BALLAST WATER MANAGEMENT SYSTEM RETROFIT

Conceptia Software Technologies Pvt. Ltd.

Naval Architecture & Marine Engineering Division

8/28/2019

TYPICAL PROJECT FLOW

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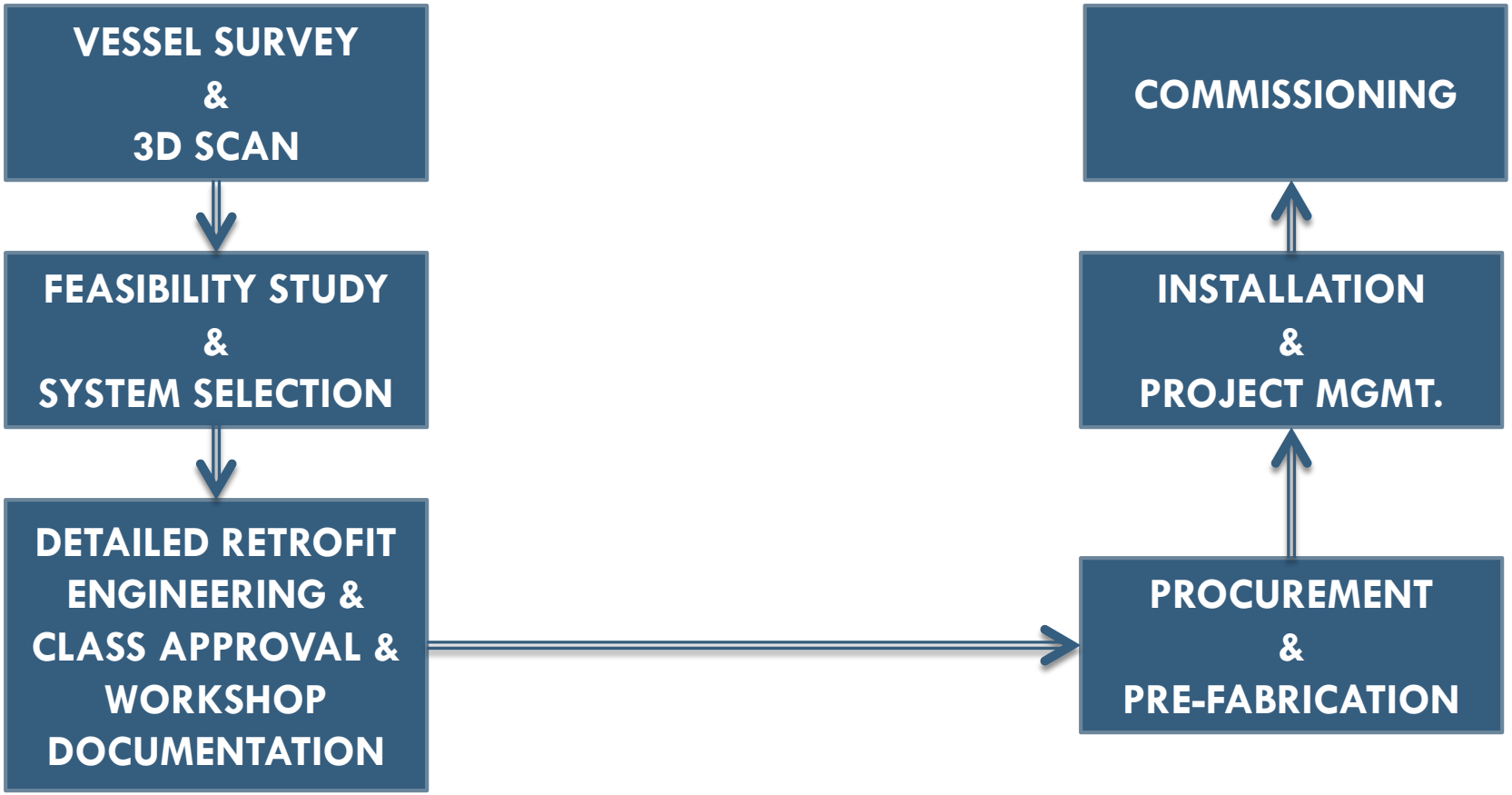

VESSEL SURVEY & 3D SCAN

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- Field experts from Conceptia would visit the vessel onboard to do a complete visual survey and interact with crew. This survey can be done even when the vessel is in service and thereby avoiding any associated downtimes.

- Onboard Survey is conducted with focus on following aspects:

  I. Space Availability
  II. Fresh Water
  III. Compressed Air Demands
  IV. Electrical Power Demand and Electrical connections
  V. Sludge discharges
  VI. Foundation and Structural Integration
  VII. Control System Integration
  VIII. 3D Scanning

VESSEL SURVEY & 3D SCAN

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- A 3D cloud points would be utilized in integrating BWMS with the existing system, as a reference.
- Conceptia will initiate feasibility study for retrofitting the vessel with BWMTS.
- The feasibility study is started out by integrating existing Ballast P&ID with BWTS.
- In the 3D scan, the basic 3D models of the equipment to be retrofitted and the piping models are modeled to work out the feasibility of the retrofitting the equipment onboard.

