SUBJECT	NE FPSO WBT integrity management - WBT 5P FMECA Introduction	[redacted]			
PROJECT	NE FPSO Naval Architecture Support	SHEET NO:	1	of	28
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Revision	Date	Description	Prepared	Checked
A1	15/08/2017	Issued for [redacted] review	[redacted]	[redacted]
A2	22/08/2017	Updated with [redacted] comments following initial mtg 18/8/17		
A3	17/11/2017	Updated iaw [redacted] comments (refer comment sheet)		-
A4	20/12/2017	Updated iaw [redacted] comments (refer comment sheet & changes in blue)		-
B1	17/01/2018	Isssued for [redacted] approval		-
B2	07/02/2018	Weight column added to Sheet 5		-

Contents

Introduction

As of October 2017, the following WBT Special Survey 4 inspections have been carried out: WBT AP, 1S, 5P, 5S, 4P, 4S, 3P.
The high level conclusions of these inspections are as follows:
- Almost all of the anomalies identified consist of generally localised corrosion due to coating breakdown.
- 90% of these corrosion anomalies are in the top third of the tanks.
- No fatigue or welding defects have been discovered.
- Girth belt measurements demonstrate that there is no generalised corrosion (e.g. 5P measurements for deck zone mostly show no diminution, with the average diminution across all gauged locations at just 0.6%).
- Coating condition in general is GOOD.

Based on the results to date, an integrity management methodology has been developed using a Failure Modes Effects and Criticality Analysis (FMECA). Where required this qualitative approach is complemented by quantitative analysis of bending stress and buckling using up to date combined global and local loads for the vessel. Every anomaly will be assessed using this method, to ensure that any associated risks are understood, and the most appropriate mitigating actions are put in place.

Purpose

The purpose of this document is to describe the methodology & present the results of FMECA application to WBT 5P on the Northern Endeavour FPSO based on the results of the April 2017 Special Survey 4 inspection (Ref 1).
The agreed methodology will them be applied across all the Water Ballast Tanks on the FPSO.

Scope

The scope covers all 198 anomalies recorded during the Special Survey 4 inspection. The inspection covered all hull structure, ladders, handrails, access platforms, walkways, hatches, anodes, marine system piping and associated brackets, suction bell mouth & sea chests.

FMECA participants

The FMECA was initially carried out as a desktop exercise, with subsequent review and input from an independent 3rd party specialist, and [redacted] subject Matter Experts in Hull Structures and Risk.
The participants were:
Author and initial desktop exercise: [redacted]
3rd party subject matter expert review: [redacted]
[redacted] review:
- [redacted]
- [redacted]

[redacted]

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General methodology

The FMECA methodology is derived from MIL-STD-1629A (Ref 2) and BS EN 60812:2006 (Ref 3). It comprises of the following main steps:

Step 1: Define the hierarchical composition of the elements which make up the system under assessment

The hull structure and marine systems are broken down into their constituent parts by level, from Global down to detail level.

Step 2 Define the Functions & Performance Standard for the system to be assessed

P21 Substructure Performance Standard: To provide and maintain vessel structural integrity under all expected operational and environmental conditions through service life, and to provide sufficient robustness to maintain availability of critical systems during a major accident / environment event.

Step 2 Identify potential failure modes and their causes

Step 3 Determine the effects of each Failure Mode

Step 4 Assign the Severity Rating for each Failure Mode and Effect

Step 5 Assign the probability of the occurrence rating for each Failure Mode / Effect

Step 6 Assign the probability of detection rating for each Failure Mode / Effect

Step 7 Calculate the Risk Priority Number (RPN) for each Failure Mode / Effect

Step 8 Review the results and prioritise the Failure Modes for action

Step 9 Take action to eliminate or reduce risks to an acceptable level (RPN < 100)

The acceptable RPN threshold is subjective and differs depending on application - in this instance, based on a previous example of FMECA assessment of a pedestal crane, an RPN of 100 was chosen as the acceptable threshold. As the FMECA progressed, this value was repeatedly questioned based on engineering judgment to ensure that it remains appropriate for the present analysis.

Step 10 Recalculate the RPN following the remedial actions

Specific methodology for NE FPSO Water Ballast Tank integrity assessment

1. A significant quantity of localised anomalies have been discovered in each tank (approx. 150-650), with most of the anomaly types repeated multiple times. As such the method used has been to initially apply a 'generic' FMECA assessment to all structural elements in the hierarchy defined in Step 1. The assessment of the severity (consequence), occurrence (likelihood) and detectability of failure of each of these elements is based on a 'typical' anomaly.
2. All of the anomalies discovered have been listed in a register, and classified against the Step 1 hierarchy. Based on this, each anomaly can hence be assigned a default 'generic' FMECA assessment, in terms of original RPN, mitigating action and revised RPN.
3. As this assessment is based on a 'typical' anomaly, if the specific anomaly assessed is particularly better or worse (e.g. more or less extensive, or in a more or less critical location), the Occurrence can be adjusted manually to represent the fact that this anomaly is more or less likely to fail than a 'typical' one would be.
4. Refer to Sheet 1-Guidelines for factors to consider when adjusting the Occurrence assigned by the 'generic' FMECA.
5. For any anomalies with an initial RPN >300, mandatory additional quantitative assessment has been carried to confirm or adjust the appropriate risk mitigation to apply.
6. The qualitative FMECA approach is complemented by quantitative analysis of bending stress and buckling using up to date combined global and local loads for the vessel.
7. This approach enables the handling of large quantities of anomalies, and the application of standard mitigating actions to groups of similar anomalies, whilst still allowing for the outliers which may be significantly better or worse than is typical.

Standard mitigating actions

The following standard mitigation actions are used in this assessment.

Mitigating actions	
Arrest & monitor CVI	Grind sharp edges smooth, blast, recoat to arrest corrosion & monitor annually (fly by CVI by ROV)
Arrest & monitor CVI+	Grind sharp edges smooth, blast, recoat to arrest corrosion & monitor annually (CVI + by ROV)
Arrest & GVI	Grind sharp edges smooth, blast, recoat to arrest corrosion. Annual GVI by ROV
Det assm't &/or repair	Carry out further assessment to determine most appropriate mitigation, or
Structural repair	Hot or cold work repair - details TBC
Remove anode	During initial tank entry assess anodes & remove any for which the brackets have the potential to fail while people are in the tank.
Replace anode	Replace anode and also brackets if required
Replace bolts	Replace bolts of suitable material
Removal + temporary access	Remove structure in danger of falling & put unsafe structures out of service - install temporary access aids at each manned entry
None	None required - however arrest & monitor will be minimum

Key notes

1. Most anomalies are localised, are of similar size and are repeated in multiple locations in the top third of the tank. Such an anomaly is considered to be 'typical'.
2. Anomalies have been compiled in the file 'WBT 5P anomalies.pdf'. Each anomaly is bookmarked with it's anomaly code e.g. AN001, AN002 etc. for quick access.
3. For the assessment of the likelihood of failure, the lifetime is considered to be 10 years.
4. Minimum risk mitigation action for all corrosion anomalies will be recoat to arrest corrosion, even when FMECA initial RPN is acceptable.

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Guidelines for adjusting the Occurrence from the Generic FMECA

The following guidelines should be considered when reviewing the detailed FMECA (5-WBT 5P FMECA) and deciding whether to adjust the Occurrence assigned by the 'generic' FMECA (4-Generic FMECA):

1. Average % thickness diminution: 'typical anomaly' considered to be 20/25 - 50% average diminution (ignoring any 'knife edge' readings). Where average diminution is greater or less than this range, consideration to be given to adjusting the occurrence factor.

2. Extent of anomaly as a proportion of member depth: Noting that the renewable / substantial limits are not readily visible on the inspection report and marked extend of anomaly is boundary of return to uncorroded steel. Actual area of substantial / renewable corrosion will be smaller then full anomaly extents shown in report. To be considered on a case by case basis.

3. Location of anomaly on stiffener: For web anomalies / shear stress, criticality will be higher at the ends of the span, and lower in the center of the span. For flange anomalies / bending stress, criticality will be highest at the ends of the span, average in the center and lower at approximately 1/4 span. Consider using quantitative assessment to determine whether remaining section properties satisfy local & global (if applicable) loads.

4. Proximity to other anomalies / density of anomalies in the vicinity: In assessing each anomaly, the anomaly map shall be consulted in order to consider the combined effect on the member in question of other anomalies in proximity. Where there are several anomalies impacting an area, consideration shall be given to increasing the likelihood of failure.

Additional quantitative assessment

Where required, additional calculations have been carried out. These are referenced against each anomaly in Sheet 5-WBT 5P FMECA, and the calculation details can be found in a separate spreadsheet (NE FPSO WBT integrity management WBT 5 - calculations, Ref 4).

Bending stress and buckling checks for longitudinal structure

For longitudinal stiffeners, stringers, side shell and longitudinal bulkhead plate, calculations have been developed using the governing up to date local and global loads, and rule calculations from [redacted] Ship Rules, July 2000.

Check corroded section properties against requirements for specific location on span of stiffener

Beam sections are designed for the maximum bending and shear stress that the beam will experience, but local stresses vary along the length of the span. A simple tool has therefore been created to calculate the section properties at the anomaly location, and compare this against the actual local bending and shear stress (as a % of the maximum) at that location.

Refer to Ref 4 for detasils of the methodology and results.

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Anomaly report pdf setup

1 Extract anomaly reports from [redacted] inspection report (Typically Appendix F.3)
2 The new file should have one anomaly per page.
3 Using Nitro PDF (refer user manual), add bates number to each page in the format AN001, AN002... etc.
2 Using Nitro PDF, bookmark the bates numbers - this way all the anomalies are bookmarked

Initial spreadsheet setup

1 Save a copy of the spreadsheet from the previous tank, updating the tank name
2 Sheet 5: Delete all data (not formulas) from Column AG onwards
3 Sheet 5: Copy and paste the [redacted] anomaly table data into Sheet 5
4 Sheet 7: Take snapshots of anomaly maps from [redacted] inspection report and insert into Sheet 7
Sheet 8: Update anomaly quantity tables and verify results are correct
5 Sheet 5: Apply structural categorisation to all anomalies in accordance with the hierarchy in Sheet 2
6 Sheet 5: Generic pre & post action FMECA scores should be filled in automatically

FMECA application

1 Sheet 5: Commence review of generic FMECA results, and adjust if required, in accordance with the Guidelines in Sheet 1 and based on the methodology used for the previous tank as a reference
2 Sheet 5: It is best to proceed by type of structure, e.g. start with Shear strake - Panel - Plate, & do all similar anomalies together. Then move onto the next grouping.
3 Sheet 5: As a minimum all anomalies require the generic RPN and action to be checked, adjusted if required, and a comment added in the notes column to explain the result of the check.
4 Sheet 5: All anomalies with initial RPN higher than 300 are classed as 'critical' anomalies and must be subject to a detailed assessment.

SUBJECT	NE FPSO WBT integrity management - WBT 5P FMECA References

[redacted]

References

Ref No	Doc No	Title
1	[redacted]-51568-REP-WBT5P-002.1	NE Special Survey IV - No. 5 Water Ballast Tank Port Side
2	MIL-STD-1629A	Procedures for performing a failure mode, effects and criticality analysis
3	BS EN 60812:2006	Analysis techniques for system reliability - Procedure for failure mode and effects analysis (FMEA)
4	FSC-[redacted]-01-TEC-02-B1	NE FPSO WBT integrity management - WBT 5P calculations
5	FSC-[redacted]-01-TEC-03-B1	WBT 5P anomalies (anomaly reports extracted from main inspection report and numbered for easy reference)
6	FSC-[redacted]-01-DCS-01-A3	Document Comment Sheet - WBT 5P FMECA & calculations

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[redacted]

Structural categorisation: the system has been broken into its constituent parts

ID	Global	Primary	Secondary	Local	Detail
1	Hull Girder	Deck	Panel	Plate	
2				Long'l stiff'r	Web
3					Flange
4					Web & flange
5					Drain/m'hole
6			Trans frame	Web	
7				Flange	
8		Shear Strake	Panel	Plate	
9				Long'l stiff'r	Web
10					Flange
11					Web & flange
12					Drain/m'hole
13				Insp Stringer	Web
14					Flange
15					Drain/m'hole
16					Access/Peno
17					Flat bar stiff'r
18					Bracket
19			Trans frame	Web	
20				Web	Access/Peno
21					Stiffener
22				Flange	
23		Side shell	Panel	Plate	
24				Long'l stiff'r	Web
25					Flange
26					Web & flange
27					Drain/m'hole
28			Trans frame	Web	
29				Web	Access/Peno
30					Stiffener
31				Flange	
32			Stringer 1,2,3	Web	
33				Web	Drain/m'hole
34				Web	Access/Peno
35				Flange	
36		Long'l bhd	Panel	Plate	
37				Long'l stiff'r	Web
38					Flange
39					Web & flange
40					Drain/m'hole
41				Insp Stringer	Web
42					Flange
43					Drain/m'hole
44					Access/Peno
45					Flat bar stiff'r
46					Bracket
47			Trans frame	Web	
48				Web	Access/Peno
49					Stiffener
50				Flange	
51			Stringer 1,2,3	Web	
52				Web	Drain/m'hole
53					Access/Peno
54				Flange	

Structural categorisation: the system has been broken into its constituent parts					
55		Btm shell	Panel	Plate	
56				Long'l stiff'r	Web
57					Flange
58					Web & flange
59					Drain/m'hole
60			Trans frame	Web	
61				Flange	
62		Trans bhd	Panel	Plate	
63				Plate	Collar
64				Stiffener	Web
65					Flange
66					Bracket
67				Insp Stringer	Web
68					Flange
69					Access/Peno
70					Flat bar stiff'r
71					Drain/m'hole
72			Stringer 1,2,3	Web	
73				Web	Drain/m'hole
74				Flange	

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[redacted]

Typical (but not the only) categories used in this FMECA

FAILURE MODE SEVERITY RISK MATRIX

Rating	Effect on safe operations or environment	Effect on system	Effect on equipment	Total cost of repair
1	No injury or loss to the environment	No or negligible effect on system performance	Negligible effect on performance of equipment under consideration	No or negligible effect on cost of repair
3	Minor first aid injury or minor hydrocarbon release <1bbl contained within the bunded areas or minor secondary damage to plant equipment	Less than 10% loss of system performance	Minor degradation effect on performance of equipment under consideration	Minor effect: cost of repair <$10k
5	Moderate injury with full recovery (LTI) and / or moderate hydrocarbon release < 10bbl (contained internally within the operational area) and/or moderate secondary damage to plant and equipment	10 to 40% loss of system performance	Important degradation on performance of equipment under consideration	Moderate effect: Cost of repair >$10k<$50k
8	Severe injury and / or severe hydrocarbon release causing long term damage > 100bbl and/or major secondary damage to plant and equipment	40 to 80% loss of system performance	Complete failure or damage to equipment under consideration	Significant effect cost of repair >$50k<$100k
10	Loss of life and / or extreme hydrocarbon release causing permanent environmental damage and/or catastrophic secondary damage to plant and equipment	Complete loss of system performance	Complete failure of equipment and consequential damage of other functional equipment	Major effect cost of repair >$100k<$1million

FAILURE MODE RISK DETECTABILITY MATRIX (PRE-ACTION)

Rating	Detectability	Definition	Notes
1	Very high	**Evident:** The failure mode is inherently detectable immediately through design or due to installed sensors and / or on line data recording.	
6	Very low	**Detectable:** Once conditions have deteriorated to a significant level where a functional failure of the equipment and / or system has occurred.	
8	Hidden	**Hidden:** The failure mode on **its own** is not evident to the operator during normal operating duties but the consequence of failure **is not safety critical** i.e. only affects operating capability or total cost of repair.	Applicable to most 'typical' corrosion anomalies
10	Hidden	**Hidden:** The failure mode on **its own** is not evident to the operator during normal operating duties and the consequence of failure **is safety or environmentally critical**.	

