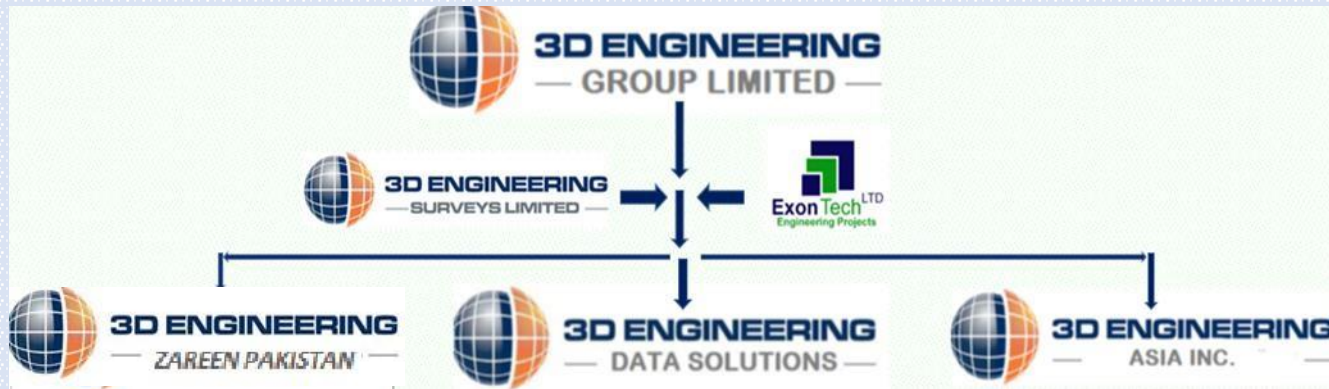


Dimensional control services

Introduction to 3D Engineering Group



3D Engineering Surveys Ltd (3DES) is based in the UK with offices in UAE, Pakistan, Manilla



3D Engineering Surveys Ltd are directed by chartered surveyors and is regulated by the Royal Institution of Chartered Surveyors, is a member of the European GPR Society, our UAV department is authorised by the CAA and our QA systems managed to ISO 9001 standards,

3D Engineering Surveys Ltd has developed over twenty-five years has developed systems which are constantly reviewed and developed ensuring that we offer the latest products to our global clients assisting them in managing their plants for asset management, redesign, expansion, upgrade and relocation / integration purposes.

The following presentation illustrates our processes and methodologies adopted enabling us to complete scan to BIM Intelligent 3D Models and all associated documentation

Dimensional Control

The Golden Rules

A Dimensional Control survey company needs to take ownership of all fit ups. Clear lines of communication are required to report, discuss and resolve any issues that are identified.

The following stages must be observed.

- If there is a civils interface – carry out precision 3D survey
- If relocating plant carry out precision civils interface survey of existing site and replicate at new site if appropriate.
- Carry out precision 3D survey of existing plant in hot condition (create first working CAD model)
- Issue hot condition 2D drawings to fabricators. Temperature corrections applied. Key dimensions and geometry to be shown.
- Carry out precision 3D survey to all major, new critical items of plant.

Dimensional Control

The Golden Rules

- Survey at Fab shop, if possible, to facilitate changes in a controlled environment and before shipping.
- As early as possible - Carry out precision 3D survey of existing plant in cold condition (fast survey using pre-established control points)
Create second working CAD model
- Report changes in hot / cold geometry. Compare changes to expectations. Check bellows behaviour.
- Issue cold condition 2D drawings to fabricators. Check against corrected hot drawings. Key dimensions and geometry to be shown.
- Check survey to all new items of plant

Dimensional Control The Golden Rules

- Replace old plant with new plant (virtually) in cold condition working CAD model.
- Check fit ups between new items as well as interfaces with existing plant not being replaced. (virtually)
- Check hangers and supports (virtually)
- Check civils fits (virtually)
- Mark cut lines and match marks.

Dimensional Control The Golden Rules

- Carry out clash survey if appropriate.
- Oversee all stages of installation and survey each element after installation. Compare to working CAD model.
- Understand and react, if necessary, to anomalies.
- Circumstances will dictate changes to this process.

The above system is well proven, it works.

Selecting individual items from the list will rarely work and is misleading – this would not be Dimensional Control.

Oil, Gas & Industrial Measurement

Two main definable activities:

- **Critical Interface / Dimensional Control**
- **Laser Scanning**

All images are intended to illustrate typical tasks and situations and come from a variety of sources

Modular Build / Single Weld Hook Up

- Build PAU's and PAR's in locations all over the world
- Bring to final site for fit up

Benefits

- Faster Construction Schedule
- Less Man Hours on Site
- Improved Safety

- No Surprises!

