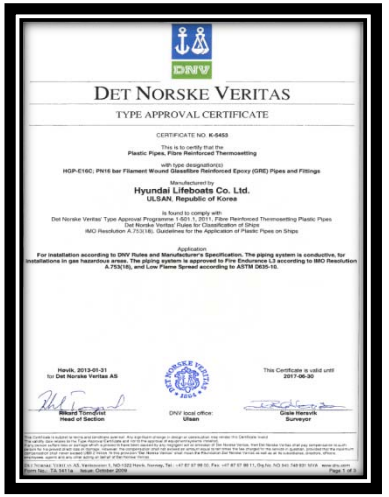
TYPE APPROVAL CERT.

No	Class	Name	Remark
1	Norway Class (DNV)	GRE PIPE TYPE APPROVAL	Including Fittings & Joint
2	Korea Class (KR)	GRE PIPE TYPE APPROVAL	Including Fittings & Joint
3	Italy Class (RINA)	GRE PIPE TYPE APPROVAL	Including Fittings & Joint
4	America Class (ABS)	GRE PIPE TYPE APPROVAL	Including Fittings & Joint


TYPE APPROVAL CERTIFICATE


ABS
CERTIFICATE OF
DESIGN ASSESSMENT


DET NORSKE VERITAS
TYPE APPROVAL CERTIFICATE


TYPE APPROVAL CERTIFICATE

Part 03

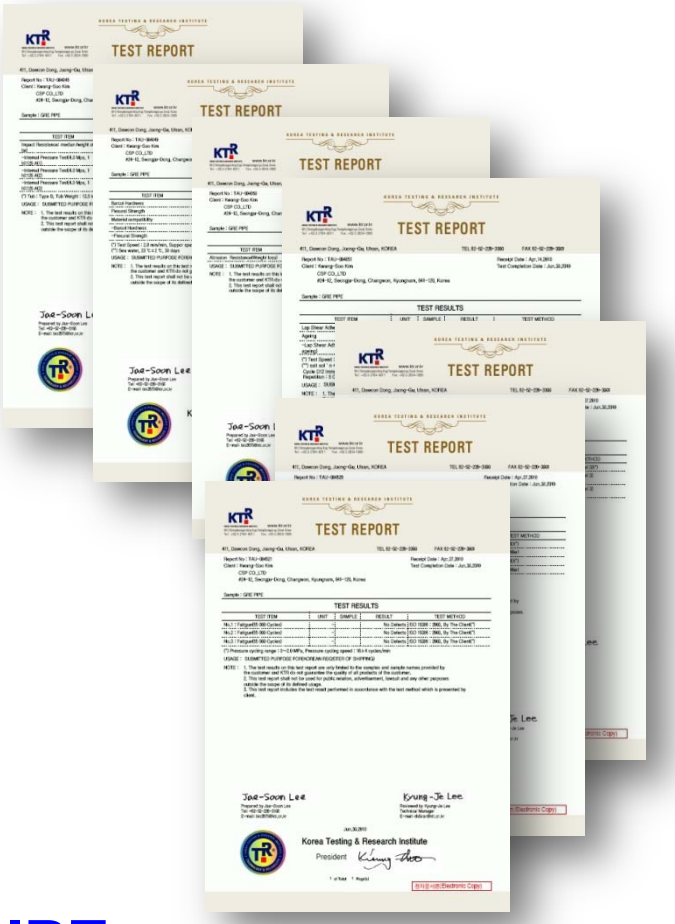
R&D

PIPE TEST

- Internal Pressure – Long term (ASTM D2992)
- Internal Pressure – Short term (ASTM D2992)
- External Pressure (ASTM D2924)
- Heat Distortion Temperature (ISO 75-1 2004)
- External Load (ASTM D 2412)
- Impact Resistance (ASTM D2444)
- Fire Endurance (IMO Res. A. 753)
- Electrical Conductivity (ASTM D257-91)
- ETC.