FAILURE MODE OCCURRENCE RISK MATRIX

Rating	Description	Mean time between failures
1	**Extremely unlikely:** A failure whose probability of occurrence is insignificant during the operating life of the field.	> 20 years
2	**Unlikely:** A failure whose probability of occurrence is negligible during the operating life of the equipment.	> 10 years
3	**Remote:** An unlikely probability of occurrence during the operating life of the equipment.	> 5 years < 10 years
5	**Occasional:** An occasional probability of occurrence during item operation.	> 3 years < 5 years
7	**Reasonably probable:** A moderate probability of occurrence during the item operation.	> 1 year < 3 years
9	**Frequent:** A high probability of occurrence during item operation.	> 6 months < 1 year
10	**Extremely likely:** A failure almost certain within the first 6 months of operation.	< 6 months

FAILURE MODE RISK DETECTABILITY MATRIX (POST-ACTION)

Rating	Detectability	Definition	Notes
1	Very high	**Evident:** The failure mode is inherently detectable immediately through design or due to installed sensors and / or on line data recording.	
2	High	**Predictable:** The onset of failure is predictable if measured data is analysed for changes in trends and the impact of failure will be avoided through timely maintenance intervention.	Could improve to this using Corrosion coupons - known corrosion rate?
3	Moderate	**Preventable:** The onset of failure can be observed during normal operations i.e. routine watch keeping, function testing or servicing activities.	
4	Low	**Preventable:** The failure is preventable through time based intrusive preventative maintenance because the useful or safe life is known.	Applicable once corrosion is arrested & annual inspection carried out.
8	Hidden	**Hidden:** The failure mode on **its own** is not evident to the operator during normal operating duties but the consequence of failure **is not safety critical** i.e. only affects operating capability or total cost of repair.	
10	Hidden	**Hidden:** The failure mode on **its own** is not evident to the operator during normal operating duties and the consequence of failure **is safety or environmentally critical**.	

Definition of Safety Critical Element
SCEs are defined as those items of equipment or structures whose failure could lead to a Majotr Accident Event (MAE) or Major Environmental Event (MEE) or whose purpose is to prevent or limit the consequences of a MAE or MEE.
MAE - Event which has the potential to result in multiple casualties
MEE - Those events with potential Environment, or Social / Cultural Consequences 3 or higher (as per [redacted] Operational Risk Matrix), which are evaluated against credible worst case scenarios that may occur when all controls are absent or have failed.

[redacted] **RISK MATRIX**

MEE

		LIKELIHOOD →					
	Historical:	"Unheard of in the industry"	"Has occurred once or twice in the industry"	"Has occurred many times in the industry, but not in the Company"	"Has occurred once or twice in the Company"	"Has occurred frequently in the Company"	"Has occurred frequently at the location"
	Frequency: (Continuous Operation)	Once every 10,000-100,000* years at location	Once every 1,000-10,000 years at location	Once every 100-1,000 years at location	Once every 10-100 years at location	Once every 1-10 years at location	More than once a year at location or continuously
	Probability: (Single activity)	1 in 100,000-1,000,000*	1 in 10,000-100,000	1 in 1,000-10,000	1 in 100-1,000	1 in 10-100	>1 in 10
		1	2	3	4	5	6
		Remote	Highly Unlikely	Unlikely	Possible	Likely	Very Likely
CONSEQUENCE →	Health and Safety / Environment / Reputation / Social/Cultural / Value						
6	Catastrophic	Multiple fatality/multiple permanent disability / Permanent impact on highly valued ecosystems or habitat / International Media Coverage, Company at Stake / Permanent long term years) into a community or social infrastructure or highly valued areas/items of cultural significance / >A$50M	10	12	18	24	30	SEVERE 36
5	Severe	Single fatality/permanent disability / Serious Long term (>10 years) impact on highly valued ecosystems species or habitats / Persistent National Concern, Operations severely / Serious long term (>10 years) into a community or social infrastructure or highly valued areas/items of cultural significance / A$20M-A$50M	5	10	15	20	25	30
4	Major	Lost Time injury - Partial disability / Major long term (5 to 10) years impact on ecosystems, species or habitat / Significant Impact, national media coverage, operations / Major long term (10 years) impact to a community or social infrastructure or highly valued areas/items of cultural significance / A$10M-A$20M	4	8	12	HIGH 16	20	24
3	Moderate	Alternate Duties/Restricted Work / Moderate, medium term (2 to 5 years) impacts but not affecting ecosystem function / National bad mention. Short term regional concern. Close scrutiny / Moderate Medium Term (5 to 10 years) impact to a community or highly valued areas/items of cultural significance / A$2M-A$10M	3	6	MEDIUM 9	12	15	18
2	Minor	Medical Treatment Case / Minor short term (1-2) years impact but not affecting ecosystem or function / Short term local concern. Some impact on asset level non-production / Minor-Short Term (<5 years) impact to a community or areas/items of cultural significance / Loss from $1-$2M	2	4	6	8	10	12
1	Negligible	First Aid Treatment/Minor injury / Slight and temporary <1-localised effect on ecosystem, species or habitat / Local mention only. Quickly forgotten. Freedom to / Minor Temporary impact to a community or areas/items of cultural significance / <1M	LOW 1	2	3	4	5	10

Applicable MAEs & MEEs in accordance with NE FPSO Performance Standard P21 - Substructures (those applicable to this assessment in red)	
MAE-01: Subsea Loss of Containment Loss of hydrocarbon containment from subsea equipment resulting in sea fire Loss of hydrocarbon containment from subsea flowline release, I-tube riser release resulting in sea fire Loss of hydrocarbon containment from gas lift flowlines and risers resulting in sea fire/jet fires /explosions	**MEE-05 Hydrocarbon release caused by a cargo tank loss of containment** Release of hydrocarbons in the form of processed oil to the environment.
MAE-03: Loss of Structural Integrity or Stability - Loss of structural integrity resulting in possible foundering of FPSO - Sub structure collapse or failure	
MAE04 Loss of Marine Separation Collision of offtake tanker, attendant vessel or passing vessel with the FPSO	
MAE-05: Loss of Control of Suspended Load Dropped objects from cranes, davits etc.	

SUBJECT	NE FPSO WBT Integrity management – WBT 5P FMECA Generic FMECA	[redacted]

ID	Global	Primary	Secondary	Local	Detail		Potential failure mode	Most credible potential effect of failure	Sev	Potential cause of failure	Occ	Det	Current design controls	RPN	Recommended action / additional comments	Respon sibility	PM frequency	After actions taken Sev	Occ	Det	RPN	% reduction
1	Hull Girder	Deck	Panel	Plate		DeckPanelPlate	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Loss of WB containment	5	Coating breakdown	9	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations, Class Periodical Survey Regulations	360	Arrest & monitor CVI+		Annual	5	3	4	60	83%
2		Deck	Panel	Long'l stiff'r	Web	DeckPanelLong'l stiff'rWeb	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of longitudinal stiffener	3	Coating breakdown	5	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	120	Arrest & monitor CVI		Annual	3	3	4	36	70%
3		Deck	Panel	Long'l stiff'r	Flange	DeckPanelLong'l stiff'rFlange	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of longitudinal stiffener	3	Coating breakdown	5	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	120	Arrest & monitor CVI		Annual	3	3	4	36	70%
4		Deck	Panel	Long'l stiff'r	Web & flange	DeckPanelLong'l stiff'rWeb & flange	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of longitudinal stiffener	5	Coating breakdown	5	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	200	Arrest & monitor CVI		Annual	5	3	4	60	70%
5		Deck	Panel	Long'l stiff'r	Drain/m'hole	DeckPanelLong'l stiff'rDrain/m'hole	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of longitudinal stiffener	5	Coating breakdown	3	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	120	Arrest & monitor CVI		Annual	5	2	4	40	67%
6		Deck	Trans frame	Web		DeckTrans frameWeb	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of transverse frame	8	Coating breakdown	3	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	192	Arrest & monitor CVI		Annual	8	2	4	64	67%
7		Deck	Trans frame	Flange		DeckTrans frameFlange	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Overstress / buckling / deformation of transverse frame	8	Coating breakdown	3	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	192	Arrest & monitor CVI		Annual	8	2	4	64	67%
8		Sheer strake	Panel	Plate		Sheer strakePanelPlate	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Loss of WB containment. Progressive failure of hull girder	10	Coating breakdown	7	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations, damage stability design	560	Arrest & monitor CVI+		Annual	10	3	4	120	79%
8		Sheer strake	Panel	Plate		Sheer strakePanelPlate	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Loss of WB containment. Progressive failure of hull girder	10	Coating breakdown	7	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations, damage stability design	560	Det assm't &/or repair		Annual	10	2	4	80	86%
9		Sheer strake	Panel	Long'l stiff'r	Web	Sheer strakePanelLong'l stiff'rWeb	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of longitudinal stiffener	8	Coating breakdown	5	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	320	Arrest & monitor CVI+		Annual	8	3	4	96	70%
10		Sheer strake	Panel	Long'l stiff'r	Flange	Sheer strakePanelLong'l stiff'rFlange	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of longitudinal stiffener	8	Coating breakdown	5	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	320	Arrest & monitor CVI+		Annual	8	3	4	96	70%
11		Sheer strake	Panel	Long'l stiff'r	Web & flange	Sheer strakePanelLong'l stiff'rWeb & flan	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of longitudinal stiffener	8	Coating breakdown	7	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	448	Arrest & monitor CVI+		Annual	8	5	4	160	64%
11		Sheer strake	Panel	Long'l stiff'r	Web & flange	Sheer strakePanelLong'l stiff'rWeb & flan	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of longitudinal stiffener	8	Coating breakdown	7	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	448	Det assm't &/or repair		Annual	8	3	4	96	79%

12	Sheer strake	Panel	Long'l stiff'r	Drain/m'hole	Sheer strakePanelLong'l stiff'rDrain/m'ho	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of longitudinal stiffener, crack propagating into shear strake	8	Coating breakdown	3	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	192	Arrest & monitor CVI		Annual	8	2	4	64	67%
13	Sheer strake	Panel	Insp Stringer	Web	Sheer strakePanelInsp StringerWeb	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of stringer under global compressive loads	5	Coating breakdown	2	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	80	Arrest & monitor CVI		Annual	5	1	4	20	75%
14	Sheer strake	Panel	Insp Stringer	Flange	Sheer strakePanelInsp StringerFlange	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of stringer under global compressive loads	8	Coating breakdown	2	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	128	Arrest & monitor CVI		Annual	8	1	4	32	75%
15	Sheer strake	Panel	Insp Stringer	Drain/m'hole	Sheer strakePanelInsp StringerDrain/m'h	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of stringer, crack propagating into shear strake	8	Coating breakdown	2	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	128	Arrest & monitor CVI		Annual	8	2	4	64	50%
16	Sheer strake	Panel	Insp Stringer	Access/Peno	Sheer strakePanelInsp StringerAccess/Per	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of stringer under global compressive loads	5	Coating breakdown	2	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	80	None							
17	Sheer strake	Panel	Insp Stringer	Flat bar stiff'r	Sheer strakePanelInsp StringerFlat bar sti	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of stringer under global compressive loads	5	Coating breakdown	2	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	80	None							
18	Sheer strake	Panel	Insp Stringer	Bracket	Sheer strakePanelInsp StringerBracket	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of stringer under global compressive loads	8	Coating breakdown	2	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	128	Arrest & monitor CVI		Annual	8	2	4	64	50%
19	Sheer strake	Trans frame	Web		Sheer strakeTrans frameWeb	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of transverse frame	8	Coating breakdown	3	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	192	Arrest & monitor CVI		Annual	8	2	4	64	67%
20	Sheer strake	Trans frame	Web	Access/Peno	Sheer strakeTrans frameWebAccess/Pend	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of transverse frame web	5	Coating breakdown	2	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	80	None							
21	Sheer strake	Trans frame	Web	Stiffener	Sheer strakeTrans frameWebStiffener	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of transverse frame web	8	Coating breakdown	2	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	128	Arrest & monitor CVI		Annual	8	2	4	64	50%
22	Sheer strake	Trans frame	Flange		Sheer strakeTrans frameFlange	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Overstress / buckling / deformation of transverse frame	8	Coating breakdown	3	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	192	Arrest & monitor CVI		Annual	8	2	4	64	67%
23	Side shell	Panel	Plate		Side shellPanelPlate	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Loss of WB containment	8	Coating breakdown	7	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations, damage stability design	448	Arrest & monitor CVI+		Annual	8	3	4	96	79%
24	Side shell	Panel	Long'l stiff'r	Web	Side shellPanelLong'l stiff'rWeb	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of longitudinal stiffener	5	Coating breakdown	5	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	200	Arrest & monitor CVI		Annual	5	3	4	60	70%
25	Side shell	Panel	Long'l stiff'r	Flange	Side shellPanelLong'l stiff'rFlange	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of longitudinal stiffener	5	Coating breakdown	5	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	200	Arrest & monitor CVI		Annual	5	3	4	60	70%
26	Side shell	Panel	Long'l stiff'r	Web & flange	Side shellPanelLong'l stiff'rWeb & flange	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of longitudinal stiffener	5	Coating breakdown	7	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	280	Arrest & monitor CVI		Annual	5	3	4	60	79%