- **Is a Single Weld Hook Up possible?**

Requirements

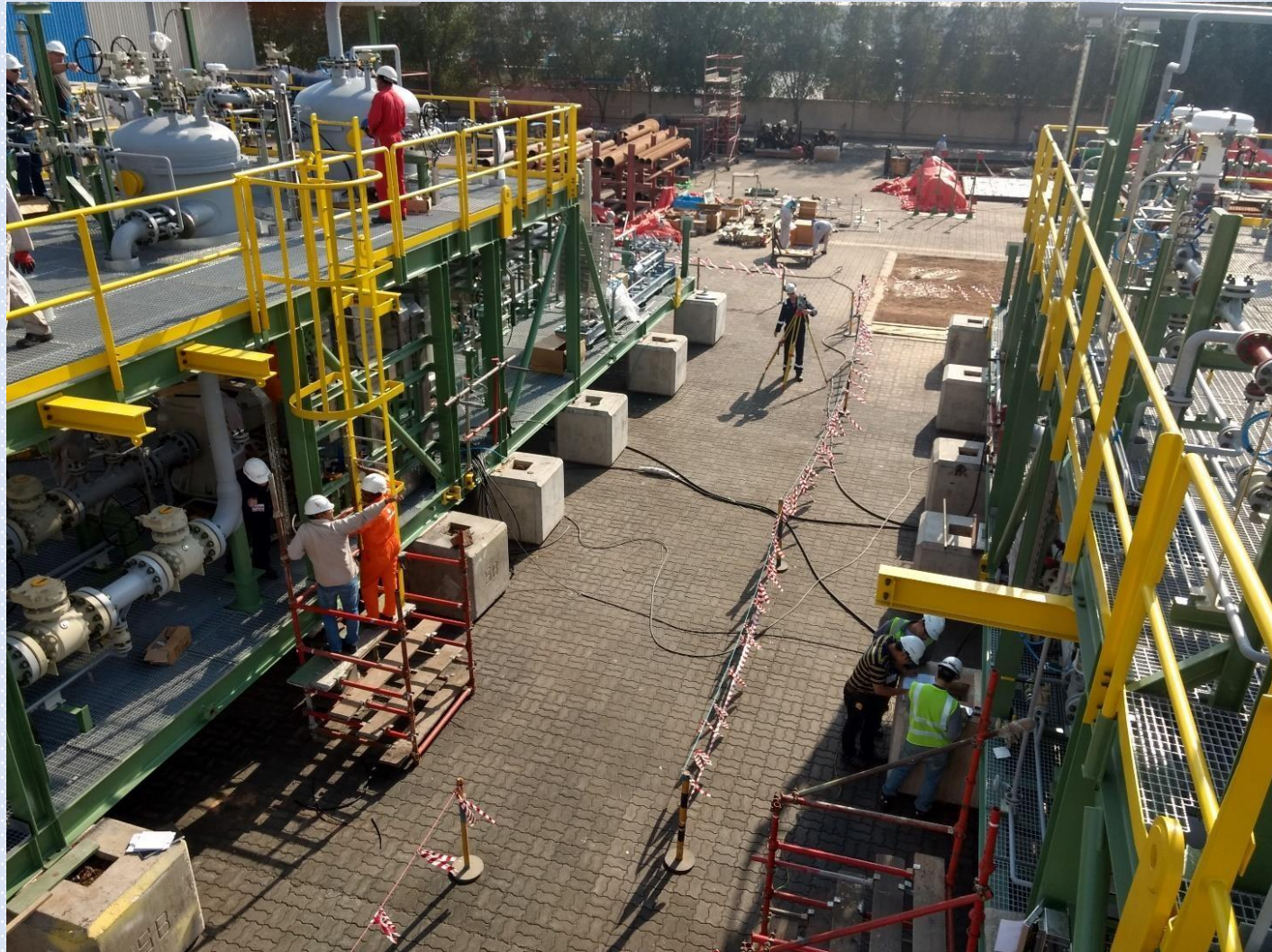
Identify the following points (pre mobilisation)

- Civils Interface (3 Dimensions)
- Critical Interface points
- Unambiguous Co-ordinate system
- Survey Control
- Match Marks / Setting out points (project convention)