CADFIL winding program

ANALYSIS OF GRE/GRP PIPE

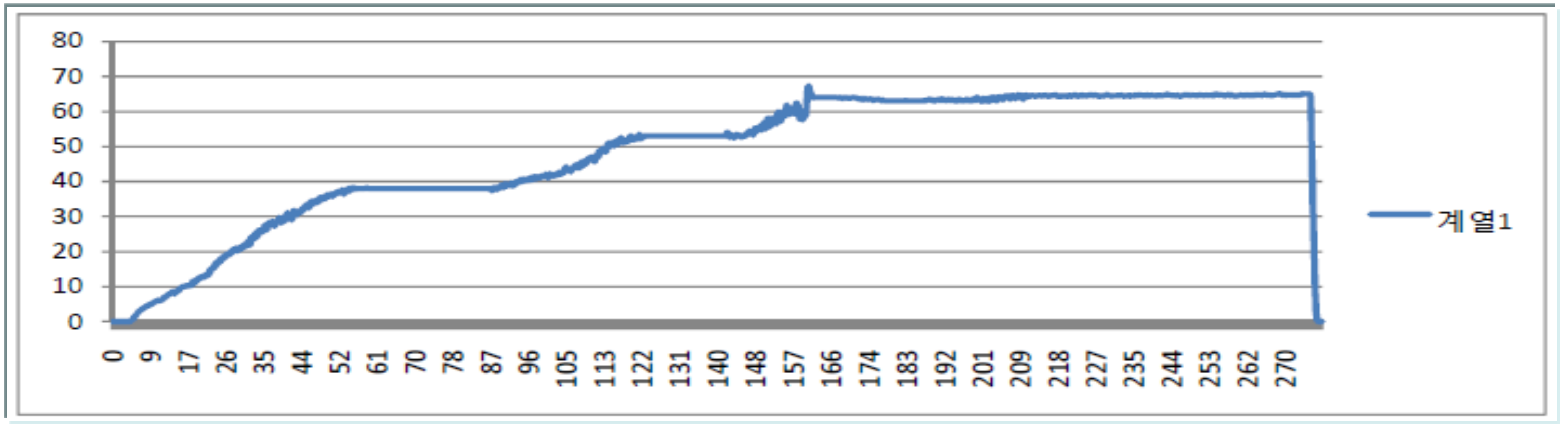


Test Report

R&D

Internal Pressure-Short Term(64bar/Pass)

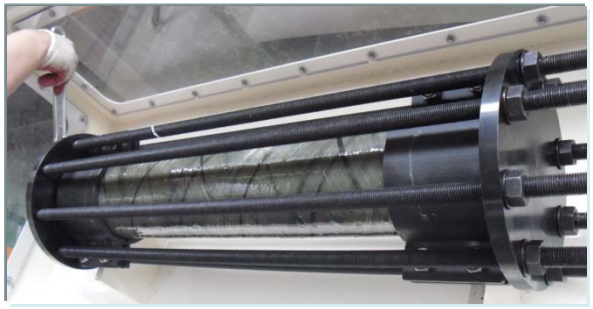
Increase the pressure uniformly and continuously until minimum burst pressure (6.4 Mpa) shall be reached between 60s and 70s. In this time, there are no leakage in the pipe & fittings.

