	External Structure	NFCM
B	Inspection of Internal Structure for Corrosion	NFCM
C	Examination of the connection to the legs and gantry yokes	NFCM



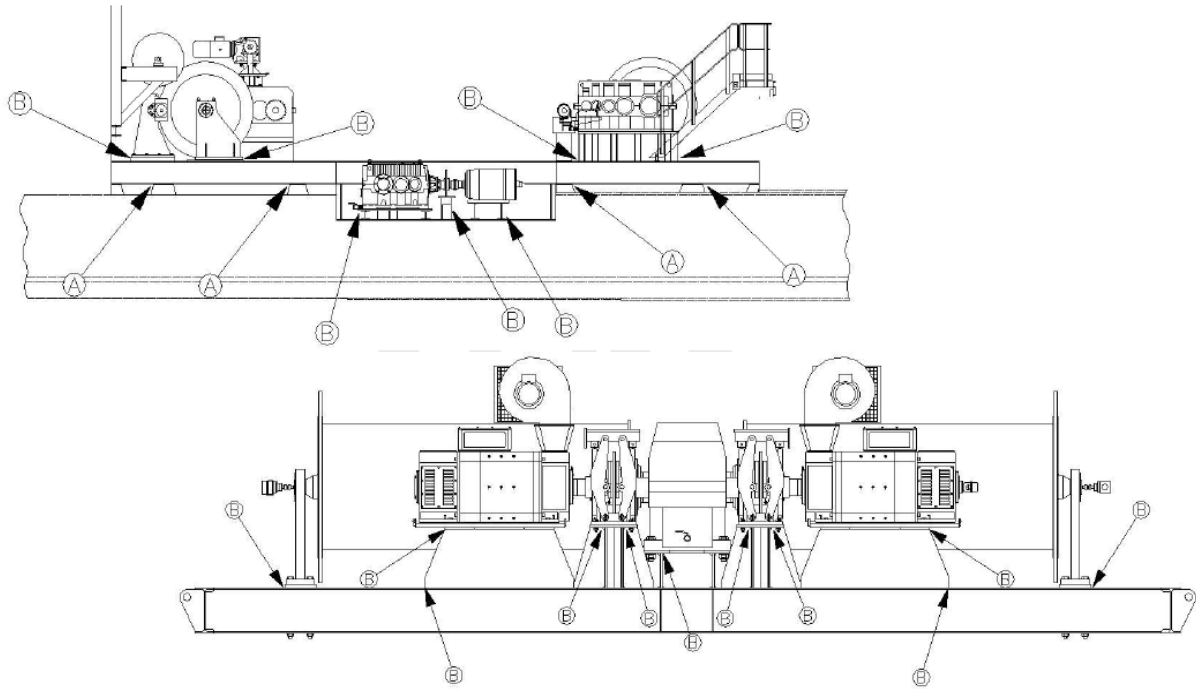
15) GANTRY BOGIE

ITEM	DESCRIPTION	FCM/ NFCM
A	Examination of the equaliser and bogie fabrications; in particular the corners	NFCM
B	Attachment of welded pieces for pivot pins	NFCM
C	Bores and pivot pins (when wear is observed on pin connection)	NFCM
D	Examination of motor and gearbox mounting bases	NFCM