Major Modular Build Example

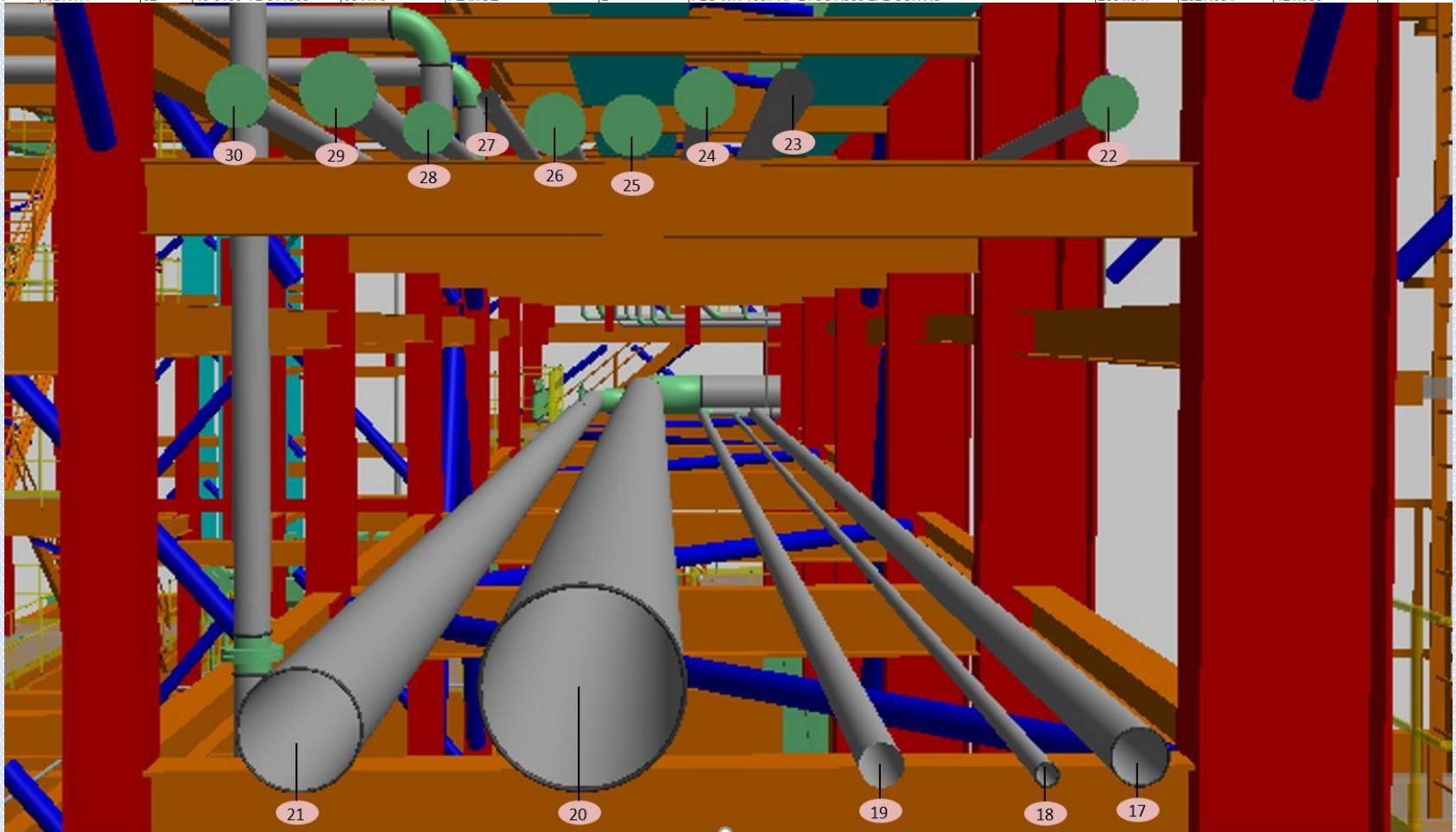
- Multiple pre-assembled units & pipe racks (**PAU's & PAR's**)
- Modules constructed in different locations
- Survey of **critical interface points** at fab yards
- Comparison to design, residuals 'identified'
- All rectification work completed in **fab yards**
- Brought to site for **first time fit** / single weld hook up
- Survey teams land modules on site in correct location
- Single weld hook up **achieved!!**

