



Topics of assistance

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1. Introduction

For GRP piping systems the main topics are:

- a. Qualification
- b. Quality control
- c. Engineering
- d. Installation

The specification for an essential system must be accurately described and contain the aspects as mentioned above. There are engineering standards who meets this criteria like Shell Dep, ISO 14692 and others, however the best parts have to be taken out or selected of those spec's to get a guarantee for the quality as requested by the end-user.

Qualification

This has to be looked at very carefully. Mostly and only this is done by a so-called 1000hrs test. Meaning a spool consisting out of pipe, fittings and joints, is hydrotested at an elevated temperature (is design temperature in this case) for 1000hrs and no failure is allowed. GRPcenter recommends qualification tests to be performed at independent institutes and inspect from making the fitting up to the test. Weighting of fittings upfront is an extra "easy tool for inspection". Special forms have to be filled in describing materials used etc.

In case the results are positive, it is the project reference baseline to check if the products are made in the same way as the tested ones.

Quality control

Results of the Qualification tests are for instance base settings for the products finally made. A ITP containing this information and other issues mentioned e.g. in the ISO 14692, have to be added

Engineering

The ISO 14692 part 3 does give here guidelines inclusive a stress envelope for e.g. a Ceasar 2 stress analysis. When required a hydraulic analysis can be executed as well. The guidelines for buried pipelines can be find in the AWWA M45 second edition.

Installation

This part is the most important part and also the most neglected part. Well-trained bonders and pipefitters in combination with dedicated and skilled/experienced supervisors and inspectors can generate a perfect installation.

Important for the end-user is to have an inspector that is reporting to the end-user and not to the contractor. The difference is that the contractor wants to open the ground and to close it as fast as possible where the end-user has a complete different expectation, namely "successful and reliable installation".

What to do

- Write a spec tailor made for the project.
- Drive production and installation quality to the required level and control this accurately, no escapes, what is promised must be done.
- Testing to be done independently, not by witnessing of third party at the premises of the manufacturer.
- Have a knowledgeable inspector on board during installation with an excellent skilled crew (take time for training).

2. Engineering

| | Topic | Client | GRPcenter |
|----|--|----------------------|---------------------------------------|
| a. | Kick-off meeting Piping system, design conditions parameters etc. | Project presentation | Present |
| b. | Fine tuning spec's by GRPcenter with gathered knowledge about production, jointing systems, testing (which tests), monitoring, inspection, stress analysis, installation etc. Standards review or write tailor made spec. | | Conceptual, input, review and writing |
| c. | Evaluation of alternative GRP concepts | | Literature and market investigation |
| d. | Research and selection of one system concept (best match for application) | | Report |
| e. | Job specification | | Writing and/or review |
| f. | Front-end engineering | | Review |
| g. | Detail engineering | | Review |
| h. | Stress analysis | | Review |
| i. | Approved for construction | | Review |



"installation in Oman 61 km, no leaks!"

3. Manufacturer

| | Topic | Manufacturer | Client | GRPcenter |
|----|---|--|--------|------------------------|
| a. | Manufacturer selection phase 1 | Technical offer | | Evaluation and Review |
| b. | Short list Manufacturers "Technical part" | Production site visits | | Support technical part |
| c. | Manufacturer selection phase 2 | Financial offer | | Not involved |
| d. | Selected manufacturer | Test on products by independent institutes | | Inspection/supervision |
| e. | Production | ITP program | | Inspection |
| | Final inspection | Ready for shipment | Review | Inspection |



"1000 hrs test of Elbow and adhesive bonded joint acc. ASTM D 1598"

4. Installation

| | Topic | Contractor | Client | GRPcenter |
|----|---|--------------|--------|----------------------------------|
| a. | Contractor selection | Presentation | | Technical support |
| b. | Selected contractor | ITP plan | | Inspection |
| c. | Joint training crew by manufacturer | Action | | Inspection As with BP project |
| d. | Qualification of the crew (always, whatever credentials) | Action | | Inspection Act as examiner |
| e. | Installation | Action | | Inspection |
| f. | Document control | Action | | Inspection |
| g. | Flushing | Action | | YES, Inspection |
| h. | Hydro test | Action | | Inspection |
| | | | | |
| i. | Civil works | ? | | ? |
| | | | | |
| j. | Mechanical works | ? | | ? |
| | | | | |



“Training in Oman, adhesive bonded joints, 2 crews making a spool”

CERTIFICATE OF COMPETENCE

Certificate number:
CERT-GRPIN-20140528-10001-Rev.1

Exam date:
28 May 2014

Valid till:
28 May 2018

DNV GL Business Assurance B.V. declares that:

J. Steen

Date of birth: 6 December 1957
Place of birth: den Ham (Overijssel)

Has fulfilled the conditions to be certified as:



RTR / FRP / GRP Inspector
Glass reinforced Plastics (GRP/RTR) pipe installations,
Competence profiles section, Attachment D2-2

Date of examination : 28 May 2014
Place of examination : Barendrecht
Country of examination : The Netherlands
Examination organisation : DNV supervision

This Certificate of Competence is valid only after the certificate holder has signed, as per examination date until 28 May 2018. The validity conditions of this Certificate of Competence are specified in the relevant standard, endorsed by the DNV GL Certification Committee of GRP pipes Attachment D1 and relates to ISO 14692. See reverse side for the information statement by employer and prolongation by DNV GL Business Assurance B.V. Additional information can also be stated in the column "supplementary remarks".

Thus agreed and signed,
The certificate holder:

Barendrecht, 14 June 2016
DNV GL Business Assurance B.V.


J.J. van Unnik

Signature

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