FEASIBILITY STUDY AND SYSTEM SELECTION

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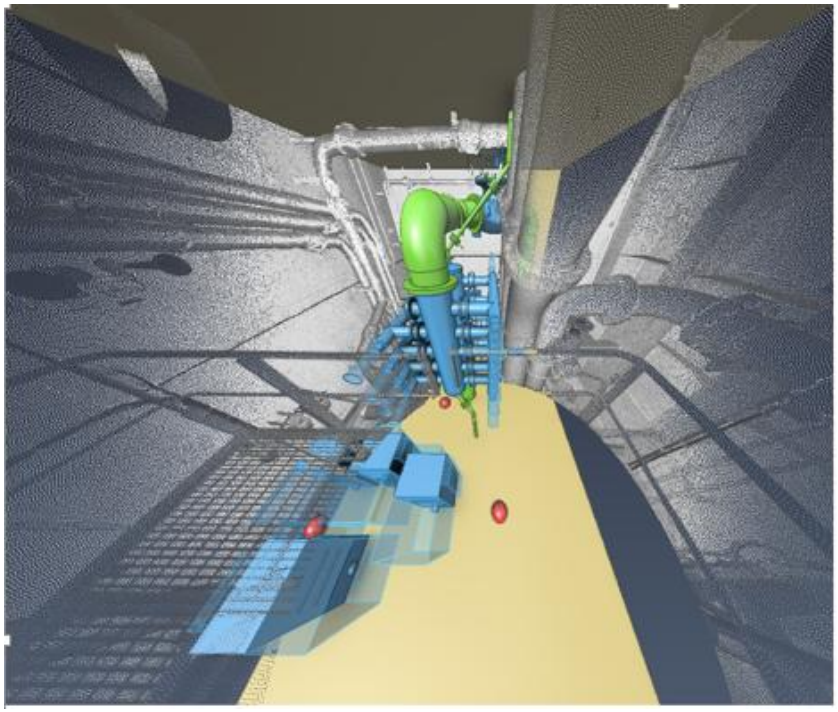
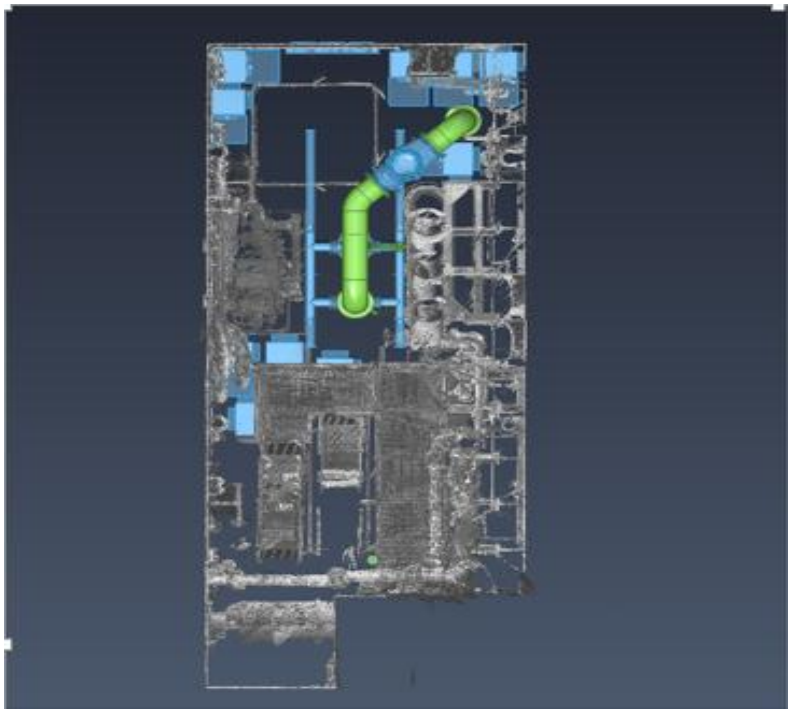
Few snaps from CADMATIC for the project that Conceptia is working on:





FEASIBLITY STUDY AND SYSTEM SELECTION

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- Based on the feasibility study, the customer would be provided with the best possible solution to successfully integrate the BWMS system considering the following aspects:

I. Selection of suitable BWTS by close communication with Equipment manufacturer and Ship Owner to suit their requirement.

II. Load balance calculation considering vessel's operating regimes and available power generator capacities onboard.

FEASIBILITY STUDY AND SYSTEM SELECTION

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I. Best location for the components of the equipment based on

   a. Spatial analysis in line with installation requirements of the equipment
   b. Suitability of existing ballast pumps with details on operating points based on flow analysis