Survey in Fab Yards

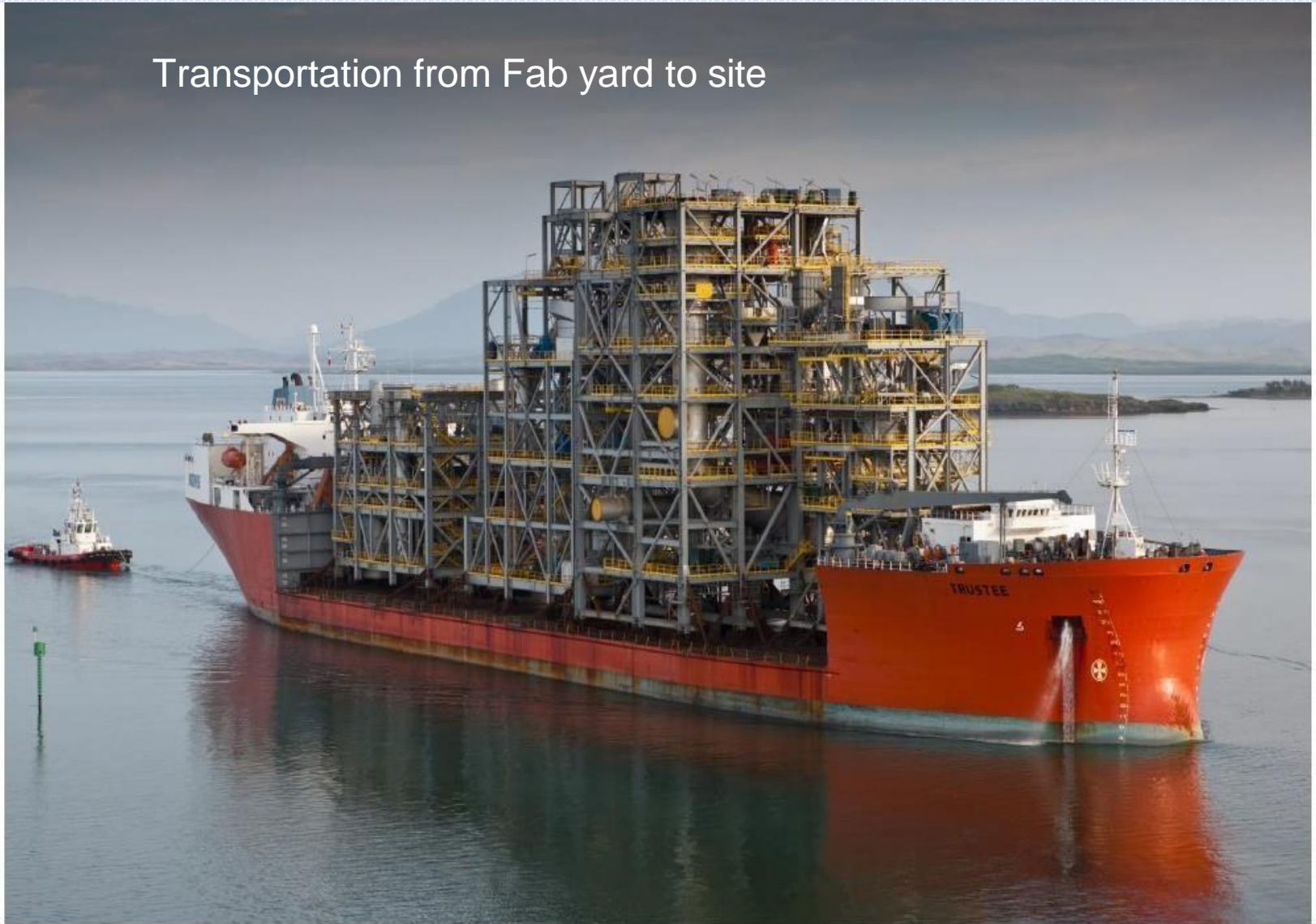




'0A	NORTH	16	42-9100-DL-42514	546981	FLANGE	6"	FLG WN 150# RF LTCS A350 LF2 SCH STD	2605.881	2927.590	103.695	
'0A	NORTH	17	42-0200-PHC-011026	TBC	BUTT WELD	8"	PIPE SCH STD SMLS LTCS A333 GR.6 BE	2604.330	2927.599	107.460	
'0A	NORTH	18	53-1000-DHC-012214	TBC	BUTT WELD	3"	PIPE SCH STD SMLS LTCS A333 GR.6 BE	2604.680	2927.599	107.394	
'0A	NORTH	19	51-5600-FGH-011840	TBC	BUTT WELD	6"	PIPE SCH XS SMLS LTCS A333 GR.6 BE	2605.300	2927.599	107.434	
'0A	NORTH	20	42-0340-GS-011179	TBC	BUTT WELD	30"	PIPE WT 35.0MM EFW LTCS A671 CC60 CL.22 BE	2606.414	2927.599	107.731	
'0A	NORTH	21	42-0200-PHC-011165	TBC	BUTT WELD	18"	PIPE SCH 40 EFW LTCS A671 CC60 CL.22 BE	2607.459	2927.599	107.579	
'0A	NORTH	22	43-9100-TL-013619	562186	FLANGE	3"	FLG WN 300# RF LTCS A350 LF2 SCH STD	2604.457	2927.597	109.894	
'0A	NORTH	23	43-9100-SM-011121	TBC	BUTT WELD	6"	PIPE SCH STD SMLS LTCS A333 GR.6 BE	2605.640	2927.599	109.934	
'0A	NORTH	24	43-9100-TL-011502	583851	FLANGE	4"	FLG WN 150# RF LTCS A350 LF2 SCH STD	2605.960	2927.601	109.907	
'0A	NORTH	25	43-9200-NL-011509	146487	FLANGE	4"	FLG WN 150# RF LTCS A350 LF2 SCH STD	2606.230	2927.601	109.807	
'0A	NORTH	26	43-9200-VI-011242	146486	FLANGE	4"	FLG WN 150# RF SS A182 F316/316L SCH 40S BORE	2606.510	2927.601	109.809	
'0A	NORTH	27	43-9100-WU-011380	TBC	BUTT WELD	3"	PIPE SCH 80 SMLS LTCS A333 GR. 6 PE GALV	2606.754	2927.603	109.894	
'0A	NORTH	28	43-9200-VU-011145	146481	FLANGE	3"	FLG WN 150# RF LTCS A350 LF2 SCH STD	2606.974	2927.601	109.794	
'0A	NORTH	29	43-9100-SL-011653	146479	FLANGE	6"	FLG WN 150# RF LTCS A350 LF2 SCH STD	2607.305	2927.601	109.934	
'0A	NORTH	30	43-9200-FG-011843	515541	FLANGE	4"	FLG WN 150# RF LTCS A350 LF2 SCH STD	2607.670	2927.601	109.907	
'0A	NORTH	31	53-1000-BFL-011390	TBC	BUTT WELD	10"	PIPE SCH STD SMLS LTCS A333 GR.6 BE	2605.334	2927.590	114.554	
'0A	NORTH	32	43-9100-TL-011803	394175	FLANGE	2"	FLG WN 150# RF LTCS A350 LF2 SCH XS	2604.547	2927.594	121.380	