27	Side shell	Panel	Long'l stiff'r	Drain/m'hole	Side shellPanelLong'l stiff'rDrain/m'hole	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of longitudinal stiffener	5	Coating breakdown	3	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	120	Arrest & monitor CVI		Annual	5	2	4	40	67%
28	Side shell	Trans frame	Web		Side shellTrans frameWeb	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of transverse frame	8	Coating breakdown	3	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	192	Arrest & monitor CVI		Annual	8	2	4	64	67%
29	Side shell	Trans frame	Web	Access/Peno	Side shellTrans frameWebAccess/Peno	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of transverse frame web	5	Coating breakdown	2	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	80	None							
30	Side shell	Trans frame	Web	Stiffener	Side shellTrans frameWebStiffener	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of transverse frame web	8	Coating breakdown	2	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	128	Arrest & monitor CVI		Annual	8	2	4	64	50%
31	Side shell	Trans frame	Flange		Side shellTrans frameFlange	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Overstress / buckling / deformation of transverse frame	8	Coating breakdown	3	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	192	Arrest & monitor CVI		Annual	8	2	4	64	67%
32	Side shell	Stringer 1,2,3	Web		Side shellStringer 1,2,3Web	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of stringer	8	Coating breakdown	5	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	320	Arrest & monitor CVI+		Annual	8	3	4	96	70%
33	Side shell	Stringer 1,2,3	Web	Drain/m'hole	Side shellStringer 1,2,3WebDrain/m'hole	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of stringer	5	Coating breakdown	3	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	120	Arrest & monitor CVI		Annual	5	2	4	40	67%
34	Side shell	Stringer 1,2,3	Web	Access/Peno	Side shellStringer 1,2,3WebAccess/Peno	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of stringer	5	Coating breakdown	3	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	120	Arrest & monitor CVI		Annual	5	2	4	40	67%
35	Side shell	Stringer 1,2,3	Flange		Side shellStringer 1,2,3Flange	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of stringer	8	Coating breakdown	5	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	320	Arrest & monitor CVI+		Annual	8	3	4	96	70%
36	Long'l bhd	Panel	Plate		Long'l bhdPanelPlate	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Loss of WB / Cargo containment	8	Coating breakdown	7	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	448	Arrest & monitor CVI+		Annual	8	3	4	96	79%
37	Long'l bhd	Panel	Long'l stiff'r	Web	Long'l bhdPanelLong'l stiff'rWeb	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of longitudinal stiffener	5	Coating breakdown	5	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	200	Arrest & monitor CVI		Annual	5	3	4	60	70%
38	Long'l bhd	Panel	Long'l stiff'r	Flange	Long'l bhdPanelLong'l stiff'rFlange	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of longitudinal stiffener	5	Coating breakdown	5	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	200	Arrest & monitor CVI		Annual	5	3	4	60	70%
39	Long'l bhd	Panel	Long'l stiff'r	Web & flange	Long'l bhdPanelLong'l stiff'rWeb & flange	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of longitudinal stiffener	5	Coating breakdown	7	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	280	Arrest & monitor CVI		Annual	5	3	4	60	79%
40	Long'l bhd	Panel	Long'l stiff'r	Drain/m'hole	Long'l bhdPanelLong'l stiff'rDrain/m'hole	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of longitudinal stiffener	5	Coating breakdown	3	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	120	Arrest & monitor CVI		Annual	5	3	4	60	50%
41	Long'l bhd	Panel	Insp Stringer	Web	Long'l bhdPanelInsp StringerWeb	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of stringer	8	Coating breakdown	2	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	128	Arrest & monitor CVI		Annual	8	1	4	32	75%

42	Long'l bhd	Panel	Insp Stringer	Flange	Long'l bhdPanelInsp StringerFlange	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of stringer	8	Coating breakdown	2	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	128	Arrest & monitor CVI		Annual	8	1	4	32	75%
43	Long'l bhd	Panel	Insp Stringer	Drain/m'hole	Long'l bhdPanelInsp StringerDrain/m'hol	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of stringer	5	Coating breakdown	2	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	80	None							
44	Long'l bhd	Panel	Insp Stringer	Access/Peno	Long'l bhdPanelInsp StringerAccess/Peno	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of stringer	5	Coating breakdown	2	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	80	None							
45	Long'l bhd	Panel	Insp Stringer	Flat bar stiff'r	Long'l bhdPanelInsp StringerFlat bar stiff'	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of stringer	5	Coating breakdown	2	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	80	None							
46	Long'l bhd	Panel	Insp Stringer	Bracket	Long'l bhdPanelInsp StringerBracket	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of stringer	8	Coating breakdown	2	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	128	Arrest & monitor CVI		Annual	8	2	4	64	50%
47	Long'l bhd	Trans frame	Web		Long'l bhdTrans frameWeb	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of transverse frame	8	Coating breakdown	2	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	128	Arrest & monitor CVI		Annual	8	2	4	64	50%
48	Long'l bhd	Trans frame	Web	Access/Peno	Long'l bhdTrans frameWebAccess/Peno	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of transverse frame web	5	Coating breakdown	2	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	80	None							
49	Long'l bhd	Trans frame	Web	Stiffener	Long'l bhdTrans frameWebStiffener	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of transverse frame	8	Coating breakdown	2	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	128	Arrest & monitor CVI		Annual	8	2	4	64	50%
50	Long'l bhd	Trans frame	Flange		Long'l bhdTrans frameFlange	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Overstress / buckling / deformation of transverse frame	8	Coating breakdown	2	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	128	Arrest & monitor CVI		Annual	8	2	4	64	50%
51	Long'l bhd	Stringer 1,2,3	Web		Long'l bhdStringer 1,2,3Web	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of stringer	8	Coating breakdown	5	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	320	Arrest & monitor CVI+		Annual	8	3	4	96	70%
52	Long'l bhd	Stringer 1,2,3	Web	Drain/m'hole	Long'l bhdStringer 1,2,3WebDrain/m'hol	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of stringer	5	Coating breakdown	3	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	120	Arrest & monitor CVI		Annual	5	2	4	40	67%
53	Long'l bhd	Stringer 1,2,3	Web	Access/Peno	Long'l bhdStringer 1,2,3WebAccess/Peno	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of stringer	5	Coating breakdown	3	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	120	Arrest & monitor CVI		Annual	5	2	4	40	67%
54	Long'l bhd	Stringer 1,2,3	Flange		Long'l bhdStringer 1,2,3Flange	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of stringer	8	Coating breakdown	5	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	320	Arrest & monitor CVI+		Annual	8	3	4	96	70%
55	Btm shell	Panel	Plate		Btm shellPanelPlate	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Loss of WB containment	8	Coating breakdown	7	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	448	Arrest & monitor CVI+			8	3	4	96	79%
56	Btm shell	Panel	Long'l stiff'r	Web	Btm shellPanelLong'l stiff'rWeb	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of longitudinal stiffener	5	Coating breakdown	5	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	200	Arrest & monitor CVI		Annual	5	3	4	60	70%

57	Btm shell	Panel	Long'l stiff'r	Flange	Btm shellPanelLong'l stiff'rFlange	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of longitudinal stiffener	5	Coating breakdown	5	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	200	Arrest & monitor CVI		Annual	5	3	4	60	70%
58	Btm shell	Panel	Long'l stiff'r	Web & flange	Btm shellPanelLong'l stiff'rWeb & flange	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of longitudinal stiffener	5	Coating breakdown	7	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	280	Arrest & monitor CVI		Annual	5	3	4	60	79%
59	Btm shell	Panel	Long'l stiff'r	Drain/m'hole	Btm shellPanelLong'l stiff'rDrain/m'hole	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of longitudinal stiffener	5	Coating breakdown	3	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	120	None							
60	Btm shell	Trans frame	Web		Btm shellTrans frameWeb	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of transverse frame	8	Coating breakdown	3	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	192	Arrest & monitor CVI		Annual	8	2	4	64	67%
61	Btm shell	Trans frame	Flange		Btm shellTrans frameFlange	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Overstress / buckling / deformation of transverse frame	8	Coating breakdown	3	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	192	Arrest & monitor CVI		Annual	8	2	4	64	67%
62	Trans bhd	Panel	Plate		Trans bhdPanelPlate	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Loss of WB containment	8	Coating breakdown	5	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	320	Arrest & monitor CVI+		Annual	8	3	4	96	70%
63	Trans bhd	Panel	Plate	Collar	Trans bhdPanelPlateCollar	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Loss of WB containment	8	Coating breakdown	7	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	448	Arrest & monitor CVI+		Annual	8	3	4	96	79%
64	Trans bhd	Panel	Stiffener	Web	Trans bhdPanelStiffenerWeb	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of Trans bhd stiffener	5	Coating breakdown	5	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	200	Arrest & monitor CVI		Annual	5	3	4	60	70%
65	Trans bhd	Panel	Stiffener	Flange	Trans bhdPanelStiffenerFlange	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of Trans bhd stiffener	5	Coating breakdown	5	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	200	Arrest & monitor CVI		Annual	5	3	4	60	70%
66	Trans bhd	Panel	Stiffener	Bracket	Trans bhdPanelStiffenerBracket	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of Trans bhd stiffener	5	Coating breakdown	3	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	120	Arrest & monitor CVI		Annual	5	2	4	40	67%
67	Trans bhd	Panel	Insp Stringer	Web	Trans bhdPanelInsp StringerWeb	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of stringer	8	Coating breakdown	2	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	128	Arrest & monitor CVI		Annual	8	1	4	32	75%
68	Trans bhd	Panel	Insp Stringer	Flange	Trans bhdPanelInsp StringerFlange	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of stringer	8	Coating breakdown	2	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	128	Arrest & monitor CVI		Annual	8	1	4	32	75%
69	Trans bhd	Panel	Insp Stringer	Access/Peno	Trans bhdPanelInsp StringerAccess/Peno	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of stringer web	5	Coating breakdown	2	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	80	Arrest & monitor CVI		Annual	8	2	4	64	20%
70	Trans bhd	Panel	Insp Stringer	Flat bar stiff'r	Trans bhdPanelInsp StringerFlat bar stiff'r	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of stringer	5	Coating breakdown	2	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	80	None							
71	Trans bhd	Panel	Insp Stringer	Drain/m'hole	Trans bhdPanelInsp StringerDrain/m'hole	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of stringer	5	Coating breakdown	2	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	80	None							

72		Trans bhd	Stringer 1,2,3	Web		Trans bhdStringer 1,2,3Web	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of stringer	8	Coating breakdown	2	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	128	Arrest & monitor CVI		Annual	8	3	4	96	25%
73		Trans bhd	Stringer 1,2,3	Web	Drain/m'hole	Trans bhdStringer 1,2,3WebDrain/m'hole	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of stringer	5	Coating breakdown	2	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	80	None							
74		Trans bhd	Stringer 1,2,3	Flange		Trans bhdStringer 1,2,3Flange	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Buckling of stringer	8	Coating breakdown	2	8	Corrosion margin, allowable stress margins, ULS/ALS design, grillage effect, Class Periodical Survey Regulations	128	Arrest & monitor CVI		Annual	8	2	4	64	50%
75	Marine	Ballast syst	Lines	Ejector		Ballast systLinesEjector	Line perforated	Can't strip tank	8	Severe corrosion	7	6	Corrosion margin	336	Structural repair			5	2	4	40	88%
76		Ballast syst	Lines	Ejector	Bracket	Ballast systLinesEjectorBracket	Brackets fail	Pipe movement & eventual failure	8	Severe corrosion	5	6	Corrosion margin, allowable stress margins	240	Structural repair			5	2	4	40	83%
77		Ballast syst	Lines	Discharge	Bolts	Ballast systLinesDischargeBolts	Flange separates	Total failure of pump	8	Severe corrosion	7	8	Bolt material selection	448	Replace bolts			8	2	4	64	86%
78		Ballast syst	Lines	Discharge	Bracket	Ballast systLinesDischargeBracket	Brackets fail	Pipe movement & eventual failure	8	Severe corrosion	7	8	Corrosion margin, allowable stress margins	448	Structural repair			8	2	4	64	86%
79		Ballast syst	Lines	Sounding		Ballast systLinesSounding	Line perforated	Inability to do manual sounding if pipes misaligned	8	Severe corrosion	7	8	Corrosion margin	448	Structural repair			8	2	4	64	86%
80		Ballast syst	Lines	Sounding	Bracket	Ballast systLinesSoundingBracket	Brackets fail	Pipe movement & eventual failure	8	Severe corrosion	5	6	Corrosion margin, allowable stress margins	240	Structural repair			5	2	4	40	83%
81		Ballast syst	Lines	Hydraulic		Ballast systLinesHydraulic	Line perforated	Inability to operate valves	8	Severe corrosion	7	8	Corrosion margin	448	Structural repair			8	2	4	64	86%
82		Ballast syst	Lines	Hydraulic	Bracket	Ballast systLinesHydraulicBracket	Brackets fail	Pipe movement & eventual failure	8	Severe corrosion	5	6	Corrosion margin, allowable stress margins	150	Structural repair			5	2	4	40	73%
83		Ballast syst	CP protection	Anodes		Ballast systCP protectionAnodes	Insufficient CP protection	Accelerated corrosion of surrounding exposed steel	3	Anode excessively wasted	9	8	Anode design & location suitable for intended service.	216	Det assm't &/or repair		Standard	3	9	4	108	50%
84		Ballast syst	CP protection	Anodes	Bracket	Ballast systCP protectionAnodesBracket	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Brackets fail, anode falls & kills someone	10	Coating breakdown / uncoated bracket	3	6	Bracket design & coating- however not working for non-submerged anodes.	180	Det assm't &/or repair		Every manned entry	10	9	2	180	
85		Ballast syst	Access	Ladders,platf. etc.		Ballast systAccessLadders,platf. etc.	Local substantial or renewable corrosion weakens structure sufficiently to fail under normal loading conditions	Breaks under someone's weight or falls on someone	10	Coating breakdown	9	6	Corrosion margin, allowable stress margins	540	Removal + temporary access		Every manned entry	10	2	2	40	93%