FEASIBILITY STUDY AND SYSTEM SELECTION

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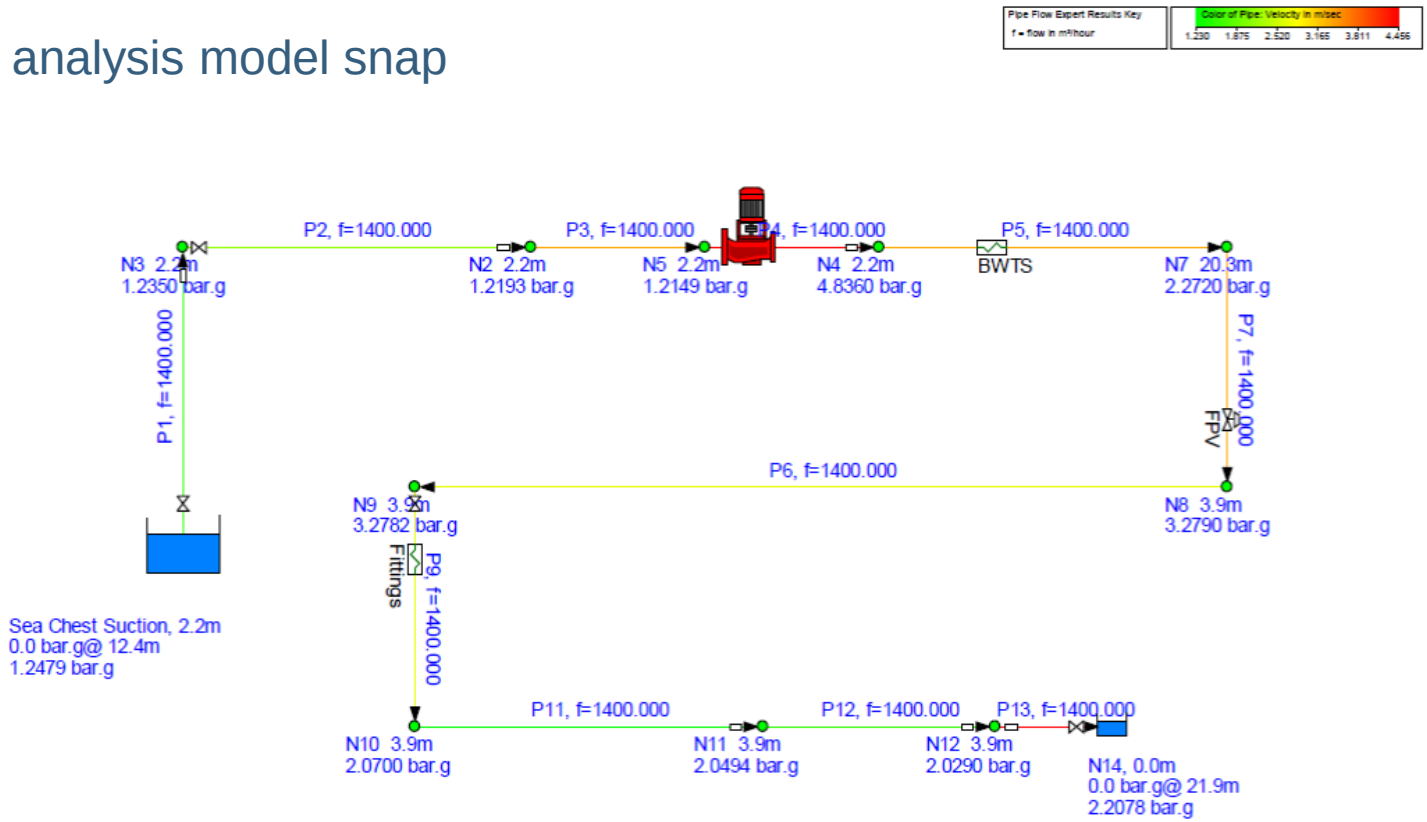
Flow analysis model snap



1. For the preliminary calculation, pressure drop for the whole BWTS is considered as a single component.

2. For the analysis, Flow Pressure Valve (FPV) is set to maintain the flow of 1400 m3/hr to be in line with the filter's maximum flow rate, though FPV is to maintain a flow rate of 1503 m3/hr (in IMO mode).