Transportation from Fab yard to site





Land Transportation for Complete Modules on SPMT Trailers



Land Transportation for PAU's on SPMT Trailers



- Module base fixing plan
- Shim packs pre-determined through up front survey



What could possibly go wrong?

- Poor quality during fabrication
- Poor quality civils setting out
- Poor quality management interface
- Thermal changes
- Accumulative errors

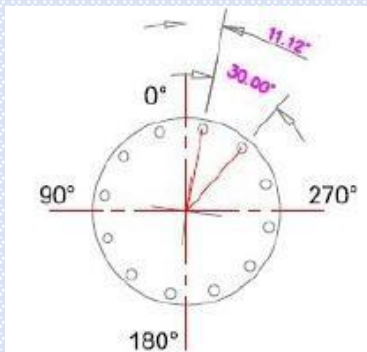
Consequences:

- Time over run (late start up date)
- Additional rework on site
- Unnecessary hot work
- Additional materials
- Contractual penalties

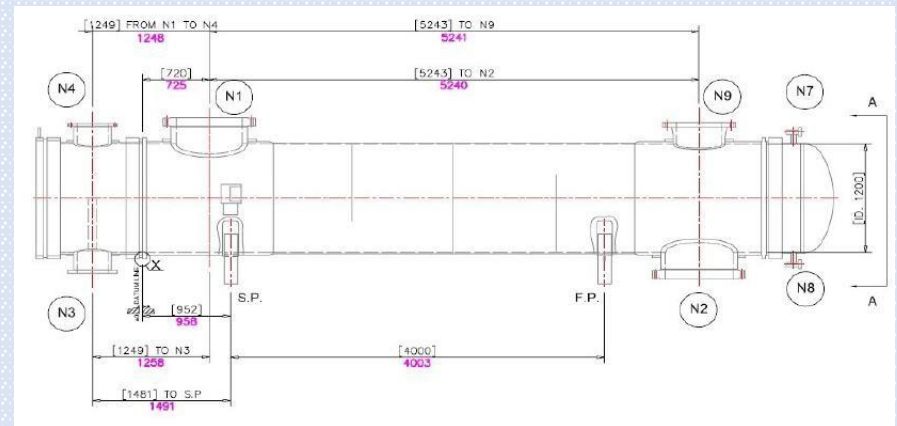
Solution

- Collaborating with & supporting fabricators
- Good communication
- Holistic project overview
- Ongoing dimensional monitoring