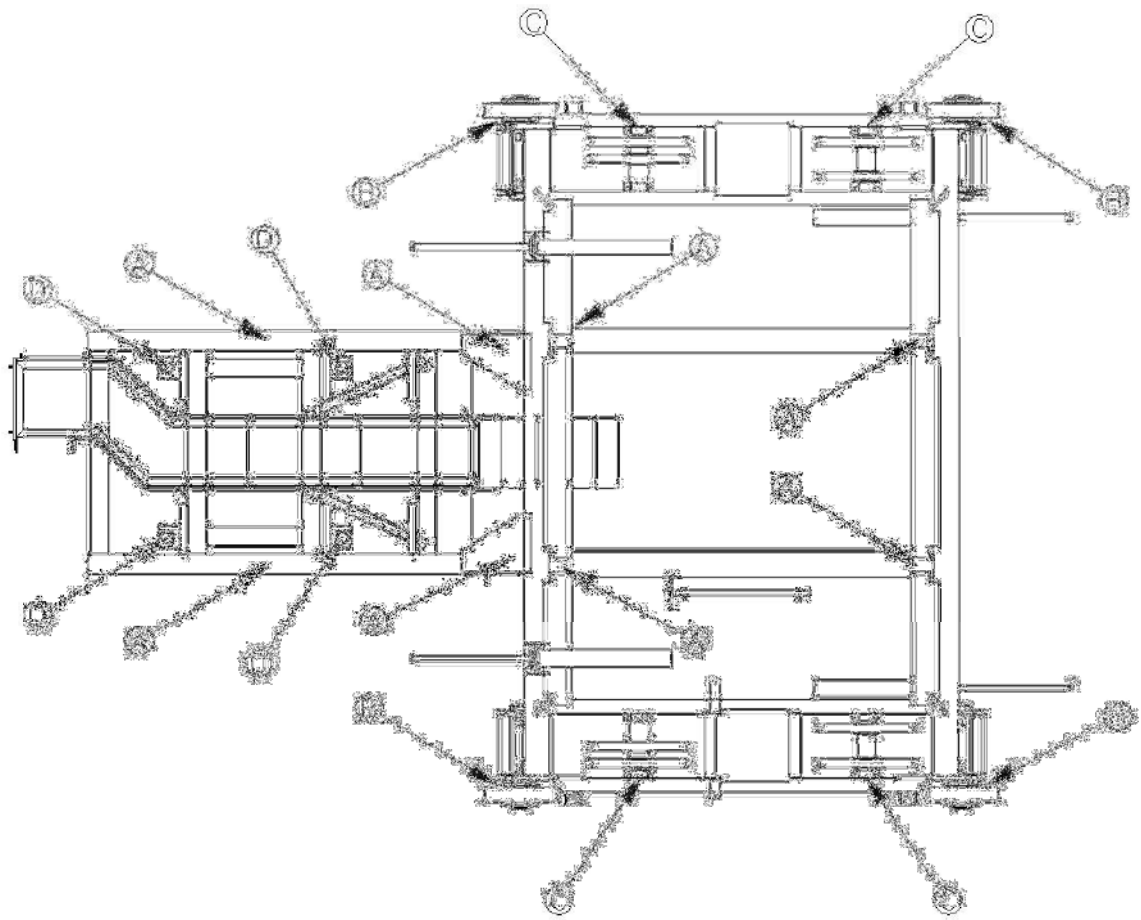
16) MACHINERY HOUSE

ITEM	DESCRIPTION	FCM/ NFCM
A	Examination of the structure from the underside, using the trolley for access. Particular attention paid to joints and members supporting the drums and gearboxes, and areas around connections to girder	FCM
B	Inspection of the plinths for the motors, gearboxes and brakes, for the hoist, cross travel and boom hoist	FCM