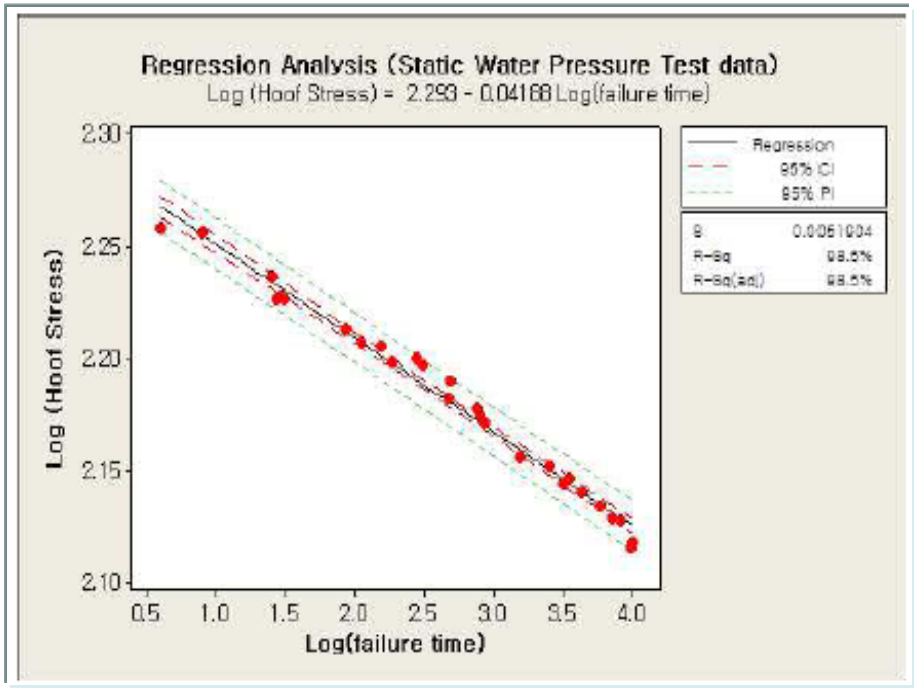


R&D

Internal Pressure-Long Term(114Mpa/PASS)

The tests were performed following the guidelines of ASTM D 2992 “Obtaining Hydrostatic or Pressure Design Basis for ‘Fiber Glass’ Pipe and Fittings-Procedure B” for measuring GRE /GRP pipe’s strength and strain after 50 years.

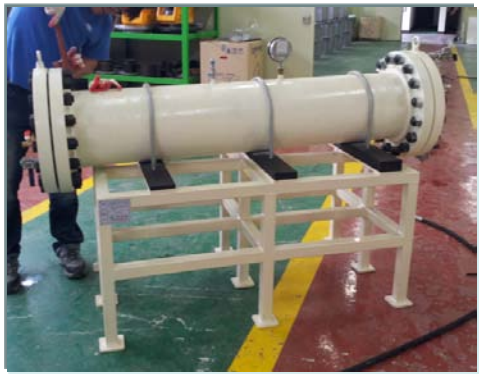


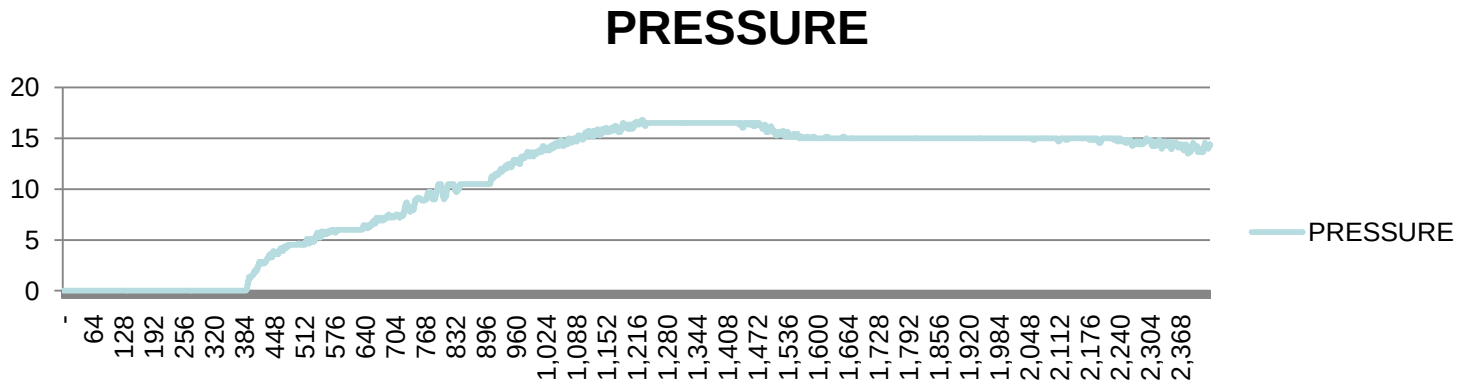


R&D

External Pressure(15bar/PASS)