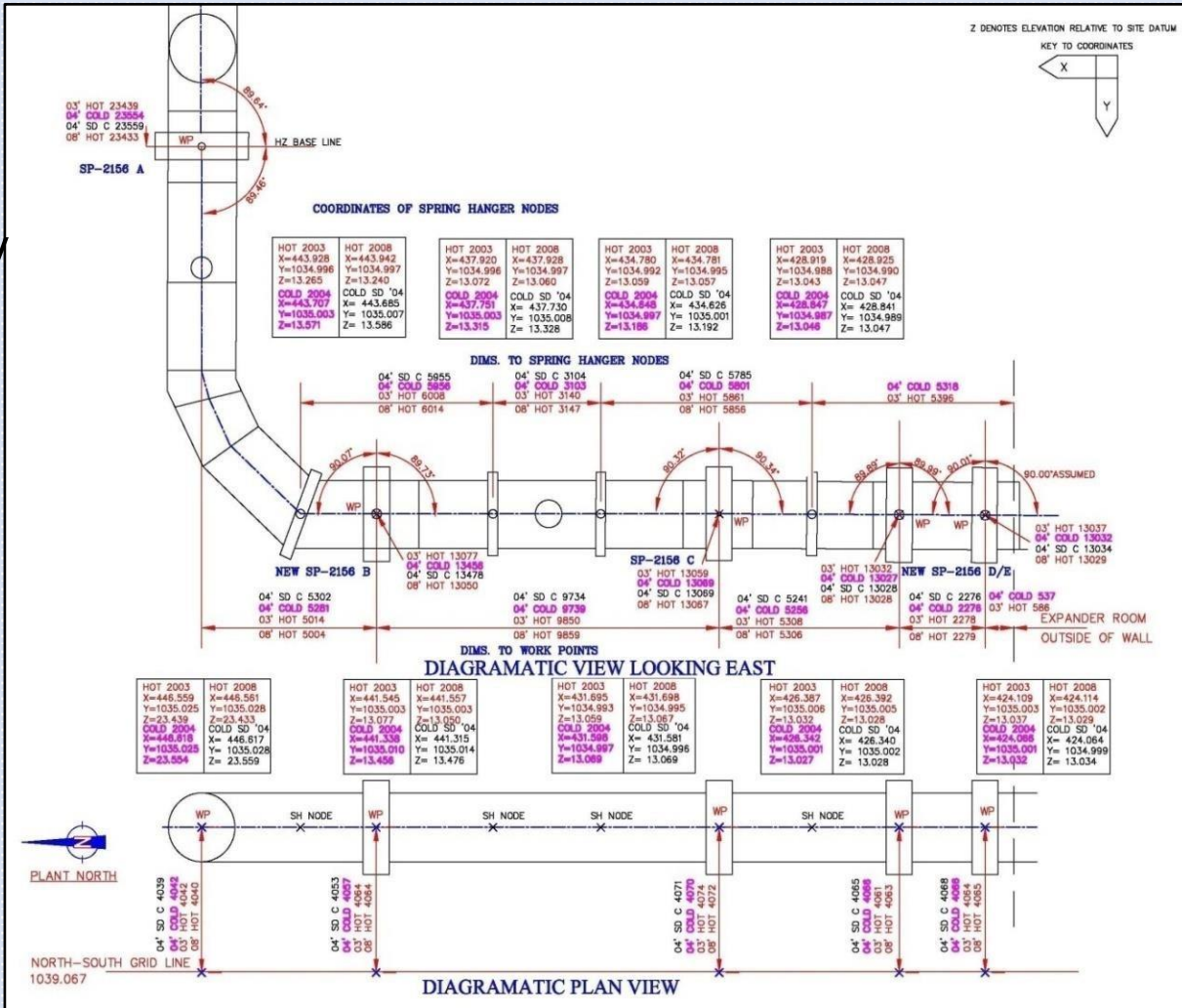
- **Detailed understanding of Dimensional Control Requirements**
- Why use Dimensional Control?
 - First Time fit / single weld hook up (**SWHU**)
 - Reduced construction time on site
 - **Eliminate risk** of failure to fit
 - Maintain schedule
 - Increase fabrication in offsite controlled environment
 - Reduce unplanned works on site
 - Reduce hot work on site



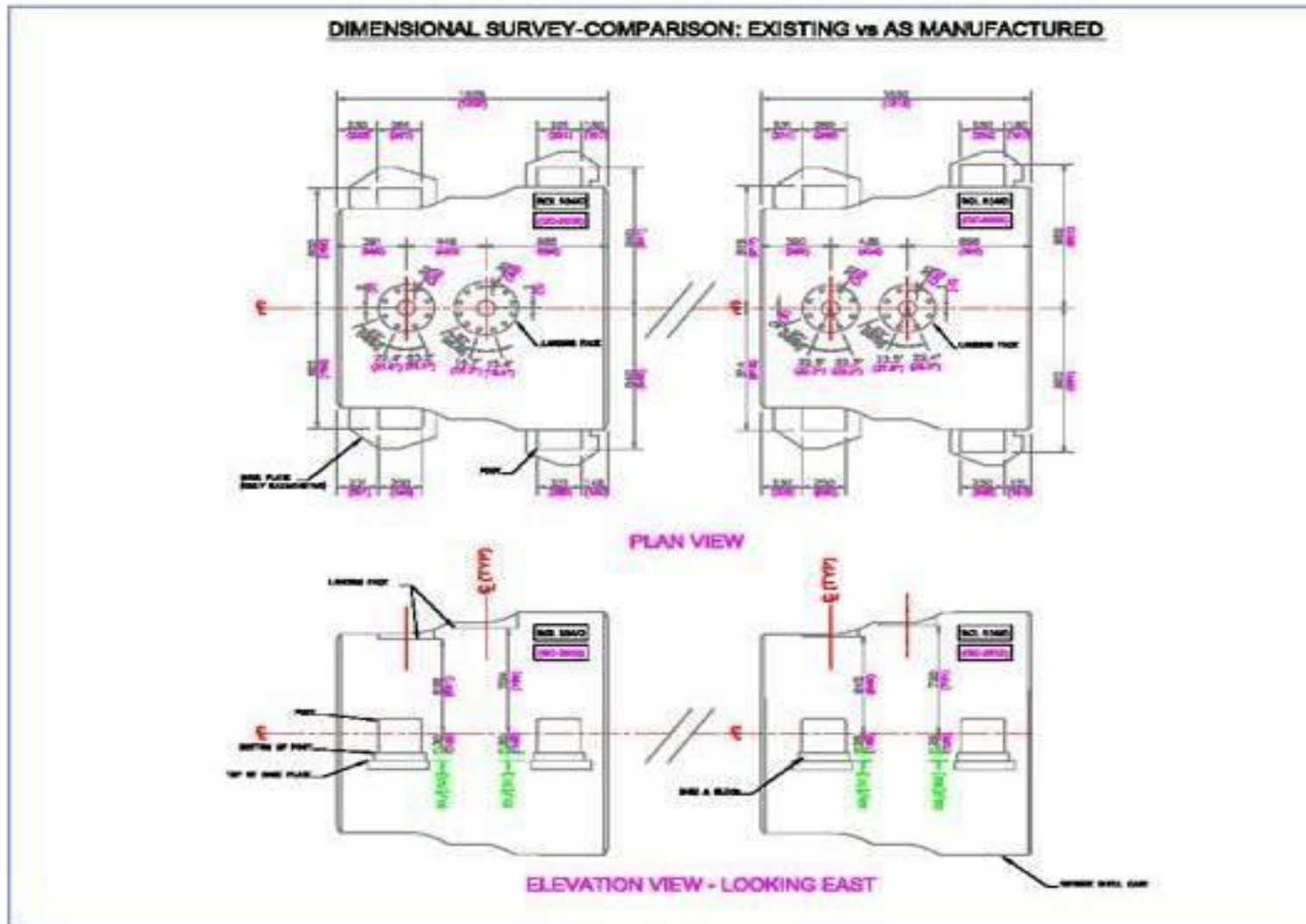
No Surprises!