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WBT SP FMECA — 3389 lg

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| Item No. | Assembly ID | Assembly Type | Frame [x] | Stiffener [y] | Structural Component | Dimensions (mm) Length [x] | Dimensions (mm) Height [z] | Datum Point Details: Nearest transverse member (THAT, THIS) | Datum Point Details: Longitudinal (S) distance (+aft to +fwd) | Datum Point Details: Nearest longitudinal member (DS, CSL, BHD) | Datum Point Details: Transverse (t) distance (+ve to +ve) | Anomaly: Anomaly Index | Anomaly: Anomaly Index [t] | As Built Thickness (mm) | Max Allowable Diminution (%) | Renewal Thickness (mm) | Substantial Asset Thickness (mm) | UTM Readings (mm): UM1 | UM2 | UM3 | UM4 | UM5 | UM6 | UM7 | UM8 | UM9 | UM10 | Average UTM Reading (mm) | (mm) | (%) | FLAG | Structural categorisation: Primary Structure | Secondary Structure | Load Structure | Detail Structure | Pre-action (generic): Sev | Occ | Det | RPN pre-action | Pre-action: Adj Sev pre | Adj RPN pre-action | Pre-action: Remarks/notes | Post-action (generic): Sev2 | Occ2 | Det2 | RPN post-action | Post-action (adjusted): Adj action | Adj Sev post | Adj RPN post-action | Subsidiary checks: Avg % diminution | Areas extends | Stress level (location on spec) | Probability / density of areas | Stress / buckle ratio? | Final action | Assessment notes |
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Item No.	Anomaly Type	Depth (mm)
67	AC	105.5
68	AC	8.2
69	AC	38.7
70	AC	8.2
71	AC	27.8
72	AC	3.1
73	AC	4.4
74	AC	5.3
75	AC	6.4
76	AC	3.4
77a	AC	42.7
77b	AC	53.4
78	AC	5.1
79	AC	5.4
80	AC	7.9
81	AC	5.4
82	AC	4.0
83	AC	3.4
84	AC	4.7
85	AC	6.5
86	AC	3.8
87	AC	3.1
88	AC	2.8
89a	AC	3.7
89b	AC	3.7
90	AC	3.4
91	AC	2.5
92	AC	3.7
93	AC	7.8
94	AC	4.4
95	AC	16.3
96	AC	12.3
97	AC	16.3
98	AC	16.3
99	AC	30.0
100	AC	5.9
101	AC	6.9
102	AC	4.9
103	AC	9.4
104	AC	49.8
105	AC	2.8
106	AC	15.1
107	AC	11.7
108	AC	4.4
109	AC	6.1
110	AC	3.4
111	AC	3.5
112	AC	0.7
113	AC	7.8
114	AC	16.8
115	AC	37.9
116	AC	18.4
117	AC	5.2
118	AC	117.6
119	AC	1.9
120	AC	3.7
121	AC	6.2
122	AC	3.5
123	AC	8.0
124	AC	6.0
125	AC	6.8
126	AC	3.2
127	AC	3.4
128	AC	4.2

Item No.	Anomaly ID	Anomaly Type	Frame(s)	Stiffener(s)	Structural Component	Length (l)	Width/Height (h)	Nearest transverse member (TWF, TBHD)	Longitudinal (l) distance (from tr mem)	Nearest longitudinal member (LL, CL, LBHD)	Transverse (t) distance (from lo mem)	Hazard	Hazard	As Built Thickness (mm)	Max Allowable Diminution (%)	Renewal Thickness (mm)	Substantial Corr Thickness (mm)
129	WBTSP-AN129	AC	TWF55	LS6	Flange	670	90	TWF55		1BHD23	1675		7.6	16.3	25	13.0	13.9
130	WBTSP-AN130	AC	TWF55	LS5	TWF Plate	500	180	TWF55		1BHD23	1940		19.7	24.3	20	19.2	20.4
131	WBTSP-AN131	AC	TWF50	LS8	Stiffener Web	170	130	TWF50	160	1BHD23	300		1.6	13.3	25	9.0	9.8
132	WBTSP-AN132	AC	TWF56	LS7	HP85	200	50	TWF56	130	SS	1900		1.0	13.3	25	9.6	10.6
133	WBTSP-AN133	AC	TWF56	LS6	TWF Plate	600	480	TWF56		1BHD23	3180		26.4	14.3	20	11.2	11.9
134	WBTSP-AN134	AC	TWF58	LS8	Stiffener Web	800	210	TWF58		1BHD23	3180		13.8	14.3	25	10.5	11.4
135	WBTSP-AN135	AC	TWF58	LS4	TWF Plate	450	200	TWF58		1BHD23	3155		5.8	13.3	25	9.8	10.6
136	WBTSP-AN136	AC	TWF57	LS5-LS6	TWF Plate	200	110	TWF57		SS	3450		3.6	16.3	20	12.8	13.8
137	WBTSP-AN137	AC	TWF58	LS7	HP85	500	150	TWF58		1BHD23	2600		8.4	13.3	25	9.8	10.6
138	WBTSP-AN138	AC	TWF58	LS5	HP85	2200	150	TWF58	1120	SS	3105		32.2	13.3	25	9.0	9.8
139	WBTSP-AN139	AC	TWF58	LS5	HP85	750	150	TWF58	400	SS	2100		10.6	13.3	25	9.0	9.8
140	WBTSP-AN140	AC	59	LS7	VP85	200	80	TBHD59		SS	2180		1.6	13.3	25	9.8	10.6
141	WBTSP-AN141	AC	59	LS7	VP85	200	40	TBHD59		1BHD23	1750		1.6	13.3	25	9.8	10.6
142	WBTSP-AN142	AC	59	LS7	VP85	100	180	TBHD59		1BHD23	870		1.0	13.3	25	9.6	10.6
143	WBTSP-AN143	AC	59	LS5-LS6	TWF Plate	1300	480	TBHD59		1BHD23			65.0	13.3	20	10.4	11.1
144	WBTSP-AN144	AC	59	LS5	TWF Plate	1270	450	TBHD59		1BHD23	200		55.7	13.3	20	10.4	11.1
145	WBTSP-AN145	AC	59	LS4-LS5	TWF Plate	450	290	TBHD59		1BHD23			13.6	13.3	20	10.4	11.1
146	WBTSP-AN146	AC	51-52	LS8	Stiffener Web	240	145	TWF52	1120	1BHD24			3.6	14.3	25	9.6	10.6
147	WBTSP-AN147	AC	51-52	LS7	LBHD Plate	460	320	TBHD51	1240	1BHD23			17.5	22.3	20	17.8	18.7
148	WBTSP-AN148	AC	51-52	LS7	Stiffener Web	460	130	TBHD51	1240	1BHD23			6.1	13.3	25	9.8	10.6
149	WBTSP-AN149	AC	51-52	LS7	Flange	830	90	TBHD51	1250	1BHD23	300		10.0	17.3	25	12.8	13.8
150	WBTSP-AN150	AC	51-52	LS7	Flange	390	90	TBHD51	370	1BHD24	300		4.7	17.3	25	12.8	13.8
151	WBTSP-AN151	AC	51-52	LS6-LS7	LBHD Plate	400	400	TBHD51	1000	1BHD23			27.8	22.3	20	17.8	18.7
152	WBTSP-AN152	AC	51-52	LS6	Stiffener Web	360	600	TBHD51	1100	1BHD23	450		20.3	13.3	25	9.0	9.8
153	WBTSP-AN153	AC	51-52	LS6	Stiffener Web	1500	460	TBHD51		1BHD23	440		77.7	13.3	25	9.0	9.8
154	WBTSP-AN154	AC	51-52	LS6	HP85	775	350	TBHD51	50	1BHD23	550		14.6	13.3	25	9.0	9.8
155	WBTSP-AN155	AC	51-52	LS6	HP85	1100	190	TBHD51		1BHD23	1100		20.7	13.3	25	9.0	9.8
156	WBTSP-AN156	AC	51-52	LS6	HP85	700	200	TBHD51	2100	1BHD24	1180		13.2	13.3	25	9.0	9.8
157	WBTSPWAN157	AC	52-53	LS8	Stiffener Web	320	120	TWF55	520	1BHD23	180		1.5	13.3	25	9.8	10.6
158	WBTSP-AN158	AC	52-53	LS8	Stiffener Web	250	170	TWF53	1055	1BHD23			5.0	13.3	25	9.8	10.6
159	WBTSP-AN159	AC	52-53	LS7	Stiffener Web	410	260	TWF53	2060	1BHD23			11.4	13.3	25	9.8	10.6
160	WBTSP-AN160	AC	52-53	LS6	Stiffener Web	750	1300	TWF53		1BHD24	840		91.8	13.3	25	9.0	9.8
161	WBTSP-AN161	AC	52-53	LS6	Stiffener Web	500	100	TWF53	800	1BHD23			7.9	13.3	25	9.0	9.8
162	WBTSP-AN162	AC	52-53	LS6	Stiffener Web	450	500	TWF53	1420	1BHD23	870		14.9	13.3	25	9.0	9.8
163	WBTSP-AN163	AC	52-53	LS6	Stiffener Web	370	150	TWF52	1100	1BHD23	670		8.0	13.3	25	9.0	9.8
164	WBTSP-AN164	AC	52-53	LS6	Stiffener Web	340	170	TWF52		1BHD23	830		8.6	13.3	25	9.0	9.8
165	WBTSP-AN165	AC	53-54	LS6	LBHD Plate	300	150	TWF53	2150	1BHD23			11.1	22.3	20	17.8	18.7
166	WBTSP-AN166	AC	53-54	LS8	Stiffener Web	350	230	TWF53	2150	1BHD23			8.2	13.3	25	9.8	10.6
167	WBTSP-AN167	AC	53-54	LS8	Stiffener Web	160	160	TWF53	1880	1BHD23	60		2.6	13.3	25	9.8	10.6
168	WBTSP-AN168	AC	53-54	LS7	Stiffener Web	330	230	TWF53	2230	1BHD23			6.7	13.3	25	9.8	10.6
169	WBTSP-AN169	AC	53-54	LS6	HP85	1000	230	TWF54	1420	1BHD23	1180		18.8	13.3	25	9.0	9.8
170	WBTSP-AN170	AC	54-55	LS8	Stiffener Web	350	160	TWF55	540	1BHD23	140		5.7	13.3	25	9.8	10.6
171	WBTSP-AN171	AC	54-55	LS8	Flange	90	450	TWF55	540	1BHD23	300		4.2	17.3	25	12.8	13.8
172	WBTSP-AN172	AC	56-57	LS8	Stiffener Web	250	250	TWF57	330	1BHD23	60		6.4	13.3	25	9.8	10.6
173	WBTSP-AN173	AC	56-57	LS8	Stiffener Bracket	300	250	TWF57	320	1BHD23	440		3.8	13.3	25	9.0	9.8
174	WBTSP-AN174	AC	56-57	LS5	Stiffener Web	400	160	TWF57	510	1BHD23	580		7.5	13.3	25	9.0	9.6
175	WBTSP-AN175	AC	56-57	LS6	Flange	450	200	TWF58	940	1BHD23	1075		8.1	13.3	25	9.0	9.8
176	WBTSP-AN176	AC	58-59	LS7	Stiffener Web	210	120	TBHD59		1BHD23			2.6	13.3	25	9.8	10.6
177	WBTSP-AN177	AC	58-59	LS7	Stiffener Web	360	350	TBHD58	615	1BHD23			7.7	13.3	25	9.8	10.6
178	WBTSP-AN178	AC	58-59	LS6	Stiffener Web	650	360	TBHD59		1BHD23			23.4	13.3	25	9.0	9.8
179	WBTSP-AN179	AC	58-59	LS6	HP85	600	130	TBHD59	50	1BHD23	550		6.2	13.3	25	9.0	9.8
180	WBTSP-AN180	AC	58-59	LS6	HP85	380	130	TBHD59		1BHD23	1075		2.6	13.3	25	9.0	9.8
181	WBTSP-AN181	AC	52-53	LS5	LBHD Plate	480	350	TWF53	1800	1BHD24			17.4	22.3	20	17.8	18.7
182	WBTSP-AN182	AC	56-57	LS1	Flange	250	130	TWF59	1780	1BHD23	500		3.1	17.3	25	13.8	13.8
183	WBTSP-AN183	AC	58-59	LS5-LS6	LBHD Plate	480	320	TBHD59		1BHD23			27.4	22.3	20	17.6	18.7
184	WBTSP-AN184	AC	FR58-59	LS5	Stiffener Web	370	500	TBHD59		1BHD23				13.3	25	9.8	10.6
185	WBTSP-AN185	AC	FR50	LS1-LS2	Harbour Stiffener	250	120	TWF50		SS	1000			13.3	25	9.0	9.8
186	WBTSP-AN186	CI	FR34 - 56	LS1 - LS8	Piping	N/A	N/A	TWF 55		LLBHD 23							
187	WBTSP-AN187	CI	FR54 - 58	LBLS3	Flange Studs	N/A	N/A	TWF 55		LLBHD 23							
188	WBTSP-AN188	CI	FR51 - 53	LS1 - LS8	Piping	N/A	N/A	TBHD 51		LLBHD 23							
189	WBTSP-AN189	CI	FR51 - 53	LS1 - LS8	Pipe Supports	N/A	N/A	TBHD 51		LLBHD 23			#VALUE!				
190	WBTSP-AN190	BV	SPWBT	N/A	Ladders / access	N/A	N/A	Throughout tank		Throughout tank							
191	WBTSP-AN191	B	FR59	SL60	SL Web	1400	160	TBHD59		SL60							
192	WBTSP-AN192	3V	N/A	N/A	Anodes	N/A	N/A	Throughout tank		Throughout tank			#VALUE!				
193	WBTSP-AN193	AC	FR52	LR6-68	TWF Plate	850	450	FR52	950	Long'l Bhd	400		#VALUE!	13.3	20	10.4	11.1
194	WBTSP-AN194	AC	FR58	SL65	TWF Plate	700	200	FR58		Side Shell				13.3	20	10.4	11.1