There are no buckling in three times of the maker standard pressure

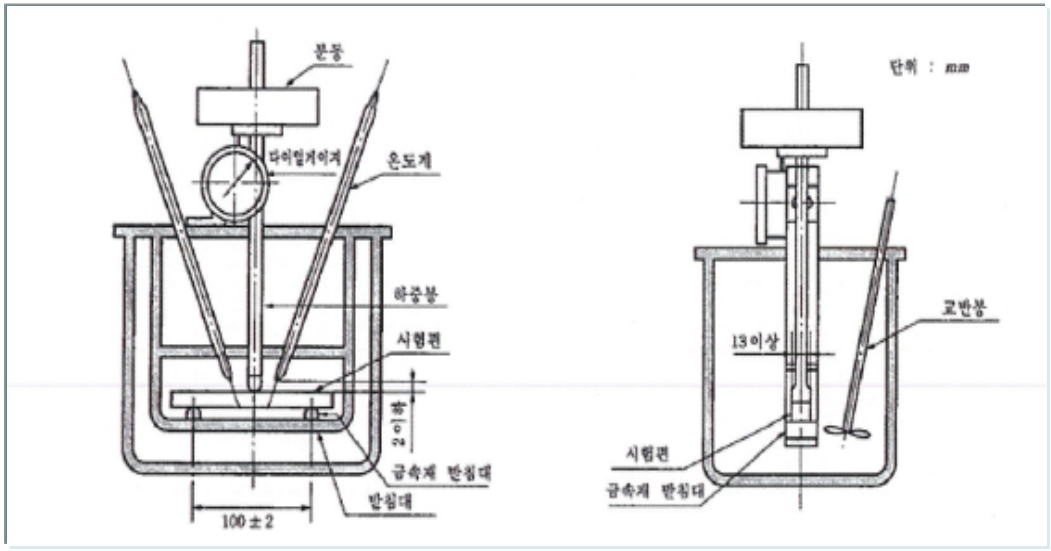




R&D

Heat Distortion Temperature(93˚C/PASS)

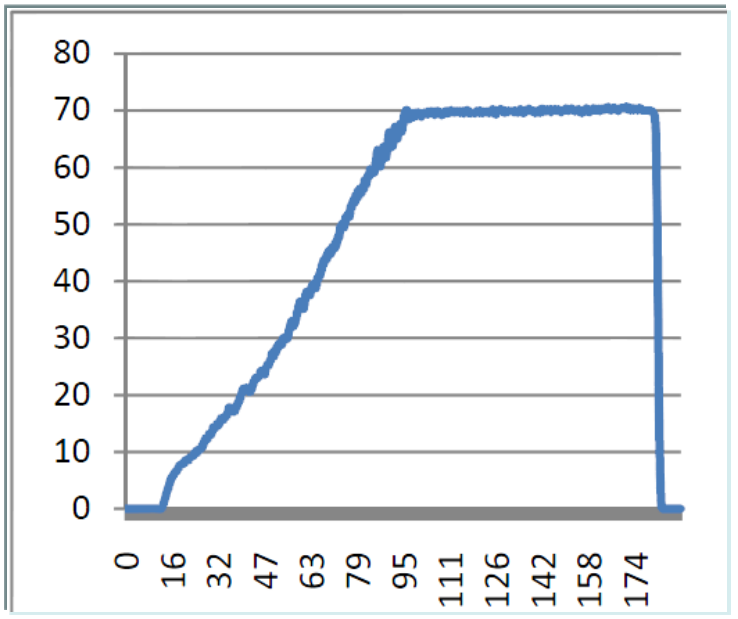
80˚C above max. operating temperature.
Install apparatus for Heat distortion temperature, and increase the heat uniformly and continuously by 120 ± 10˚C.



R&D

External Load(100kg, 64bar/PASS)

No visual damage nor reduction in short term pressure capacity after The pipe shall be able to withstand a load of 100kg applied over 100mm at mid-span



R&D

Impact Resistance(40bar/PASS)

In safety factor 2.5 on nominal pressure(service pressure), No visible damage, no distortion and leakage during the internal pressure test(1hour).