- **Conventional drawings** (Plans, Sections, Elevations) for use during fabrication or to report existing **as-built** geometry and dimensions or to represent dimensional change during operational temperature cycle or as built versus design variances.
- **Fit Up potential**
- Communication with entire project team



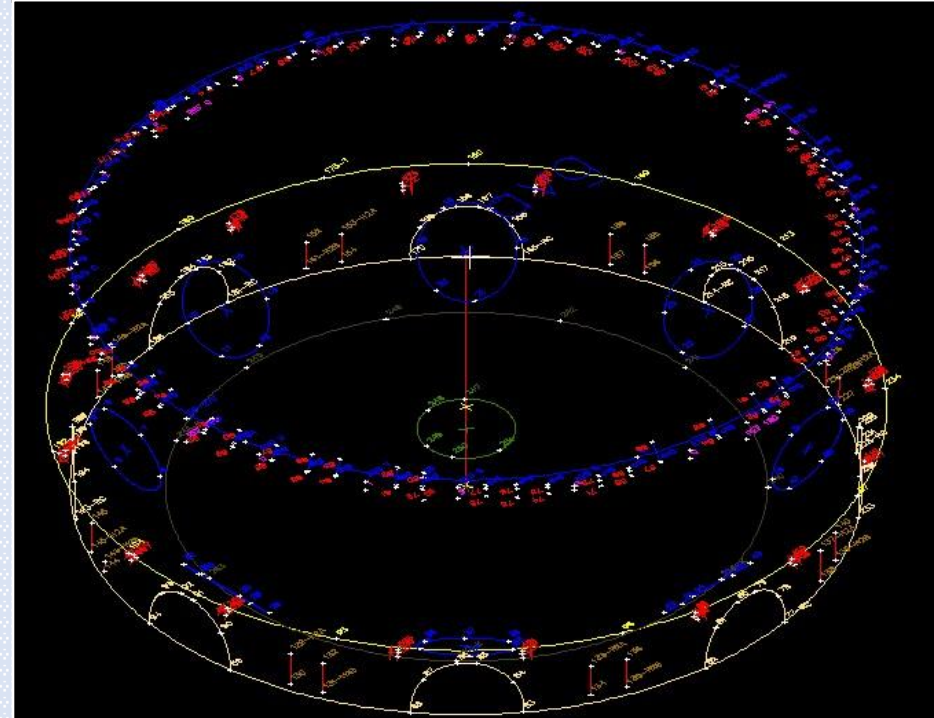
- Typical example of drawings showing fit up potential between as existing plant and new fabricated plant (**Prior to shipping**)





Survey Methodology:

- Vessel roof precision measured
- New plenum precision measured
- Both items then modelled to establish the required geometry



- Orientation marks on the shell and new installation piece.
- The complex shape for the cut set-out and made in the lay-down yard