Item No.	UT01	UT02	UT03	UT04	UT05	UT06	UT07	UT08	UT09	UT10	Average UTM Reading (mm)	(mm)	(%)	FLAG	Dim %	Primary Structure	Secondary Structure	Local Structure	Detail Structure	Sev	Occ	Det	RPN pre-action	Adj Occ pre	Adj RPN pre-action	Generic action	Sev2	Occ2	Det2	RPN post-action
129	12.9	12.2	9.0								9.4	6.6	41.5%	!	41.5%	Long'l bhd	Trans frame	Web	Stiffener	8	2	8	128			Arrest & monitor CVI	8	2	4	64
130	19.7	19.5	19.3								19.5	4.5	18.8%	SC	18.8%	Long'l bhd	Trans frame	Web		8	2	8	128			Arrest & monitor CVI	8	2	4	64
131	9.1	5.8	8.0								7.0	4.7	35.4%	!	35.4%	Long'l bhd	Trans frame	Web	Stiffener	8	2	8	128			Arrest & monitor CVI	8	2	4	64
132	8.7										8.7	4.3	33.1%	!	33.1%	Side shell	Trans frame	Web	Stiffener	8	2	8	128			Arrest & monitor CVI	8	2	4	64
133	6.9	6.7	7.4								6.3	7.7	54.8%	!	54.8%	Side shell	Trans frame	Web		8	3	8	192			Arrest & monitor CVI	8	2	4	64
134	8.1	9.8									8.9	5.3	36.8%	!	36.8%	Side shell	Trans frame	Web	Stiffener	8	2	8	128			Arrest & monitor CVI	8	2	4	64
135	6.0	7.8	8.5	8.9	9.3						8.1	4.6	36.0%	!	36.0%	Side shell	Trans frame	Web		8	3	8	192			Arrest & monitor CVI	8	2	4	64
136	13.0										13.0	3.0	18.8%	SC	18.8%	Side shell	Trans frame	Web		8	3	8	192			Arrest & monitor CVI	8	2	4	64
137	3.0	6.0									3.5	9.8	73.7%	!	53.8%	Long'l bhd	Trans frame	Web	Stiffener	8	2	8	128			Arrest & monitor CVI	8	2	4	64
138	3.0	3.0	2.0	3.5	1.7						1.8	11.2	84.7%	!	75.0%	Side shell	Trans frame	Web	Stiffener	8	2	8	128			Arrest & monitor CVI	8	2	4	64
139	3.1	5.8	3.1	5.5	2.5						3.0	10.0	81.0%	!	76.4%	Side shell	Trans frame	Web	Stiffener	8	2	8	128			Arrest & monitor CVI	8	2	4	64
140	6.0	6.7	3.0								5.7	7.8	55.7%	!	59.7%	Trans bhd	Panel	Stiffener	Web	5	5	8	200			Arrest & monitor CVI	5	3	4	60
141	6.0	7.5									6.5	7.8	59.6%	!	59.6%	Trans bhd	Panel	Stiffener	Web	5	5	8	200			Arrest & monitor CVI	5	3	4	60
142	6.6	6.7									6.4	6.9	51.2%	!	51.2%	Trans bhd	Panel	Stiffener	Web	5	5	8	200			Arrest & monitor CVI	5	3	4	60
143	9.0	7.3	8.9								7.4	3.0	40.1%	!	43.1%	Trans bhd	Panel	Plate		8	5	8	320			Arrest & monitor CVI+	8	3	4	96
144	10.9	11.9	9.8								10.9	2.1	16.4%	SC	16.4%	Trans bhd	Panel	Plate		8	5	8	320			Arrest & monitor CVI+	8	5	4	96
145	9.8	11.0	9.1								10.0	3.0	23.3%	!	23.3%	Trans bhd	Panel	Plate		8	5	8	320			Arrest & monitor CVI+	8	3	4	96
146	6.8	1.8									4.9	8.1	70.4%	!	47.7%	Long'l bhd	Panel	Long'l stiffy	Drain/m'hole	5	3	8	120			Arrest & monitor CVI	5	3	4	60
147	15.2	14.7									15.0	7.3	32.8%	!	32.8%	Long'l bhd	Panel	Plate		8	7	8	448			Arrest & monitor CVI+	8	3	4	96
148	8.8	9.3									8.9	4.3	31.9%	!	31.9%	Long'l bhd	Panel	Long'l stiffy	Web	5	5	8	200			Arrest & monitor CVI	5	3	4	60
149	13.4	13.7	14.8								13.7	3.3	19.4%	SC	19.4%	Long'l bhd	Panel	Long'l stiffy	Flange	5	5	8	200			Arrest & monitor CVI	5	3	4	60
150	13.8										13.8	3.2	18.8%	SC	18.8%	Long'l bhd	Panel	Long'l stiffy	Flange	5	5	8	200			Arrest & monitor CVI	5	3	4	60
151	18.0	18.9									17.5	4.8	20.7%	!	20.7%	Long'l bhd	Panel	Plate		8	7	8	448			Arrest & monitor CVI+	8	3	4	96
152	3.0	2.7									1.9	10.3	84.6%	!	77.5%	Long'l bhd	Panel	Long'l stiffy	Web	5	5	8	200			Arrest & monitor CVI	5	3	4	60
153	7.7	6.8	8.2	8.1	2						6.6	5.2	41.7%	!	31.8%	Long'l bhd	Panel	Insp Stringer	Flange	8	2	8	128			Arrest & monitor CVI	8	1	4	32
154	3.0	3.3	1.9	0.8	3.2						1.4	11.6	88.2%	!	73.3%	Long'l bhd	Panel	Insp Stringer	Flat bar stiff'r	5	2	8	80			None				
155	3.3	3.2	0.3	1	1.3						1.4	11.6	88.3%	!	73.3%	Long'l bhd	Panel	Insp Stringer	Web	8	2	8	128			Arrest & monitor CVI	8	1	4	32
156	3.1	3.8	1.6	1.4	1						1.6	10.4	86.8%	!	76.7%	Long'l bhd	Panel	Insp Stringer	Flange	8	2	8	128			Arrest & monitor CVI	8	1	4	32
157	7.3										7.1	3.9	45.4%	!	45.4%	Long'l bhd	Panel	Long'l stiffy	Web	5	5	8	200			Arrest & monitor CVI	5	3	4	60
158	5.4										5.4	7.6	58.5%	!	58.5%	Long'l bhd	Panel	Long'l stiffy	Drain/m'hole	5	3	8	120			Arrest & monitor CVI	5	3	4	60
159	1.6	1.9	0.9	2.0	2.0						1.7	11.3	87.1%	!	81.2%	Long'l bhd	Panel	Long'l stiffy	Drain/m'hole	5	3	8	120			Arrest & monitor CVI	5	3	4	60
160	6.0	6.4	6.5	7	7.2						6.6	3.4	44.8%	!	44.8%	Long'l bhd	Panel	Insp Stringer	Web	8	2	8	128			Arrest & monitor CVI	8	1	4	32
161	1.2	1.4									1.3	11.7	89.2%	!	XE	Long'l bhd	Panel	Insp Stringer	Drain/m'hole	5	2	8	80			None				
162	6.6	7.8									7.2	4.8	40.8%	!	40.0%	Long'l bhd	Panel	Insp Stringer	Web	8	2	8	128			Arrest & monitor CVI	8	1	4	32
163	8.0										8.0	4.0	33.3%	!	33.3%	Long'l bhd	Panel	Insp Stringer	Web	8	2	8	128			Arrest & monitor CVI	8	1	4	32
164	7.3	8.4									7.9	5.2	34.6%	!	34.6%	Long'l bhd	Panel	Insp Stringer	Web	8	2	8	128			Arrest & monitor CVI	8	1	4	32
165	18.8	15.0	18.6								17.5	4.3	19.1%	SC	19.1%	Long'l bhd	Panel	Plate		8	7	8	448			Arrest & monitor CVI+	8	3	4	96
166	8.3	7.2									7.7	5.3	40.8%	!	40.8%	Long'l bhd	Panel	Long'l stiffy	Drain/m'hole	5	3	8	120			Arrest & monitor CVI	5	3	4	60
167	9.7										9.7	3.3	25.4%	!	25.4%	Long'l bhd	Panel	Long'l stiffy	Web	5	5	8	200			Arrest & monitor CVI	5	3	4	60
168	8.0	13.8	11.8								10.1	2.9	22.1%	SC	22.1%	Long'l bhd	Panel	Long'l stiffy	Drain/m'hole	5	3	8	120			Arrest & monitor CVI	5	3	4	60
169	1.3	1.1	3.2	2.6	1.4						1.9	11.1	84.0%	!	75.8%	Long'l bhd	Panel	Insp Stringer	Flange	8	2	8	128			Arrest & monitor CVI	8	1	4	32
170	9.0	10.5									9.8	3.3	25.9%	SC	25.9%	Long'l bhd	Panel	Long'l stiffy	Web	5	5	8	200			Arrest & monitor CVI	5	3	4	60
171	10.5	12.0									11.7	5.6	31.2%	!	31.2%	Long'l bhd	Panel	Long'l stiffy	Flange	5	5	8	200			Arrest & monitor CVI	5	3	4	60
172	9.1	10.2									9.7	3.4	25.8%	!	25.8%	Long'l bhd	Panel	Long'l stiffy	Web	5	5	8	200			Arrest & monitor CVI	5	3	4	60
173	4.0	7.3									5.6	6.5	53.8%	!	53.8%	Long'l bhd	Trans frame	Web	Stiffener	8	2	8	128			Arrest & monitor CVI	8	2	4	64
174	8.1	7.3									7.7	4.6	36.3%	!	36.3%	Long'l bhd	Panel	Insp Stringer	Access/Pene	5	2	8	80			None				
175	1.2	2.4	1.8	1	1.2						1.5	11.8	88.5%	!	80.0%	Long'l bhd	Panel	Insp Stringer	Flange	8	2	8	128			Arrest & monitor CVI	8	1	4	32
176	1.0										1.0	12.0	91.3%	!	XE	Long'l bhd	Panel	Long'l stiffy	Drain/m'hole	5	3	8	120			Arrest & monitor CVI	5	3	4	60
177	4.0	4.7									4.4	8.7	66.9%	!	66.5%	Long'l bhd	Panel	Long'l stiffy	Drain/m'hole	5	3	8	120			Arrest & monitor CVI	5	3	4	60
178	4.1	5.7	8.6								6.1	5.9	48.3%	!	48.3%	Long'l bhd	Panel	Insp Stringer	Web	8	2	8	128	5	320	Arrest & monitor CVI	8	1	4	32
179	1.8										1.8	16.2	85.4%	!	XE	Long'l bhd	Panel	Insp Stringer	Flat bar stiff'r	5	2	8	80			None				
180	1.0										1.0	11.0	91.7%	!	XE	Long'l bhd	Panel	Insp Stringer	Flange	8	2	8	128			Arrest & monitor CVI	8	1	4	32
181	16.9	18.0									17.5	4.6	20.7%	!	20.7%	Long'l bhd	Panel	Plate		8	7	8	448			Arrest & monitor CVI+	8	3	4	96
182	10.0										10.0	7.0	41.2%	!	41.2%	Long'l bhd	Panel	Long'l stiffy	Flange	5	5	8	200			Arrest & monitor CVI	5	3	4	60
183	16.9	17.0	18.8								17.6	4.4	20.2%	!	20.2%	Long'l bhd	Panel	Plate		8	7	8	448			Arrest & monitor CVI+	8	3	4	96
184	9.0	6.6	10.5								8.7	3.3	25.4%	!	25.4%	Long'l bhd	Panel	Long'l stiffy	Web	5	5	8	200			Arrest & monitor CVI	5	3	4	60
185	7.0										7.0	3.0	41.7%	!	41.7%	Side shell	Trans frame	Web	Stiffener	8	2	8	128			Arrest & monitor CVI	8	2	4	64
186															XE	Ballast syst	Lines	Ejector		8	7	8	448			Structural repair	6	2	4	48
187															XE	Ballast syst	Lines	Discharge	Bolts	8	7	8	448			Replace bolts	8	2	4	64
188															XE	Ballast syst	Lines	Sounding		8	7	8	448			Structural repair	8	2	4	64
189															XE	Ballast syst	Lines	Hydraulic		8	7	8	448			Structural repair	8	2	4	64
190															XE	Ballast syst	Access	Ladders, plat. etc.		10	9	6	540			Removal + temporary access	10	2	2	40
191															XL	Side shell	Panel	Long'l stiffy	Web & flange	5	7	8	280			Arrest & monitor CVI	5	3	4	60
192															XL	Ballast syst	CP protection	Anodes		3	9	8	216			Det assm't &/or repair	3	9	4	108
193	8.7	11.1	11.9	6.8	10.7	12.7	7.5	11.6			10.0	3.0	23.0%	!	23.0%	Long'l bhd	Trans frame	Web	Access/Pene	5	2	8	80			None				
194	7.0	10.4									8.7	4.6	35.1%	!	35.1%	Shear strake	Trans frame	Web		8	3	8	192			Arrest & monitor CVI	8	2	4	64