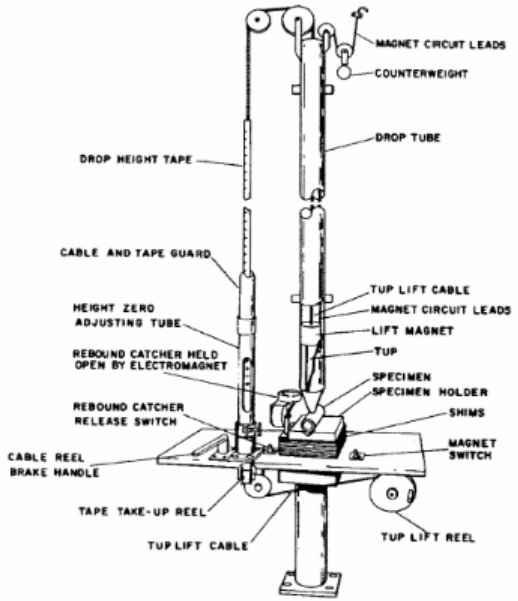
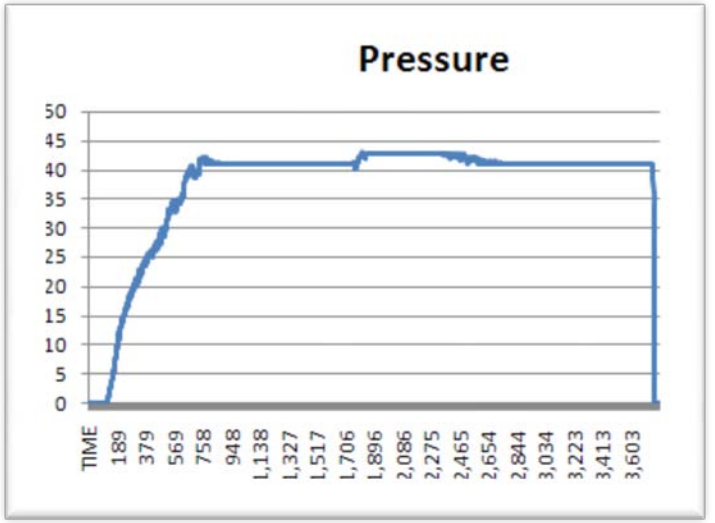


FIG. 1 One Type of Tup Impact Tester



R&D

Fire Endurance(1100˚C, 24bar/PASS)

Pipes and fittings whose functions or integrity are essential to the safety of ships are required to meet minimum Fire Endurance requirements.

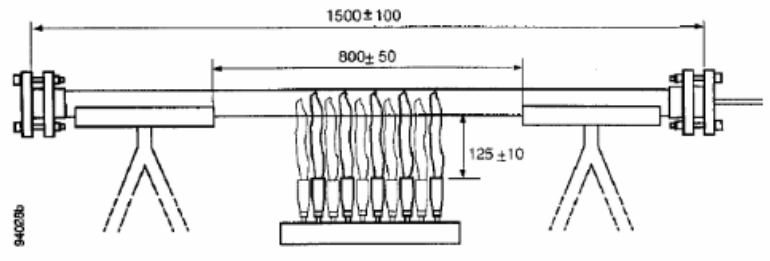
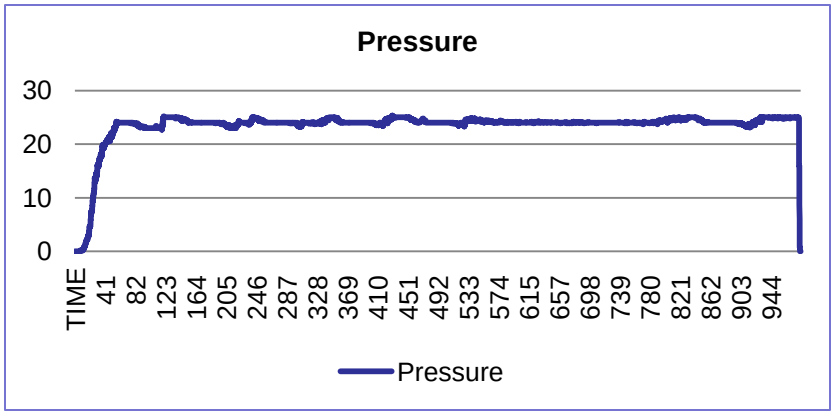