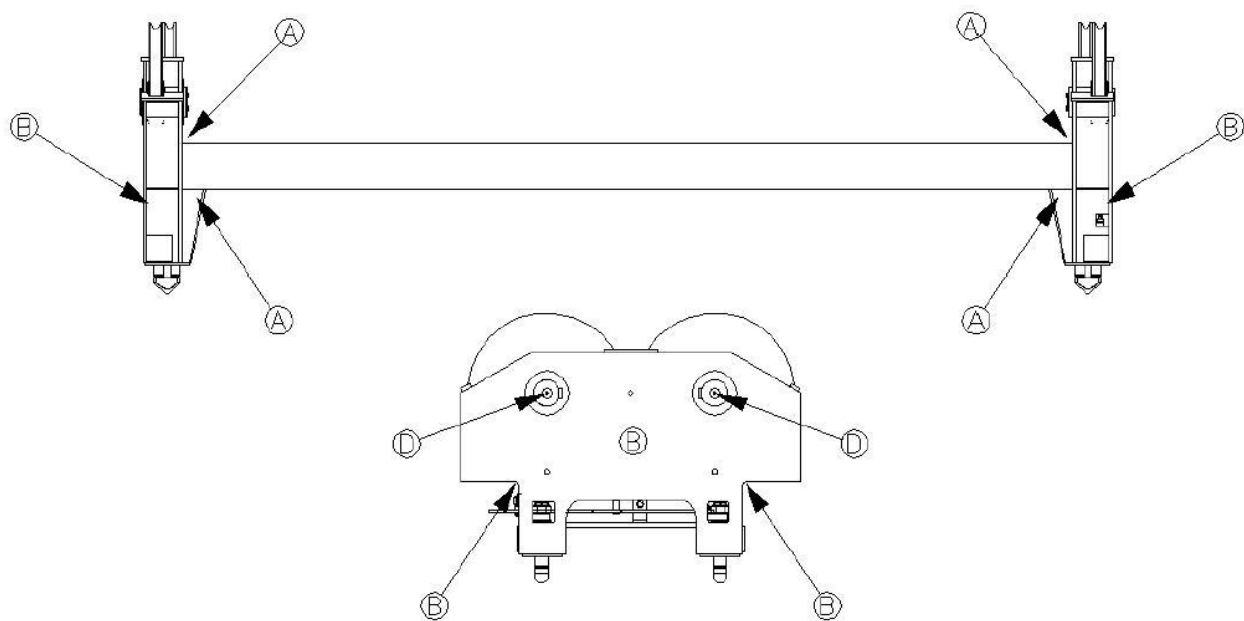
17) TROLLEY

ITEM	DESCRIPTION	FCM/ NFCM
A	Inspection of the trolley top structure, and the platform to the cab	FCM
B	Examination of the mounts for the trolley wheels and the connection to the trolley	NFCM
C	Examination of the Hoist sheave mounts	FCM
D	Examine the cab mount arrangement	FCM



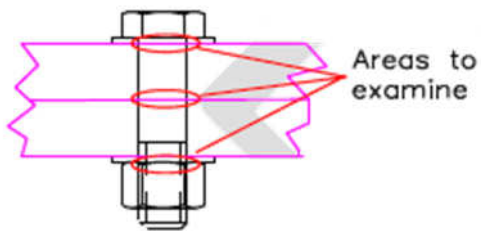
18) HEADBLOCK

ITEM	DESCRIPTION	FCM/ NFCM
A	Examination of the Structure at the ends of the headblocks longitudinal members, in particular the ends of any gussets	FCM
B	Examination of the end frames, in particulars adjacent to the twistlocks	FCM
C	Inspection around any welds on attachments	NFCM
D	Inspection of sheave pin bores for wear (eg. gaps)	FCM



19) BOLTED JOINTS

ITEM	DESCRIPTION	FCM/ NFCM
A	Structure	
A1	Bolts and nuts will be inspected without dismantling any joints for defects such as corrosion. 10% of bolts will be torque tested for tightness.	NFCM
A2	At least three bolts shall be randomly selected and removed for detailed inspection	NFCM



20) SURFACE PROTECTION & CORROSION

While examining the areas described in the preceding sections, an assessment of the paint condition and corrosion shall be made.

Areas susceptible to corrosion are those close to welded connections, with welded attachments (even if the attachments have been removed), around bolts and where water is likely to collect.

If the paint appears intact, or only the top coat has been damaged, no further action is necessary.

For corroded areas with pits deeper than 1mm, further investigation, such as UT, paint thickness tests and checks on the area/volume of loss of parent material, is necessary before determining the repair methods.