

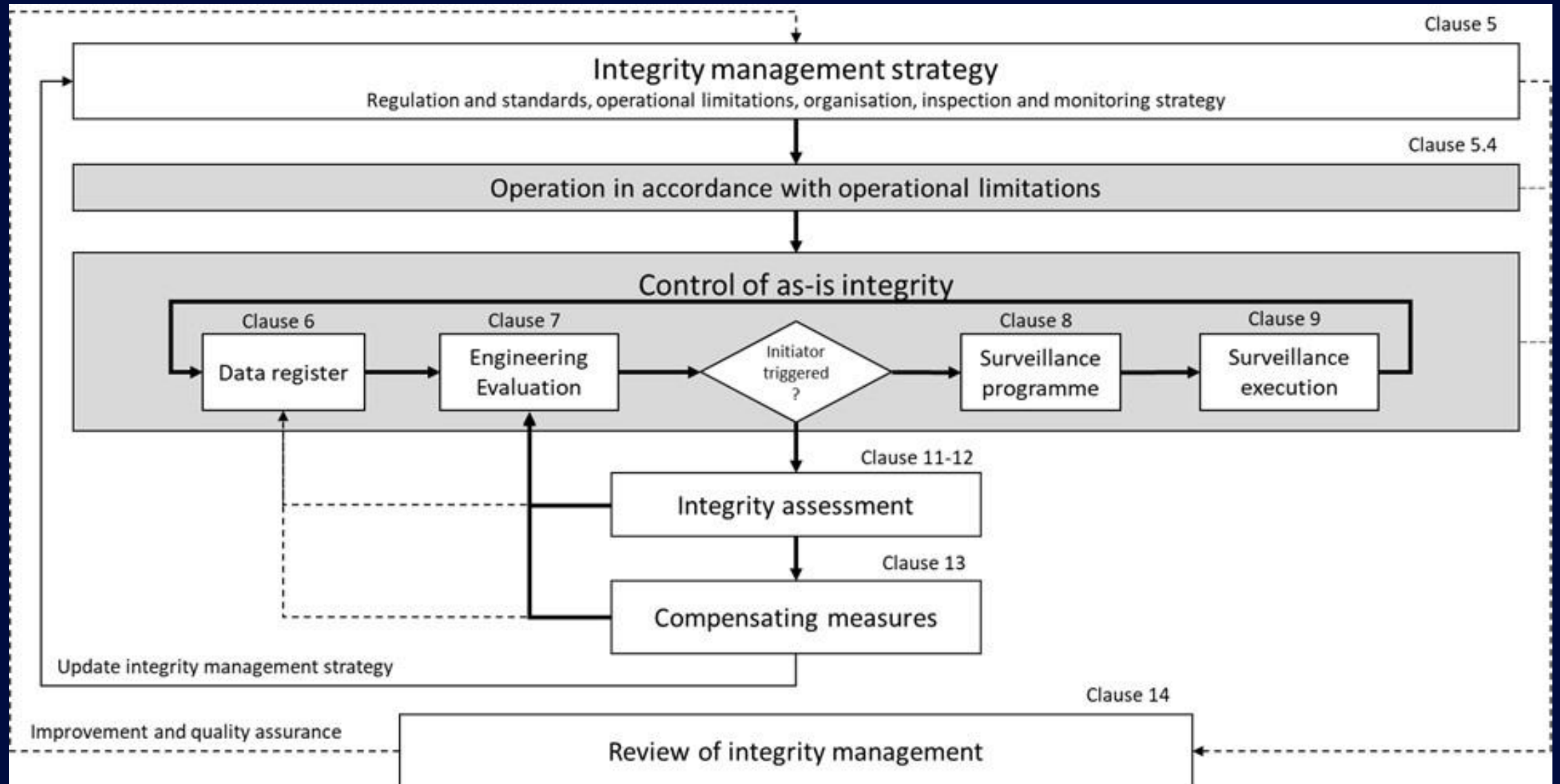
NORSOK N-005 Integrity management of offshore structures and marine systems

# Surveillance, evaluation, mitigation, repair and strengthening

- Integrity management process
- Surveillance programs
- Examples from an FPSO on the NCS
  - Inspection
  - Evaluation
  - Mitigation