FEASIBILITY STUDY AND SYSTEM SELECTION

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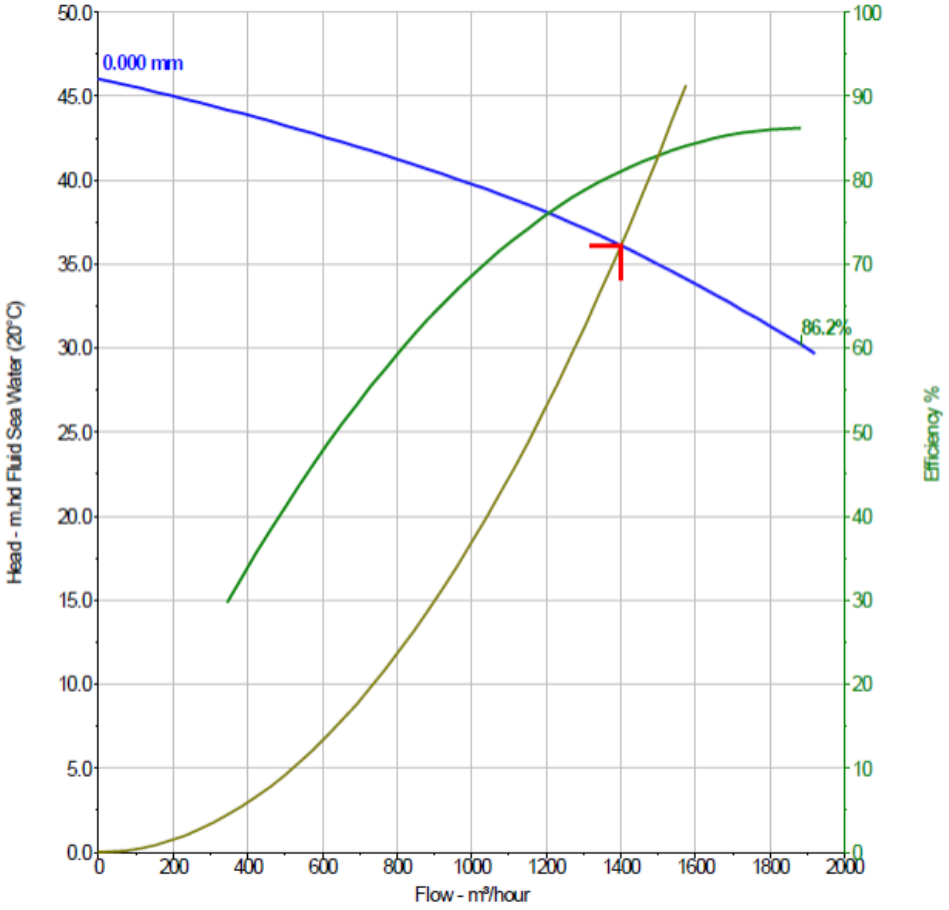
Pump operating point snap



FEASIBILITY STUDY AND SYSTEM SELECTION

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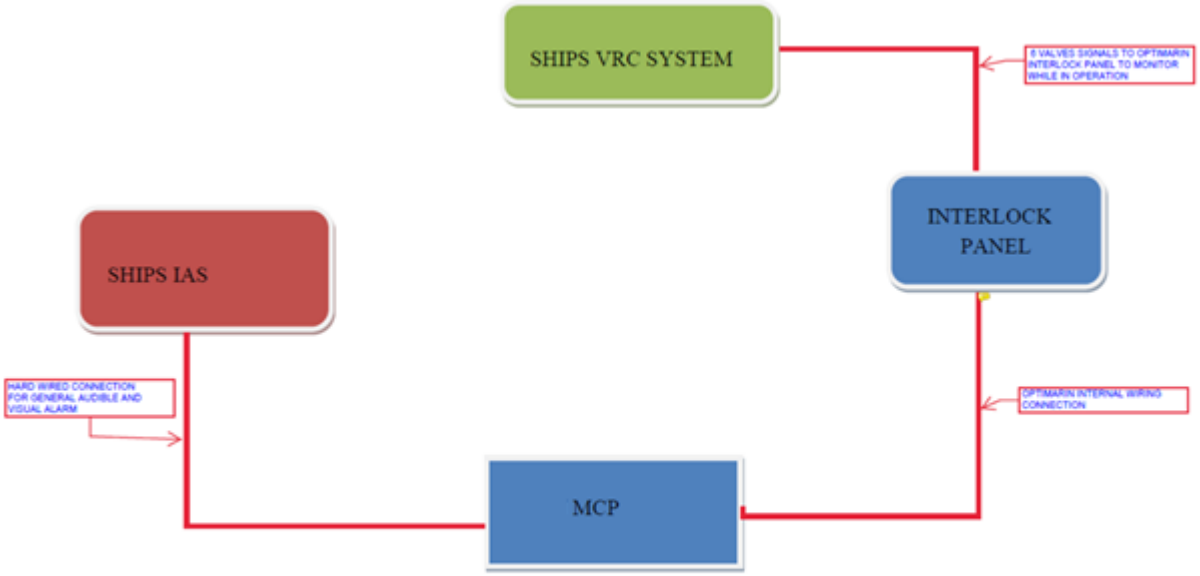
c. Suitability of existing stripping eductor in conjunction with the retrofitted BWTS during de-ballast operations.

II. Philosophy of Control system integration with Ship's existing IAS



DETAILED RETROFIT ENGINEERING

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- Once the feasibility of retrofitting the vessel with BWMS is established and accepted by the crew and owner, Conceptia will commence the detail design engineering to retrofit the vessel.

- Deliverables starting from schematic diagrams till spool drawings, penetration details, production drawings for structural modifications, shipping in & unshipping routes, pre-fabrication and assembly details, etc. would be produced as a part of the detailed engineering.

- Conceptia shall submit the complete design documentation for the yard to schedule the production phases to align with vessel's retrofit duration.

- Conceptia can optionally support the production yard in production, procurement of BWMS system, etc. till the system is commissioned and crew members are trained. As a part of the retrofit design process, Conceptia shall get Ballast Water Management Plan approved by the regulatory bodies.