Item No.	Adj action	Adj Occ post	Adj RPN post-action	Avg % diminution	Anom extents	Stress level (location on span)	Proximity / density of anom.	Stress / buckling calc?	Final action	Assessment notes
129				41%	Local	Low	No	N	Arrest & monitor CVI	Corrosion of flange of transverse web frame horizontal stiffener just under deck. Refer TWF55 AN129 calc. Remaining 24/LN, A = 64%. At this location on span BHH40B SF= 26% of max. In addition stiffener is significantly oversized for this location as the same section is used lower down the frame. Post action RPN OK.
130				13%	Local	NA	No	N	Arrest & monitor CVI	Localised substantial corrosion of trans frame web plate, caused by anode located below. Post action RPN OK.
131				38%	Local	Low	No	N	Arrest & monitor CVI	Localised corrosion around bit scallop. Grind smooth & recoat. Post action RPN OK.
132				33%	Local	Low	No	N	Arrest & monitor CVI	Localised corrosion of 150x11 trans frame flat bar panel breaker stiffener. Located near deck under minimal pressure load. Stiffener is oversized for this location as same size stiffener is used lower down and for larger spans. Post action RPN OK.
133				55%	Local	NA	No	N	Arrest & monitor CVI	Localised renewable corrosion of trans frame web plate, caused by anode located below. Post action RPN OK.
134				37%	Local	Low	No	N	Arrest & monitor CVI	Localised web corrosion of 250x14/150x12 FxB L section. Note, stiff'r has fixed ends (refer midship section) not sniped as per anomaly report drawing. Conservatively assuming remaining web thickness approx 60% of original, however anomaly located at midspan where shear force is negligible. Post action RPN OK.
135				39%	Local	NA	No	N	Arrest & monitor CVI	Localised renewable corrosion of trans frame web plate. Post action RPN OK.
136				13%	Local	NA	No	N	Arrest & monitor CVI	Localised substantial corrosion of trans frame web plate, caused by anode located below. Post action RPN OK.
137				56%	Local	Low	No	N	Arrest & monitor CVI	Localised corrosion of 150x11 trans frame flat bar panel breaker stiffener. Located near deck under minimal pressure load. Stiffener is significantly oversized for this location as same size stiffener is used lower down and for larger spans. Post action RPN OK.
138				75%	Local	Low	No	N	Arrest & monitor CVI	Knife edging of FB edge stiffener for trans frame platform at SL55 level. Platform is effectively a very oversized stiffener (usually 2SE04). Not critical provided it is arrested. Post action RPN OK.
139				79%	Local	Low	No	N	Arrest & monitor CVI	Knife edging of FB panel stiffener for trans frame platform at SL55 level. Platform is effectively a very oversized stiffener (usually 2SE04). Not critical provided it is arrested. Post action RPN OK.
140				60%	Local	NA	No	N	Arrest & monitor CVI	Although significant wastage, this is very localised (approx 150mm) corrosion at base of stiffener connecting deck longitudinal to HSS7 on BH59. At this end of the bracket connection the stresses will be very low. Agree that likelihood of failure is remote. Post action RPN OK.
141				60%	Local	NA	No	N	Arrest & monitor CVI	Refer AN140
142				51%	Local	NA	No	N	Arrest & monitor CVI	Refer AN140
143	Det assm't &/or repair	5	160	40%	Local	Med	High	Y	Det assm't &/or repair	See AN178.
144				16%	Local	NA	Med	N	Arrest & monitor CVI+	Localised substantial corrosion of BH59, adjacent to AN143 (BH59 plate) & 134 (stiffener web), however provided it is arrested likelihood of failure is remote. Post action RPN OK.
145				23%	Local	NA	Med	N	Arrest & monitor CVI+	Localised corrosion marginally exceeding renewable limit of BH59, adjacent to AN144 (BH59 plate) & 134 (stiffener web) however provided it is arrested likelihood of failure is remote. Post action RPN OK.
146				48%	Local	Low	No	N	Arrest & monitor CVI	Anomaly isolated & localised to mouse hole. Post action RPN OK.
147				32%	Local	Med	High	Y	Arrest & monitor CVI+	Localised corrosion located on LBHD plate above SL57. Adjacent to AN148 (SL57 web), AN149-150 (SL57 flange) and AN151 (LBHD plate below SL57). Refer buckling calc SL57 AN147/148/149/151. Buckling strength acceptable. Post action RPN OK.
148				32%	Local	Med	High	Y	Arrest & monitor CVI	Refer AN147
149				19%	Local	Med	High	Y	Arrest & monitor CVI	Refer AN147
150				19%	Local	Med	High	Y	Arrest & monitor CVI	Refer AN147
151				21%	Local	Med	High	Y	Arrest & monitor CVI+	Refer AN147
152				78%	Local	Low	No	N	Arrest & monitor CVI	Localised corrosion two small pipe penetrations in inspection stringer web. Post action RPN OK.
153				34%	Local	Low	Med	Y	Arrest & monitor CVI	Localised corrosion on web at end of inspection stringer span. Adjacent to knife edge corrosion on flange AN154. Inspection stringer oversized + refer buckling calcs using 4.7mm web & 1.7mm flange. Post action RPN OK.
154	Arrest & CVI			73%	Local	Low	No	N	Arrest & CVI	Localised corrosion / knife edging at the sniped end of a flat bar stiffener. Post action RPN OK.
155				73%	Local	Low	Med	Y	Arrest & monitor CVI	Refer AN153.
156				77%	Local	Low	No	N	Arrest & monitor CVI	Knife edging of inspection stringer flat bar stiffener 700mm length. Web is intact. Refer previous buckling calcs showing that due to oversized nature of inspection stringer, capacity is OK. Post action RPN OK.
157	Arrest & monitor CVI+			45%	Local	High	No	Y	Arrest & monitor CVI+	The continuous longitudinal stiffeners only have brackets at the frames where there is a horizontal frame stiffener connection. Bracket serves only the trans frame web stiffener, but in reality also reduces the span & stresses in the stiffener. In addition buckling and stress checks have now been carried out assuming web thickness is 7mm and flange 14mm. Refer calc SL58 AN157. However as its presence introduces a stress concentration at its toe location with the potential for initiation of fatigue fracture, change action to CM +.
158				58%	Local	Low	No	N	Arrest & monitor CVI	Anomaly isolated & localised to mouse hole. Post action RPN OK.
159				81%	Local	Low	No	Y	Arrest & monitor CVI	All the readings are taken adjacent to the knife edge. Also extents shown are larger than the renewable region, there will be a band between the edge of the intact coating & start of the renewable region which is > renewable thickness. Conservatively assuming 6mm remaining web thickness and 14mm flange thickness buckling & stress checks OK. Refer calc SL57 AN159 Post action RPN OK.
160				45%	Local	Low	No	N	Arrest & monitor CVI	Average 45% web diminution over an area of approx 1.3m at end of inspection stringer span. Flange is intact. Refer earlier calcs showing adequate capacity of inspection stringer. Post action RPN OK.
161	Arrest & CVI			NE				N	Arrest & CVI	Arrest & monitor CVI.
162				40%	Local	Low	No	N	Arrest & monitor CVI	Very localised corrosion of inspection stringer web (<300mm dia) and just above renewable limit. Refer earlier calcs, buckling strength will be adequate. Post action RPN OK.
163				33%	Local	Low	No	N	Arrest & monitor CVI	Very localised corrosion of inspection stringer web (<500mm dia) and just above renewable limit. Refer earlier calcs, buckling strength will be adequate. Post action RPN OK.
164				35%	Local	Low	No	N	Arrest & monitor CVI	Very localised corrosion of inspection stringer web (<300mm dia) and just above renewable limit. Refer earlier calcs, buckling strength will be adequate. Post action RPN OK.
165				19%	Local	Low	Med	N	Arrest & monitor CVI+	Localised LBH plate substantial corrosion, adjacent to mouse hole & web corrosion on SL57 (AN166,167). Located near midspan of fixed end stiffener, therefore SF is minimal. Post action RPN OK.
166				41%	Local	Low	Med	N	Arrest & monitor CVI	Refer AN165
167				25%	Local	Low	Med	N	Arrest & monitor CVI	Refer AN165
168				22%	Local	Low	No	N	Arrest & monitor CVI	Anomaly isolated & localised to mouse hole. Post action RPN OK.
169				76%	Local	Low	No	N	Arrest & monitor CVI	Knife edging of inspection stringer flat bar stiffener 1000mm length. Web is intact. Refer previous buckling calcs showing that due to oversized nature of inspection stringer, capacity is OK. Post action RPN OK.
170	Arrest & monitor CVI+			25%	Local	Med	No	Y	Arrest & monitor CVI+	Refer AN157 & calc SL58 AN170/171
171	Arrest & monitor CVI+			31%	Local	Med	No	Y	Arrest & monitor CVI+	Refer AN157 & calc SL58 AN170/171
172				26%	Local	Med	No	N	Arrest & monitor CVI	Small, localised patch of corrosion in web of SL58, at end of span connection to FR57. Marginally exceeding renewable criteria. Post action RPN OK.
173				54%	Local	Low	Med	N	Arrest & monitor CVI	Anomaly is on trans frame panel stiffener fatigue bracket connection to SL58. No significant longitudinal load (local or global) likely to be seen in this location. Reprofile & arrest. Post action RPN OK.
174	Arrest & CVI			36%	Local	Low	No	N	Arrest & CVI	Localised corrosion around penetration. Post action RPN OK.
175				80%	Local	Low	No	N	Arrest & monitor CVI	Knife edging of inspection stringer flat bar stiffener 450mm length. Web is intact. Refer previous buckling calcs showing that due to oversized nature of inspection stringer, capacity is OK. Post action RPN OK.
176				NE	Local	Low	No	N	Arrest & monitor CVI	Anomaly isolated & localised to mouse hole. Post action RPN OK.
177				67%	Local	Low	No	N	Arrest & monitor CVI	Anomaly isolated & localised to mouse hole. Post action RPN OK.
178	Det assm't &/or repair	5	160	49%	Local	Med	High	Y	Det assm't &/or repair	Localised corrosion of inspection stringer web (49% average) at trans bhd boundary. Also adjacent to localised area of knife edging on flange (AN180), long'l bhd plate corrosion (33% AN183) and trans bhd plate corrosion (43% AN143). Using very conservative wasted web (5.9mm), flange (1.0) & plate values, web buckling calc fails by 117%. Refer LS insp Str AN178/180/183 calc. **Further assessment and / or repair required.**
179	Arrest & CVI			NE	Local	Low	No	N	Arrest & CVI	Knife edging of sniped end of inspection stringer FB web stiffener. Arrest & monitor CVI.
180	Det assm't &/or repair	5	160	NE	Local	Med	High	Y	Det assm't &/or repair	See AN178.
181				21%	Local	NA	No	N	Arrest & monitor CVI+	Localised corrosion on LBHD plate above SL5. Marginally exceeds renewable criteria. Post action RPN OK.
182				41%	Local	Med	No	Y	Arrest & monitor CVI	Refer calc SL51 AN182. Initially fails bending stress, and plate buckling stress criteria, but this is based on max BM for local loads. BM for local loads at location of anomaly is in fact approx 50% of max. Using this lower value, both these criteria pass comfortably. Post action RPN OK.
183	Det assm't &/or repair	5	160	20%	Local	Med	High	Y	Det assm't &/or repair	See AN178.
184				25%	Local	NA	Med	N	Arrest & monitor CVI	Localised corrosion marginally exceeding renewable limit of LBLS5 Web, adjacent to AN144 & 145 (BH59 plate) however provided it is arrested likelihood of failure is remote. Post action RPN OK.
185	Det assm't &/or repair	5	160	42%	Local	High	No	Y	Det assm't &/or repair	BM at approx 30% at 1/3 span of pinned end stiffeners. Similar to AN132. Requires further assessment or repair.
186				XE	Local	NA	No	N	Structural repair	Ballast pump air ejector lines, heavy corrosion & perforations above Str 1. Post action RPN OK.
187				XE	Local	NA	No	N	Replace bolts	Fwd & aft ballast pump discharge lines 100% coating breakdown + bolt failures. Post action RPN OK.
188				XE	Ext	NA	High	N	Structural repair	Sounding line 100% coating breakdown, severe corrosion, perforations, corroded & missing brackets. Line perforations & brackets require repair. Post action RPN OK.
189				XE	Ext	NA	High	N	Structural repair	Small bore hydraulic lines multiple brackets missing. Post action RPN OK.
190				XE	Ext	NA	High	N	Removal + temporary access	Ladders, back scratchers & handrails above Stringer 1 heavily corroded & pieces missing. Post action RPN OK.
191				XL	Local	High	No	N	Arrest & monitor CVI	Area of deformation of web approx 1400x40 deflected up to 45mm upwards at apex. Located on SL60 at end of span adjacent to BHD59. SL60 is 350x11/150x16. No corrosion present. No visible sign of deformation / impact on UWV survey of external shell at that location. No deformation or corrosion on SL60 on the other side of the bhd in WBT 6P. Recommend monitor. Post action RPN OK.
192				XL	Ext	NA	No	N	Det assm't &/or repair	Anode brackets above Stringer 2 heavily corroded, some broken with anodes detached / fallen. Further assessment required to determine action.
193	Arrest & CVI			23%	Local	Low	No	N	Arrest & CVI	Trans frame access opening - localised edge corrosion. Post action RPN OK.
194	Arrest & monitor CVI+			33%	Local	NA	High	N	Arrest & monitor CVI+	Detailed assessment. Renewable (33%) corrosion of transverse frame web at side shell connection to SL65. If arrested then probability of failure is unlikely. Recommend CVI+ due to location next to shear strake. Revised post action RPN OK.

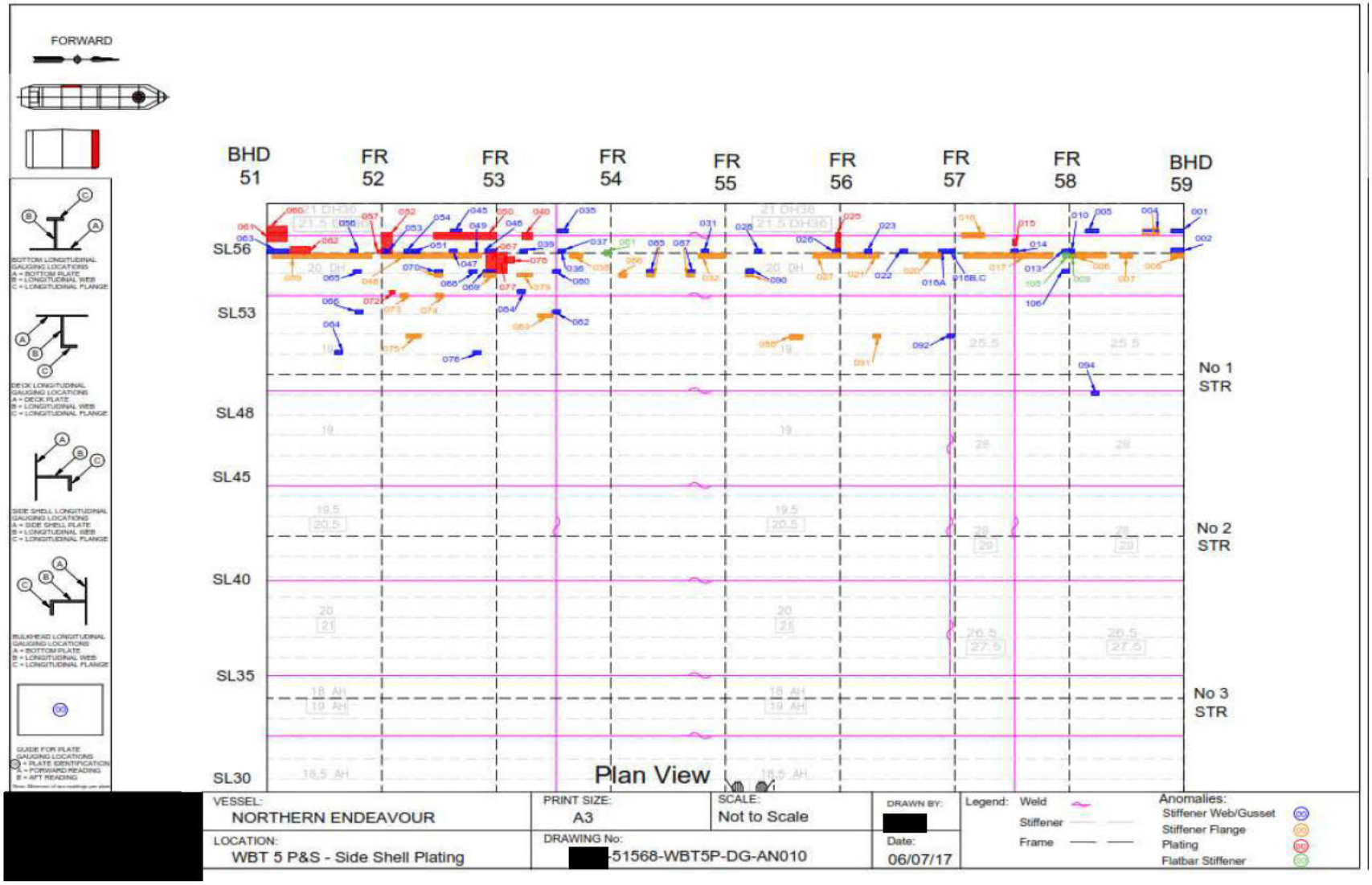
SUBJECT	NE FPSO WBT integrity management - WBT 5P FMECA Results summary	[redacted]	
PROJECT	NE FPSO Naval Architecture Support	SHEET NO:	20 of 28
		DATE	07-Feb-18
JOB NO.	[redacted]-01	BY	[redacted]
REF:	FSC-[redacted]-01-TEC-01-B2	CHECKED	TBC

The quantity of each risk mitigation action type required in order to mitigate WBT integrity risk to an acceptable level is:

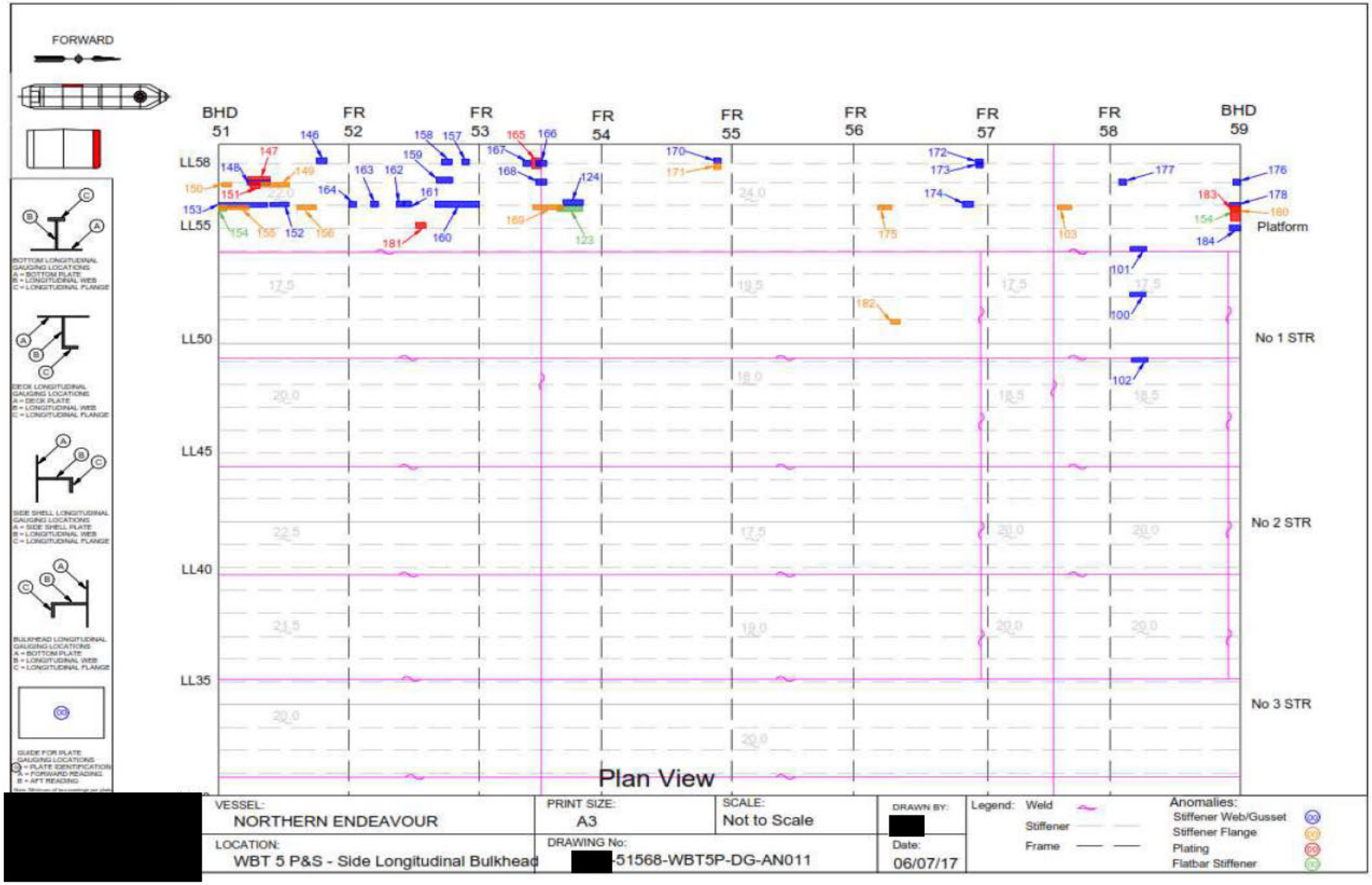
Mitigating action	Qty	Notes
Arrest & monitor CVI	128	Grind sharp edges smooth, blast, recoat to arrest corrosion & monitor annually (fly by CVI by ROV)
Arrest & monitor CVI+	37	Grind sharp edges smooth, blast, recoat to arrest corrosion & monitor annually (CVI + by ROV)
Arrest & GVI	18	Grind sharp edges smooth, blast, recoat to arrest corrosion. Annual GVI by ROV
Det assm't &/or repair	10	Carry out further assessment to determine most appropriate mitigation, or develop repair details
Structural repair	3	Hot or cold work repair - details TBC
Remove anode	0	During initial tank entry assess anodes & remove any for which the brackets have the potential to fail while people are in the
Replace anode	0	Replace anode and also brackets if required
Replace bolts	1	Replace bolts of suitable material
Removal + temporary access	1	Remove structure in danger of falling & put unsafe structures out of service - install temporary access aids at each manned entry
None	0	None required - however arrest & monitor will be minimum
Total anomalies	**198**	

SUBJECT	NE FPSO WBT integrity management - WBT 5P FMECA WBT 5P Anomaly Maps	[redacted]

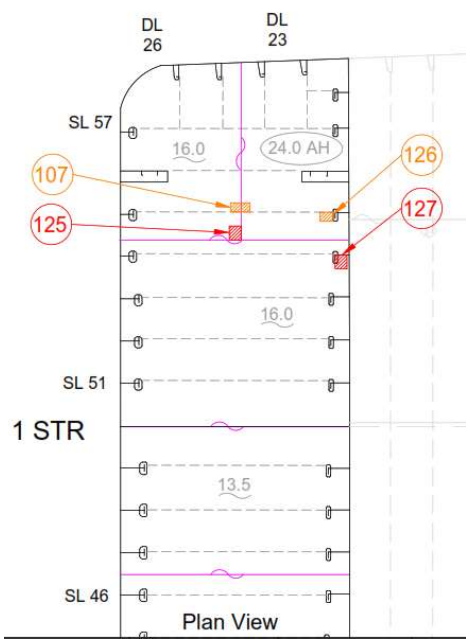
Side shell



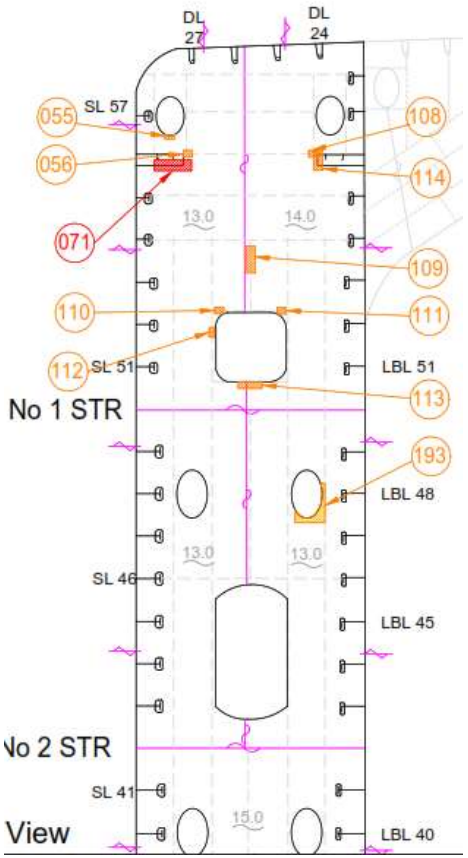
Longitudinal bulkhead



WTB Fr 51



Fr 52



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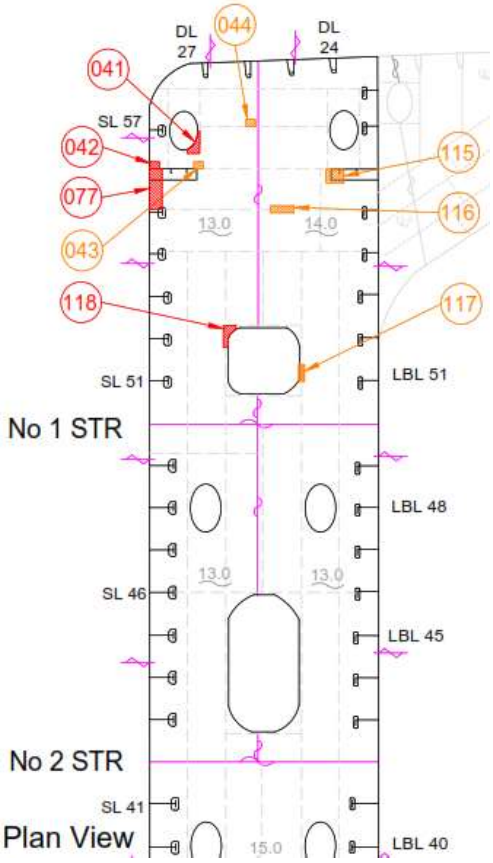

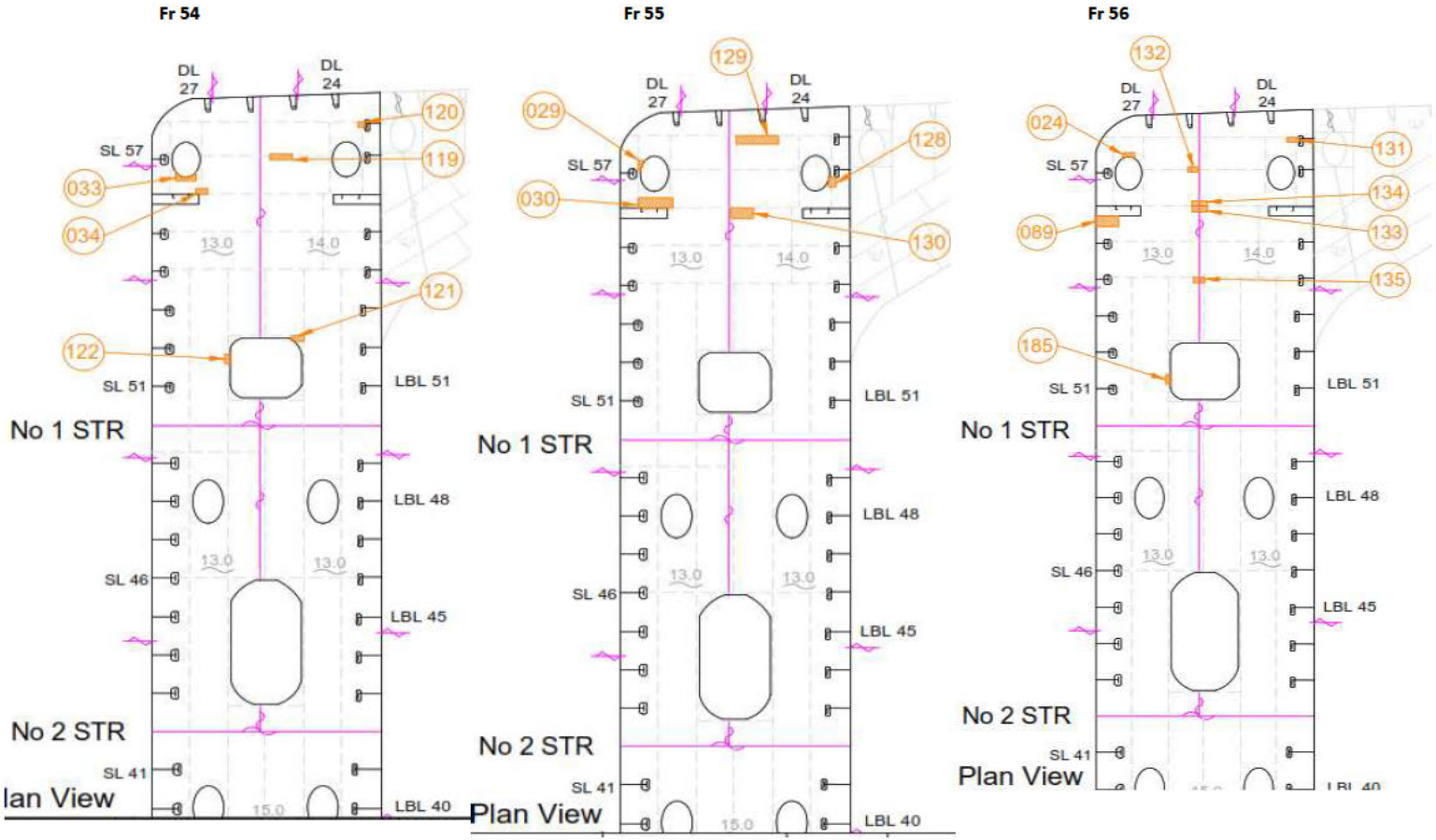
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119
SL 57
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034
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121
122
SL 51
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13.0
13.0
SL 46
LBL 45
No 2 STR
SL 41
LBL 40
15.0
lan View
Fr 55
129
DL 27
DL 24
029
128
SL 57
030
130
13.0
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13.0
SL 46
LBL 45
No 2 STR
SL 41
LBL 40
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Plan View
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SL 57
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14.0
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LBL 45
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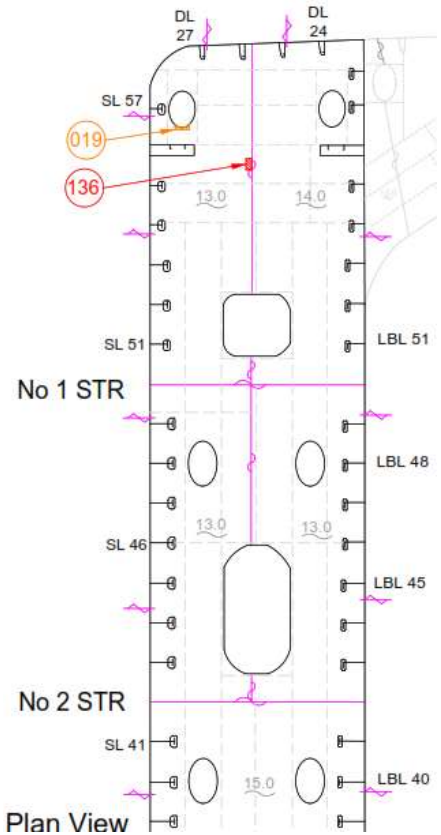
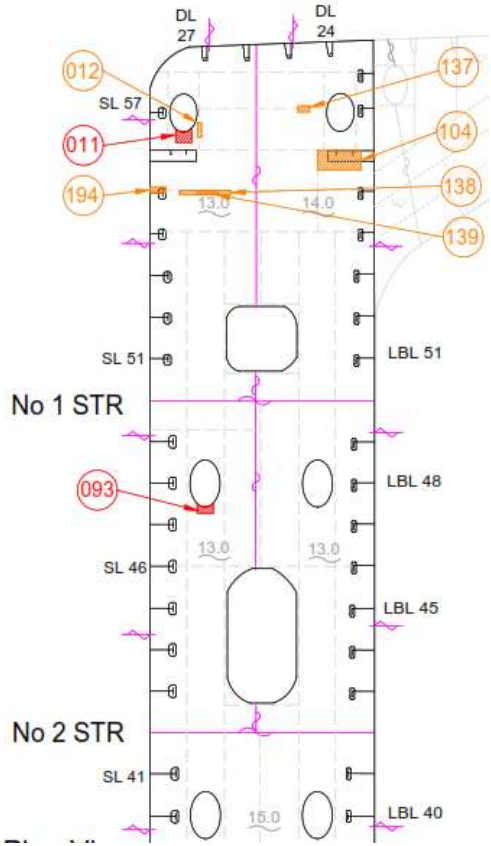
SL 41
Plan View