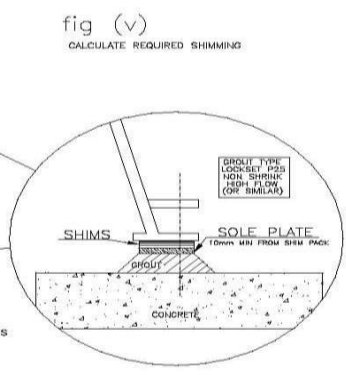
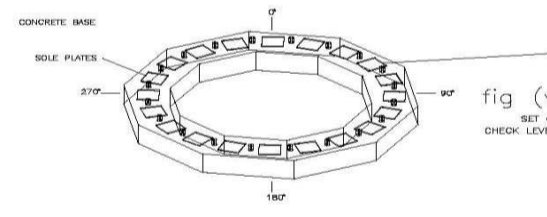
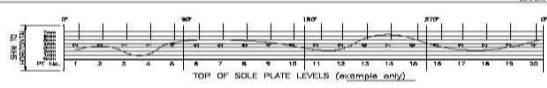
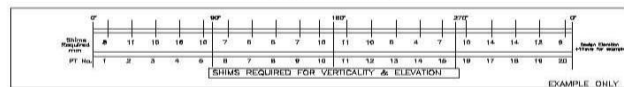
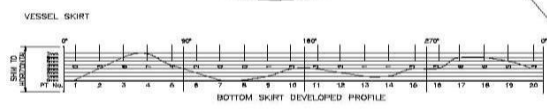
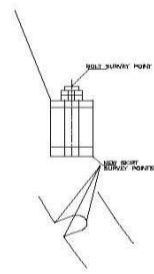
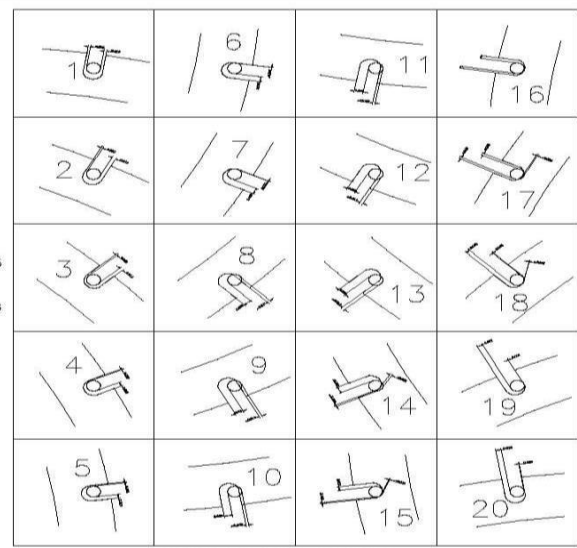
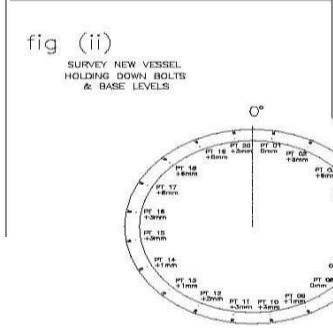
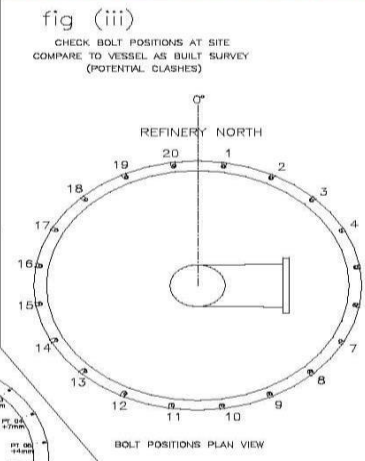
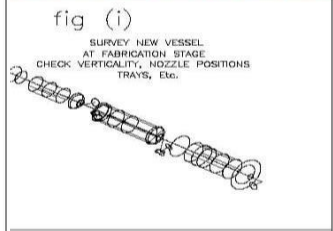
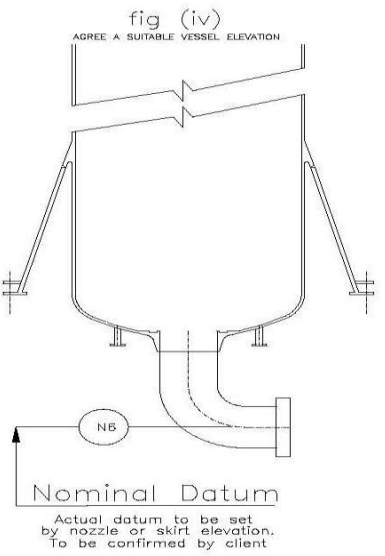


First time fit

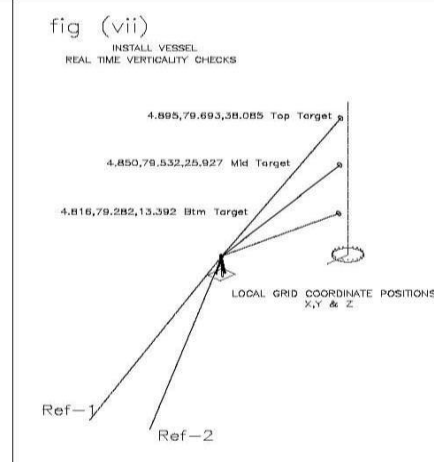


Tower Installation and dimensional checks during fabrication

VER-INSTALLATION.dwg 04/01/2006 12:22:08 Scaled to fit



EXAMPLE ONLY



Land and buried utility surveying

Our site teams are based in the UK, GCC and the Philippines. This helps us to be competitive and able to respond quickly to your requirements both here and abroad.

- Topographical Surveys
- Over head and buried conductor surveys
- Pipeline surveys and alignment sheets
- Buried utility surveys using GPR
- Near shore hydrographic surveys.
- Dimensional control for critical interfaces in complex environments.

Thank You

If you have any further questions please do not hesitate to contact us.

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