DETAILED RETROFIT ENGINEERING

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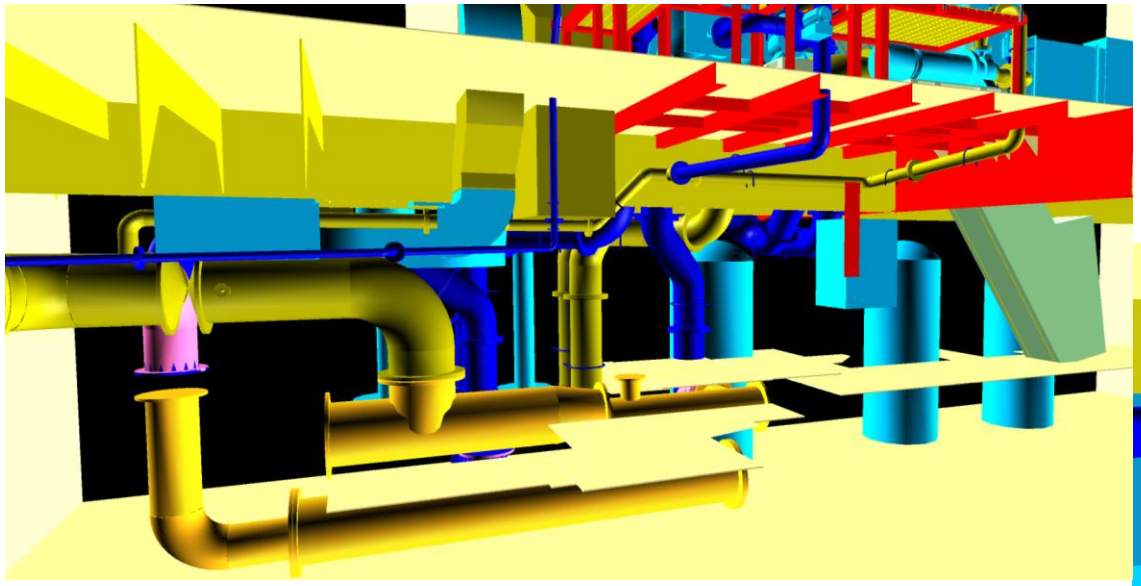
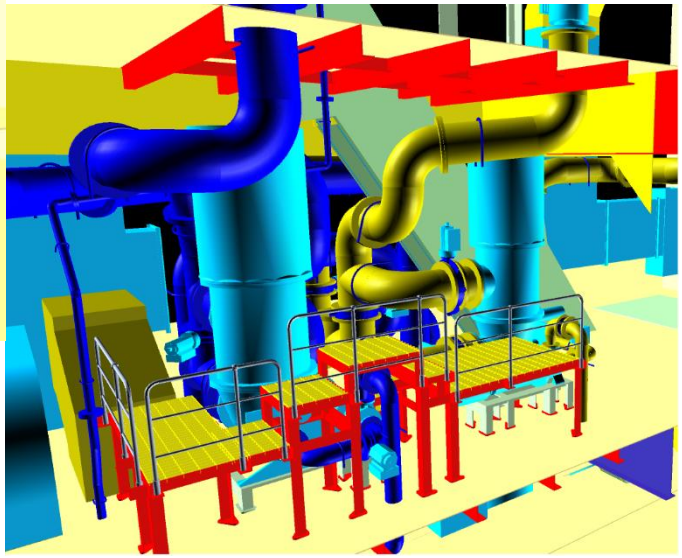
Piping model snaps from our previous projects





DETAILED RETROFIT ENGINEERING

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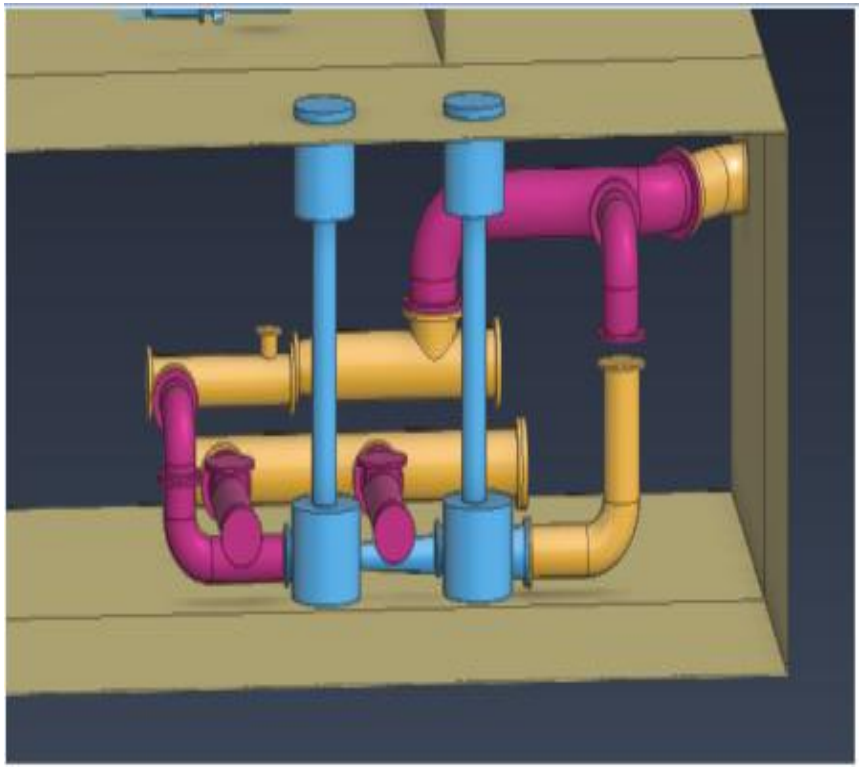
Piping model snaps from CADMATIC from previous projects