# Integrity management process



## Establishing surveillance programs

- Surveillance: in-service activities concerned with detecting changes in condition, configuration, design regime, design actions and action effects
- Baseline inspection programme: A baseline inspection of the as-installed condition shall be carried out during the first year of operation, preferably after the first winter season.
- Framework inspection programme: Inspection intervals .... shall be planned according to the approaches given in Table 2.
  - Deterministic approach
  - Qualitative risk-based approach
  - Reliability based approach
  - Reliability based approach (with prior inspection results)



# Deterministic surveillance programs

- Intervals according to tables in annex B-H
- Example :
  - Inspection intervals for FPSO and FSO units (annex C)
  - Internally in hull (ballast tanks, cargotanks, voids, machineroom etc)
  - Similar table for external hull inspections
  - Topside covered by annex F

Table C.2 — Maximum internal inspection intervals (years)

	GVI	CVI <sup>a</sup>	NDT
Critical details with a documented short service life	-	-	<sup>b</sup> -
Critical areas (e.g. Internal fairlead structure, winch foundation, moonpool, turret)	-	6	<sup>b</sup> -
Attachment of secondary steel to main steel	-	6	-
Penetrations in severely stressed areas	-	6	-
Butt welds and block joints in severely stressed areas.	-	6	<sup>b</sup> -
Details (supports and penetrations) on main deck	-	6	-
Knuckle line details in outer and inner skin in severely stressed areas (may be inspected from ballast tank)	-	3	-
Pump sump in cargo tanks (may be inspected from ballast tank)	-	3	-
Ballast tanks	3	-	-
Cargo and slop tanks	6	-	-
Voids and other tanks <sup>c</sup>	6	-	-

<sup>a</sup> CVI should be performed according to intervals in this table, unless risk-based assessments have been performed and other intervals has been established. Selected areas to be inspected should be based on criticality, lack of access for GVI and findings from GVI

<sup>b</sup> Intervals to be decide based on e.g. RBI

<sup>c</sup> Voids with leakage detection systems and tanks containing non-corrosive fluids (e.g. diesel tanks) may increase the interval to 8 years based on risk evaluation showing low risk

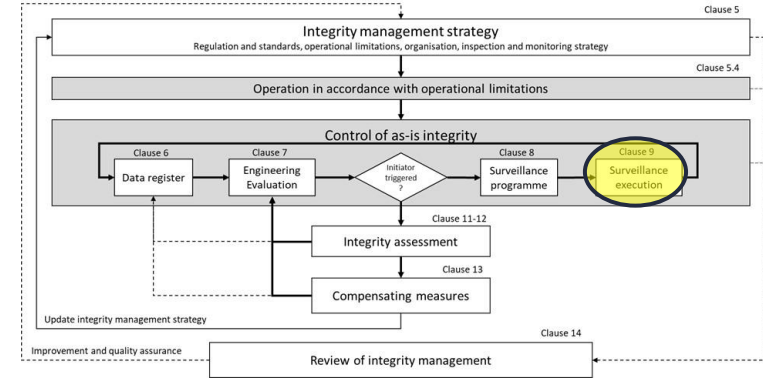
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# Surveillance execution

- 8.2.4 Special inspection

Special inspections shall be performed promptly as needed until they are incorporated into a revised version of the framework program or deemed unnecessary.



# Control of as is-integrity

- Register anomalies
- Evaluation of anomalies
- Assessment of integrity
- Update inspection program
- Perform new inspections