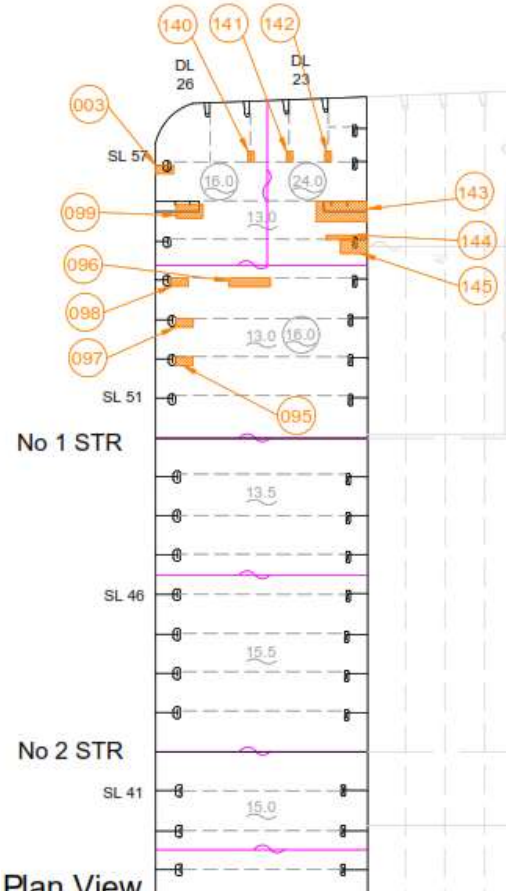
Fr 57



Fr 58



WTB 59

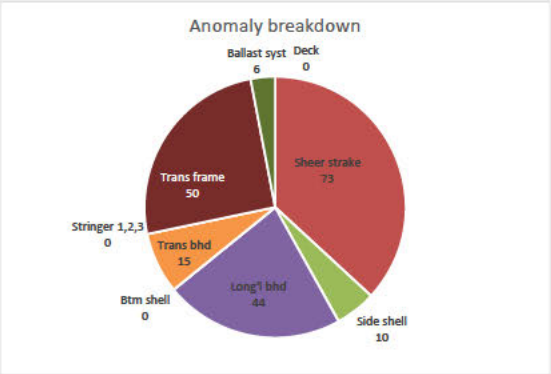


SUBJECT	NE FPSO WBT integrity management - WBT 5P FMECA Anomaly quantities

Sheet 6: Anomaly quantities by type of structure

				198				198
ID	Global	Primary	Secondary	Qty	Local	Detail		Qty
1		Deck	Panel		Plate		DeckPanelPlate	0
2		Deck	Panel		Long'l stiff'r	Web	DeckPanelLong'l stiff'rWeb	0
3		Deck	Panel	0	Long'l stiff'r	Flange	DeckPanelLong'l stiff'rFlange	0
4		Deck	Panel		Long'l stiff'r	Web & flange	DeckPanelLong'l stiff'rWeb & flange	0
5		Deck	Panel		Long'l stiff'r	Drain/m'hole	DeckPanelLong'l stiff'rDrain/m'hole	0
6		Deck	Trans frame	0	Web		DeckTrans frameWeb	0
7		Deck	Trans frame		Flange		DeckTrans frameFlange	0
8		Sheer strake	Panel		Plate		Sheer strakePanelPlate	15
9		Sheer strake	Panel		Long'l stiff'r	Web	Sheer strakePanelLong'l stiff'rWeb	1
10		Sheer strake	Panel		Long'l stiff'r	Flange	Sheer strakePanelLong'l stiff'rFlange	5
11		Sheer strake	Panel		Long'l stiff'r	Web & flange	Sheer strakePanelLong'l stiff'rWeb & flange	6
12		Sheer strake	Panel		Long'l stiff'r	Drain/m'hole	Sheer strakePanelLong'l stiff'rDrain/m'hole	6
13		Sheer strake	Panel	73	Insp Stringer	Web	Sheer strakePanelInsp StringerWeb	16
14		Sheer strake	Panel		Insp Stringer	Flange	Sheer strakePanelInsp StringerFlange	11
15		Sheer strake	Panel		Insp Stringer	Drain/m'hole	Sheer strakePanelInsp StringerDrain/m'hole	8
16		Sheer strake	Panel		Insp Stringer	Access/Peno	Sheer strakePanelInsp StringerAccess/Peno	0
17		Sheer strake	Panel		Insp Stringer	Flat bar stiff'r	Sheer strakePanelInsp StringerFlat bar stiff'r	3
18		Sheer strake	Panel		Insp Stringer	Bracket	Sheer strakePanelInsp StringerBracket	2
19		Sheer strake	Trans frame		Web		Sheer strakeTrans frameWeb	5
20		Sheer strake	Trans frame	15	Web	Access/Peno	Sheer strakeTrans frameWebAccess/Peno	6
21		Sheer strake	Trans frame		Web	Stiffener	Sheer strakeTrans frameWebStiffener	4
22		Sheer strake	Trans frame		Flange		Sheer strakeTrans frameFlange	0
23		Side shell	Panel		Plate		Side shellPanelPlate	0
24		Side shell	Panel		Long'l stiff'r	Web	Side shellPanelLong'l stiff'rWeb	0
25		Side shell	Panel	10	Long'l stiff'r	Flange	Side shellPanelLong'l stiff'rFlange	4
26		Side shell	Panel		Long'l stiff'r	Web & flange	Side shellPanelLong'l stiff'rWeb & flange	1
27		Side shell	Panel		Long'l stiff'r	Drain/m'hole	Side shellPanelLong'l stiff'rDrain/m'hole	5
28		Side shell	Trans frame		Web		Side shellTrans frameWeb	3
29		Side shell	Trans frame	16	Web	Access/Peno	Side shellTrans frameWebAccess/Peno	2
30		Side shell	Trans frame		Web	Stiffener	Side shellTrans frameWebStiffener	11
31		Side shell	Trans frame		Flange		Side shellTrans frameFlange	0
32		Side shell	Stringer 1,2,3		Web		Side shellStringer 1,2,3Web	0
33		Side shell	Stringer 1,2,3	0	Web	Drain/m'hole	Side shellStringer 1,2,3WebDrain/m'hole	0
34		Side shell	Stringer 1,2,3		Web	Access/Peno	Side shellStringer 1,2,3WebAccess/Peno	0
35		Side shell	Stringer 1,2,3		Flange		Side shellStringer 1,2,3Flange	0
36		Long'l bhd	Panel		Plate		Long'l bhdPanelPlate	5
37	Hull Girder	Long'l bhd	Panel		Long'l stiff'r	Web	Long'l bhdPanelLong'l stiff'rWeb	7
38		Long'l bhd	Panel		Long'l stiff'r	Flange	Long'l bhdPanelLong'l stiff'rFlange	4
39		Long'l bhd	Panel		Long'l stiff'r	Web & flange	Long'l bhdPanelLong'l stiff'rWeb & flange	0
40		Long'l bhd	Panel		Long'l stiff'r	Drain/m'hole	Long'l bhdPanelLong'l stiff'rDrain/m'hole	10
41		Long'l bhd	Panel	44	Insp Stringer	Web	Long'l bhdPanelInsp StringerWeb	7
42		Long'l bhd	Panel		Insp Stringer	Flange	Long'l bhdPanelInsp StringerFlange	6
43		Long'l bhd	Panel		Insp Stringer	Drain/m'hole	Long'l bhdPanelInsp StringerDrain/m'hole	1
44		Long'l bhd	Panel		Insp Stringer	Access/Peno	Long'l bhdPanelInsp StringerAccess/Peno	1
45		Long'l bhd	Panel		Insp Stringer	Flat bar stiff'r	Long'l bhdPanelInsp StringerFlat bar stiff'r	3
46		Long'l bhd	Panel		Insp Stringer	Bracket	Long'l bhdPanelInsp StringerBracket	0
47		Long'l bhd	Trans frame		Web		Long'l bhdTrans frameWeb	4
48		Long'l bhd	Trans frame	19	Web	Access/Peno	Long'l bhdTrans frameWebAccess/Peno	1
49		Long'l bhd	Trans frame		Web	Stiffener	Long'l bhdTrans frameWebStiffener	14
50		Long'l bhd	Trans frame		Flange		Long'l bhdTrans frameFlange	0
51		Long'l bhd	Stringer 1,2,3		Web		Long'l bhdStringer 1,2,3Web	0
52		Long'l bhd	Stringer 1,2,3	0	Web	Drain/m'hole	Long'l bhdStringer 1,2,3WebDrain/m'hole	0
53		Long'l bhd	Stringer 1,2,3		Web	Access/Peno	Long'l bhdStringer 1,2,3WebAccess/Peno	0
54		Long'l bhd	Stringer 1,2,3		Flange		Long'l bhdStringer 1,2,3Flange	0
55		Btm shell	Panel		Plate		Btm shellPanelPlate	0
56		Btm shell	Panel		Long'l stiff'r	Web	Btm shellPanelLong'l stiff'rWeb	0
57		Btm shell	Panel	0	Long'l stiff'r	Flange	Btm shellPanelLong'l stiff'rFlange	0
58		Btm shell	Panel		Long'l stiff'r	Web & flange	Btm shellPanelLong'l stiff'rWeb & flange	0
59		Btm shell	Panel		Long'l stiff'r	Drain/m'hole	Btm shellPanelLong'l stiff'rDrain/m'hole	0
60		Btm shell	Trans frame	0	Web		Btm shellTrans frameWeb	0
61		Btm shell	Trans frame		Flange		Btm shellTrans frameFlange	0
62		Trans bhd	Panel		Plate		Trans bhdPanelPlate	5
63		Trans bhd	Panel		Plate	Collar	Trans bhdPanelPlateCollar	1
64		Trans bhd	Panel		Stiffener	Web	Trans bhdPanelStiffenerWeb	3
65		Trans bhd	Panel		Stiffener	Flange	Trans bhdPanelStiffenerFlange	1
66		Trans bhd	Panel	15	Stiffener	Bracket	Trans bhdPanelStiffenerBracket	3
67		Trans bhd	Panel		Insp Stringer	Web	Trans bhdPanelInsp StringerWeb	0
68		Trans bhd	Panel		Insp Stringer	Flange	Trans bhdPanelInsp StringerFlange	0
69		Trans bhd	Panel		Insp Stringer	Access/Peno	Trans bhdPanelInsp StringerAccess/Peno	1
70		Trans bhd	Panel		Insp Stringer	Flat bar stiff'r	Trans bhdPanelInsp StringerFlat bar stiff'r	1
71		Trans bhd	Panel		Insp Stringer	Drain/m'hole	Trans bhdPanelInsp StringerDrain/m'hole	0
72		Trans bhd	Stringer 1,2,3		Web		Trans bhdStringer 1,2,3Web	0
73		Trans bhd	Stringer 1,2,3	0	Web	Drain/m'hole	Trans bhdStringer 1,2,3WebDrain/m'hole	0
74		Trans bhd	Stringer 1,2,3		Flange		Trans bhdStringer 1,2,3Flange	0
75		Ballast syst	Lines		Ejector		Ballast systLinesEjector	1
76		Ballast syst	Lines		Ejector	Bracket	Ballast systLinesEjectorBracket	0
77		Ballast syst	Lines		Discharge	Bolts	Ballast systLinesDischargeBolts	1
78		Ballast syst	Lines	4	Discharge	Bracket	Ballast systLinesDischargeBracket	0
79		Ballast syst	Lines		Sounding		Ballast systLinesSounding	1
80	Marine	Ballast syst	Lines		Sounding	Bracket	Ballast systLinesSoundingBracket	0
81		Ballast syst	Lines		Hydraulic		Ballast systLinesHydraulic	1
82		Ballast syst	Lines		Hydraulic	Bracket	Ballast systLinesHydraulicBracket	0
83		Ballast syst	CP protection	1	Anodes		Ballast systCP protectionAnodes	1
84		Ballast syst	CP protection		Anodes	Bracket	Ballast systCP protectionAnodesBracket	0
85		Ballast syst	Access	1	Ladders,platf. etc.		Ballast systAccessLadders,platf. etc.	1

Anomaly location	Qty	Percentage
Deck	0	0%
Sheer strake	73	37%
Side shell	10	5%
Long'l bhd	44	22%
Btm shell	0	0%
Trans bhd	15	8%
Stringer 1,2,3	0	0%
Trans frame	50	25%
Ballast syst	6	3%
TOTAL	198	100%



Anomaly location	Qty	Percentage
Deck plate	0	0%
Deck long'l stiff'r	0	0%
Sheer strake plate	15	8%
Sheer strake long'l. stiff'r	18	9%
Sheer strake insp. stringer	40	20%
Side shell plate	0	0%
Side shell long'l. stiff'r	10	5%
Long'g bhd plate	5	3%
Long'g bhd long'l stiff'r	21	11%
Long'g bhd insp. stringer	18	9%
Btm shell plate	0	0%
Btm shell long'l stiff'r	0	0%
Stinger 1,2,3	0	0%
Trans frame	50	25%
Trans bhd	15	8%
Ballast syst	6	3%
TOTAL	198	100%

Of which	Qty	Percentage
Drain or mousehole	30	15%
Access opening / penetration	11	6%
Flat bar stiff'r	7	4%

SUBJECT	NE FPSO WBT integrity management - WBT SP FMECA Data validation

Severity	Occurrence	Detectability (pre action)	Detectability (post action)
1	1	1	1
3	2	6	2
5	3	8	3
8	5	10	4
10	7		8
	9		10
	10		

Mitigation possibilities	
Arrest & monitor CVI	Grind sharp edges smooth, blast, recoat to arrest corrosion & monitor annually (fly by CVI by ROV)
Arrest & monitor CVI+	Grind sharp edges smooth, blast, recoat to arrest corrosion & monitor annually (CVI + by ROV)
Arrest & GVI	Grind sharp edges smooth, blast, recoat to arrest corrosion. Annual GVI by ROV
Det assm't &/or repair	Carry out further assessment to determine most appropriate mitigation, or develop repair details
Structural repair	Hot or cold work repair - details TBC
Remove anode	During initial tank entry assess anodes & remove any for which the brackets have the potential to fail while people are in the tank.
Replace anode	Replace anode and also brackets if required
Replace bolts	Replace bolts of suitable material
Removal + temporary access	Remove structure in danger of falling & put unsafe structures out of service - install temporary access aids at each manned entry
None	None required - however arrest & monitor will be minimum

Global	Primary	Secondary	Local	Detail
Hull Girder	Deck	Panel	Plate	Surface
	Sheer strake	Trans frame	Long'l stiff'r	Web
	Side shell	Stringer	Insp Stringer	Flange
	Long'l bhd	Lines	Web	Web & flange
	Btm shell	CP protection	Flange	Drain/m'hole
	Trans bhd	Access	Drain/m'hole	Access/Peno
	Ballast syst		Stiffener	Collar
			Bracket	Stiffener
			Ejector	Bracket
			Discharge	Flat bar stiff'r
			Sounding	Bolts
			Hydraulic	
			Anodes	
			Ladders,platf. etc.	