DETAILED RETROFIT ENGINEERING

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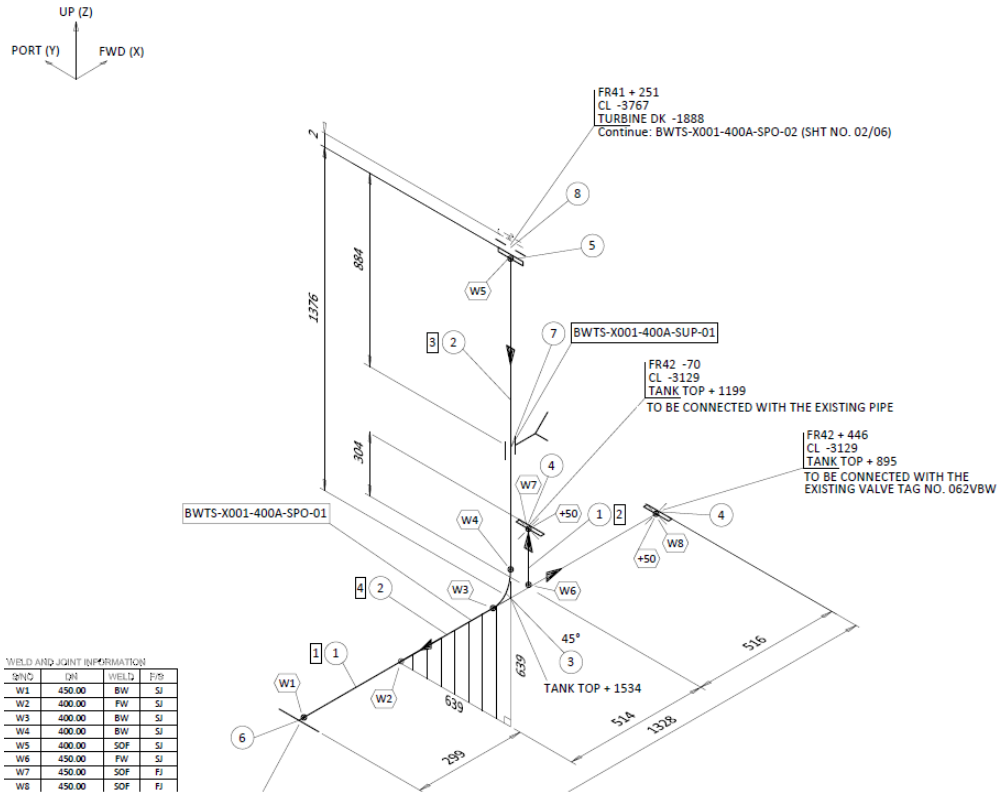
CADMATIC Pipe isometrics snaps from previous projects



WELD AND JOINT INFORMATION

SHO	DN	WELD	FIT
W1	450.00	BW	SJ
W2	400.00	FW	SJ
W3	400.00	BW	SJ
W4	400.00	BW	SJ
W5	400.00	SOF	SJ
W6	450.00	FW	SJ
W7	450.00	SOF	FJ
W8	450.00	SOF	FJ

FABRICATION MATERIALS

PART	QTY.	LENGTH	DESCRIPTION	DIMENSION	MATERIAL	UNIT Wt. (kg)
1		1.66 m	Pipe Seamless, BW, galv.	450A Sch40	STPG370	213.36
2		1.83 m	Pipe Seamless, BW, galv.	400A Sch40	STPG370	221.18
3	1		Elbow 45Deg. SR, BW, galv.	400A Sch40	STPG370E	136.20
4	2		Flange SOFF, galv	450A JIS 5K	SF 390A	21.60
5	1		Flange SOFF, galv	400A JIS10K	SF 390A	23.00
6	1		Blind Flange, galv	450A JIS10K	SF 390A	23.00

ERECTION MATERIALS

PART	QTY.	LENGTH	DESCRIPTION	DIMENSION	MATERIAL	UNIT Wt. (kg)
7	1		U-Bolt with Double nuts	DN400	Ms galv.	3.10
8	1		Gasket, JIS 10K, Thk 2mm	400A	CNAF	0.00

CUT & BENDING INFORMATION

CUT NO.	DESCRIPTION	DIMENSION	MATERIAL	STANDARD	CUT LENGTH (mm)
1	Pipe Seamless, BW, galv.	450A Sch40	STPG370	G3454	1323 mm
2	Pipe Seamless, BW, galv.	450A Sch40	STPG370	G3454	335 mm
3	Pipe Seamless, BW, galv.	400A Sch40	STPG370	G3454	1197 mm
4	Pipe Seamless, BW, galv.	400A Sch40	STPG370	G3454	631 mm

NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. CUT PIPE LENGTHS ARE CALCULATED FOR NOMINAL FITTING DIMENSIONS
3. 50mm EXTRA LENGTH PROVIDED AT ALL FIELD JOINTS(SF2)
4. "X" COORDINATE IS "+" ON PORT SIDE OF CENTER LINE, AND "-" ON STBD. SIDE.
5. POSITION OF SUPPORTS IS GIVEN FOR REFERENCE ONLY, IT SHALL BE VERIFIED DURING INSTALLATION
6. FOR BWTS EQUIPMENT LOCATION, PLEASE REFER TO EQUIPMENT LAYOUT & PIPING LAYOUT DRAWINGS
7. MATERIAL: CARBON STEEL, HOT DIP GALV.
8. PAID REFERENCE: 198561-BWTS-PAID-01 AND 02
9. "TP" STANDS FOR TIE-IN POINT AS PER PAID
10. SUP - PIPE SUPPORT
11. SPO - PIPE SPOOL

DETAILED RETROFIT ENGINEERING

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- Detailed Flow Calculations – Once the equipment and piping arrangement has been finalized, detailed modeling will be done, the flow calculations are carried out for the system with the detailed arrangements for the following operations.
  - Ballasting
  - De-ballasting
  - Stripping
- Complete Pipe and Valve MTO will be provided for the system for the procurement of materials, including installation drawings for shipyard.

DETAILED RETROFIT ENGINEERING

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- Structure

I. Structural foundations would be analyzed using FEA and design criteria are based on applicable Classification society rules.

II. Structural foundations will modelled in detail design software and production information will be extracted.

DETAILED RETROFIT ENGINEERING

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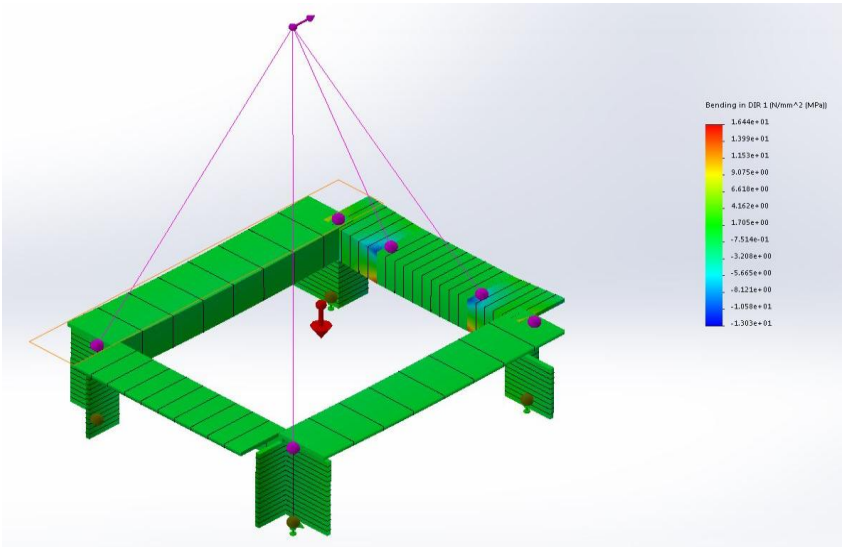
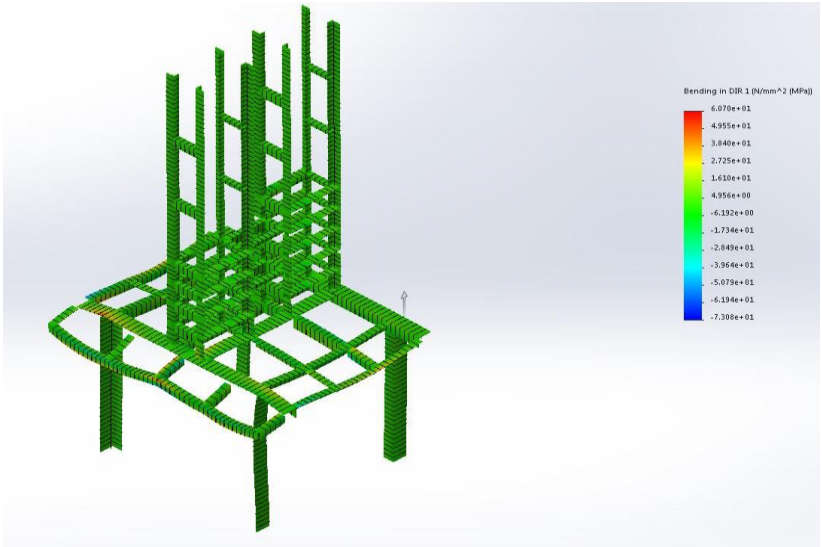
FEA analysis snapshots from previous projects