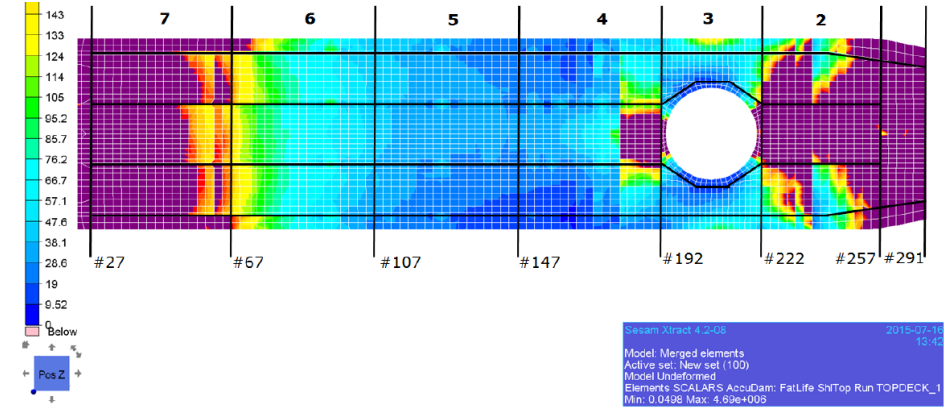
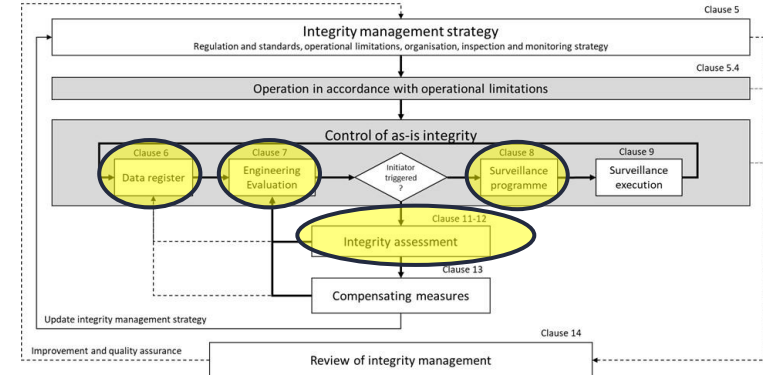
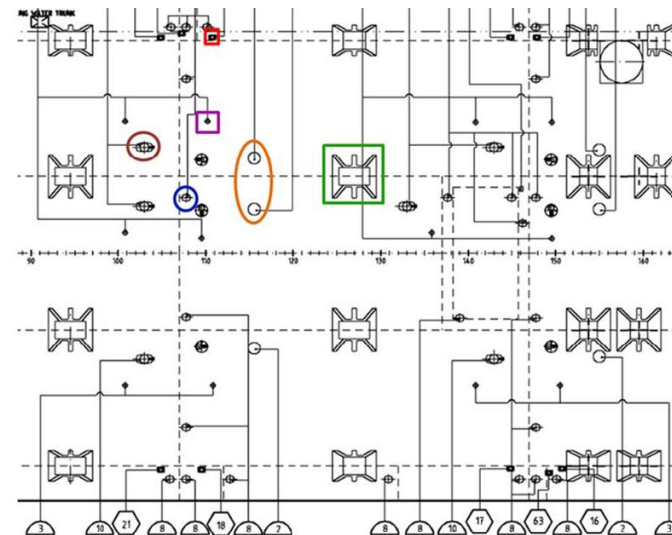


Figure 13-5 Fatigue lives - Tank boundaries highlighted

Table 13-4 Main deck attachments in cargo area – fatigue lives in years

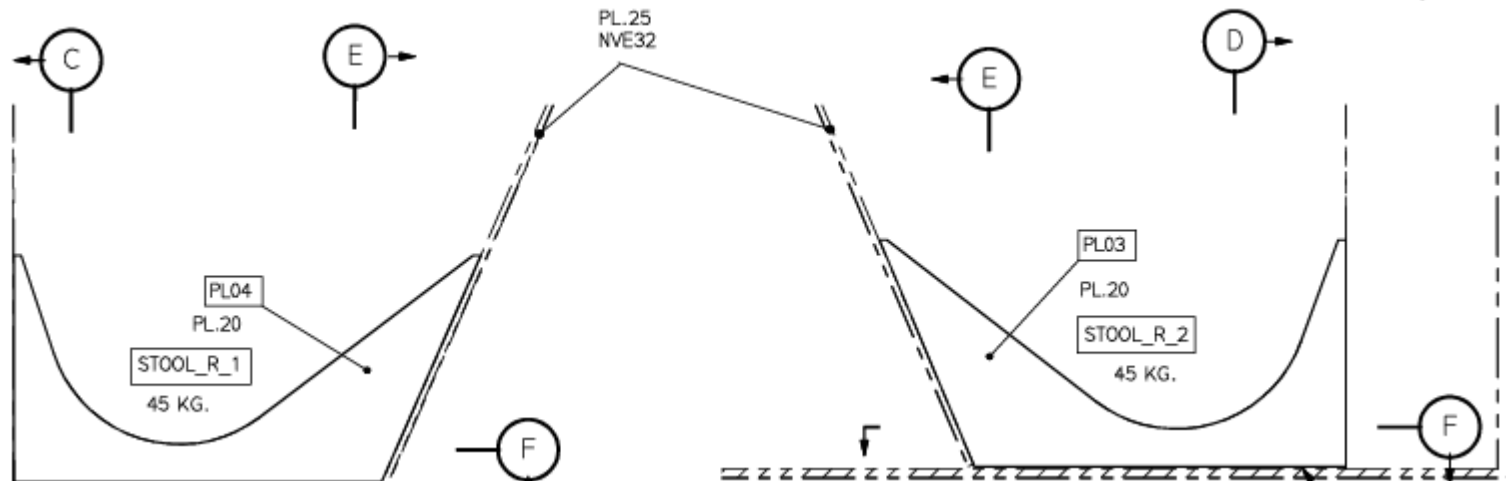
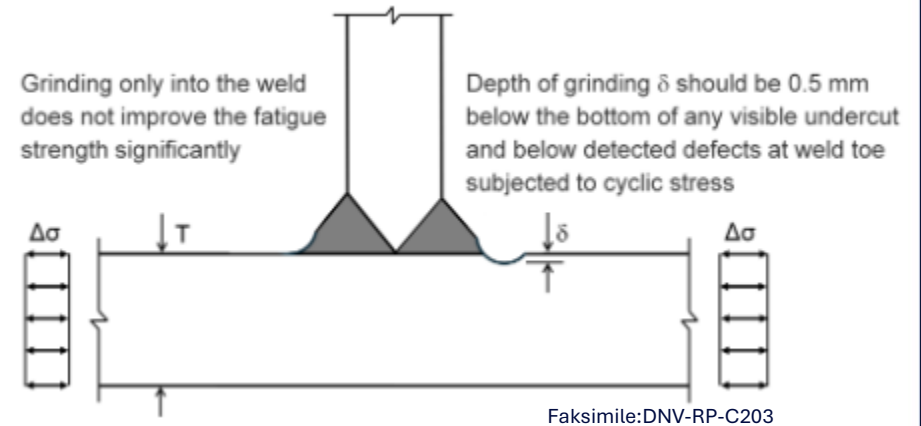
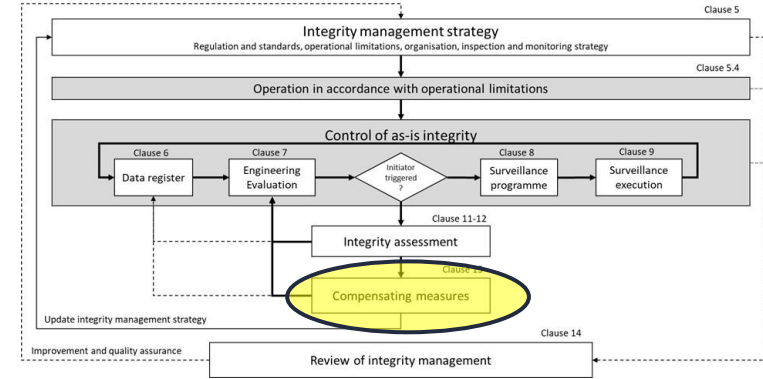
Detail	SN - Curve	SCF	Location (cargo area / ft)		
			No.6	No.5	No.4
			$K_{q1}K_{te}$ #67-#107	#107-#147	#147-#192
<b>Doubler plates</b>					
Doubler plates, $l < 300$ mm	F1	1.0		31 / 23*	31 / 27*
Doubler plates, $l > 300$ mm (ladder support)	F3	1.0	36		
<b>Weld connections to deck</b>					
Topside stools				25 / 12*	25 / 12*
Mooring chock & double bollard	F3	1.0	36		18
Fire wall brackets	F3	1.0		20 / 17*	
Walkway support (escape tunnel)	F3	1.0	36 / 36*	20 / 15*	20 / 18*
Gutter bar knuckle	D	6.67	< 1	< 1	< 1
Gutter bar – rectangular drain	F3	1	36	15	17
Gutter bar – circular drain	B2	2.4		20	24
Methanol injection skid	F3	1		36	
Foam tank support	F3	1			30

\* Fatigue life in way of WB tank



# Compensating measures

- Section 13  
Mitigations, repair and strengthening
  - Grinding (according to DNV-RP-C203) performed at 53 locations
  - Weld repair at two locations



# Summary, conclusions and recommendations

- «Failing to plan is planning to fail».
- «The best-laid plans of mice and men often go awry».
- «No plan survives first contact with the enemy».



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