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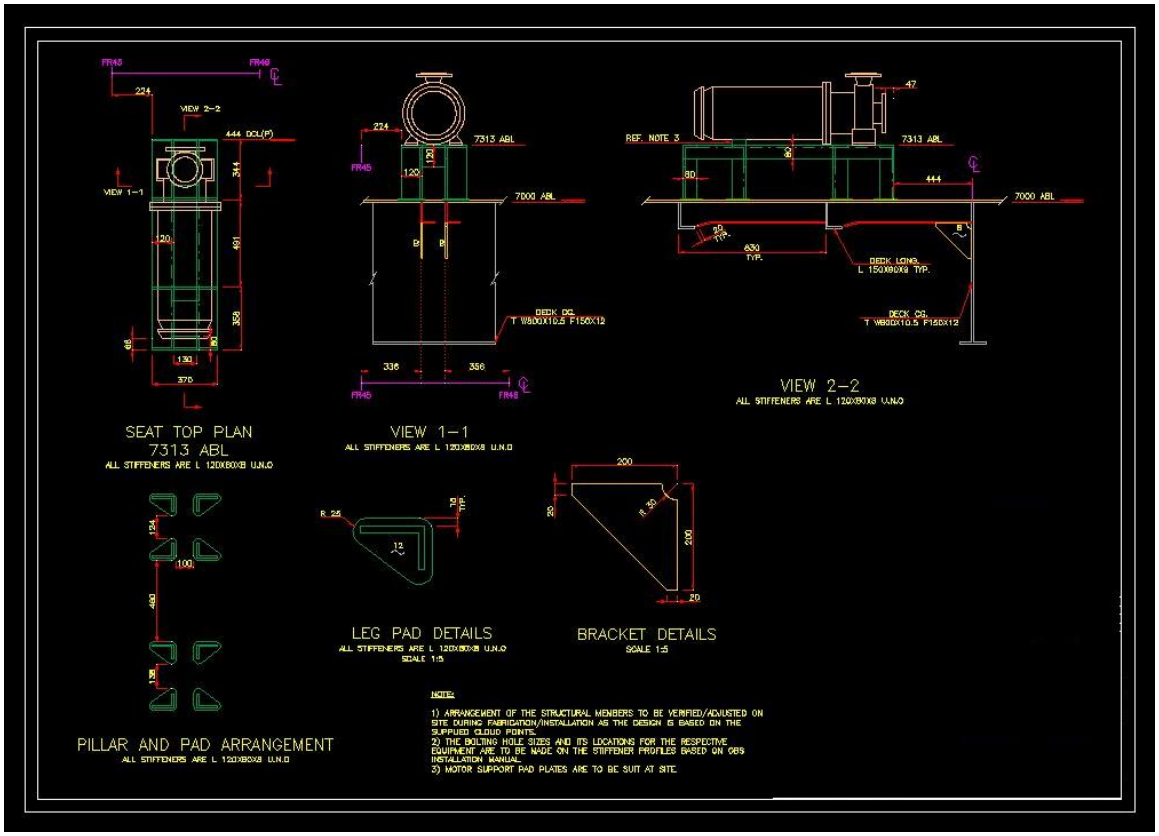
CADMATIC structural detail design drawing snaps from previous projects



DETAILED RETROFIT ENGINEERING

Typical Deliverables List

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PIPING
Piping Diagram – BWMS integrated with existing BWS
BWMS Operation Manual
Ballast Water Management Plan (D1/D1&D2/D2)
Type Approval Certificate (TAC)
Hazard Analysis (If Applicable)
Commissioning Procedure
Bilge & Ventilation piping diagram
Piping Diagram – Fresh Water, Compressed Air System (As Applicable)
Updated General Arrangement
3D Model
Piping MTO

DETAILED RETROFIT ENGINEERING

Typical Deliverables List

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STABILITY
Lightship Calculation
Inclining test report (If Applicable)
New Trim and Stability booklet (If Applicable)
An updated Watertight integrity plan (If Applicable)
New Damage Stability calculations (If Applicable)

STRUCTURE
Updated structural drawings (If Applicable)
Foundation Drawings
Structural Calculation Report
Structural MTO

DETAILED RETROFIT ENGINEERING

Typical Deliverables List

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FEASIBILITY REPORT
Feasibility Report for Installing BWMS onboard

ELECTRICAL
Description of changes
Updated electrical power single line diagram
Making and breaking capacities of new circuit breakers
Updated electric load balance
Selectivity between new circuit breakers and upstream existing circuit breakers
Emergency stop of new fans (if relevant)
Updated EX documentation (As applicable)
Cable and Cable Tray MTO

DETAILED RETROFIT ENGINEERING

Typical Deliverables List

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CONTROL SYSTEMS
Interphase description
Environmental testing (I080) or data sheets of components (If Applicable)

FIRE SAFETY
Structural fire safety integrity, detection, escape arrangement etc. (If Applicable)
Cargo Ship Safety Certificate and Cargo Ship Safety Equipment Certificate (If Applicable)

PRODUCTION DRAWINGS
Piping Production Drawings
Electrical Produciton Drawings
Structural Production Drawings

TYPICAL PROJECT TIMELINE

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RETROFIT PHASES	DURATION
Preparation, Onboard 3D Scanning & Survey	4 Weeks
Conceptia Retrofit Design (Including Feasibility Study)	8 Weeks
Class Approval Time	2 Weeks
Shipyard Preparation time on designer's inputs	3 Weeks
Shipyard Retrofit Work	6 Weeks
Scheduled Special survey of the vessel	NA

SOFTWARE USED

- The software that are used for a typical BWMS retrofit project are as follows:
  I. CADMATIC – for detail and production design of structure and piping
  II. Solid Works – for FEA for equipment foundation analysis
  III. Auto CAD – for drawings
  IV. Pipe Flow – for Flow Calculations
  V. Naviswork Freedom