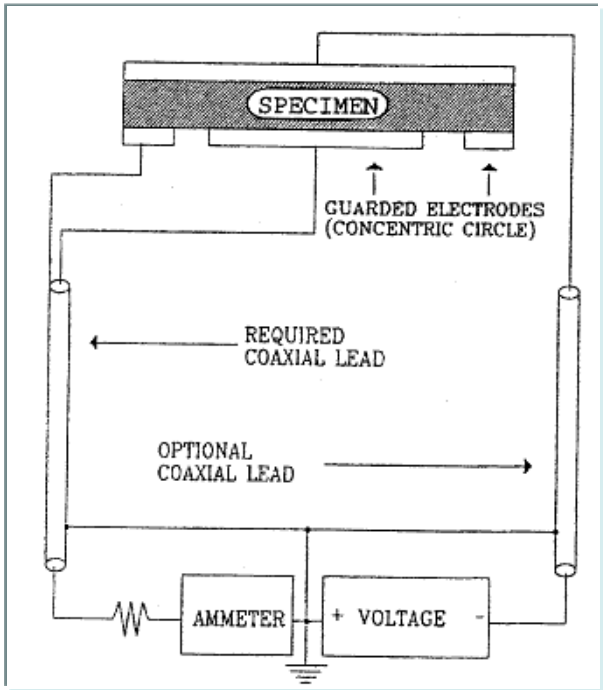
Figure 2 – *Fire endurance test: stand with mounted sample (all dimensions in mm)*



R&D

Electric Conductive(0.1MΩ/PASS)

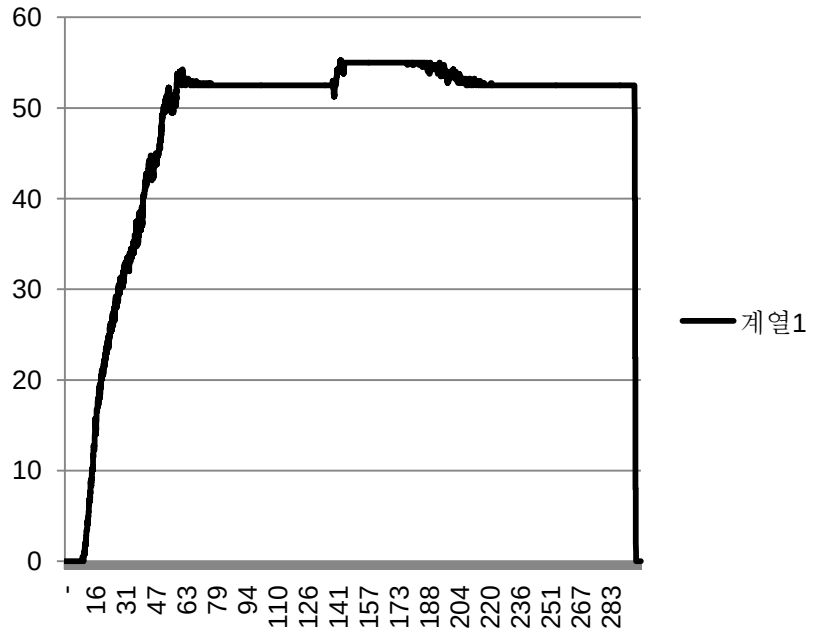
Piping which satisfies the criteria for electrical conductivity inside and outside, will be approved for conveying non-conductive fluids (refined oil products and distillates) in hazardous areas.



R&D

Expansion Couple-ring Test(48bar/PASS)

Engineer should consider thermal expansion of GRP/GRE pipe. Internal pressure test follow ASTM 1599 but this test is different from other pipes & fittings. It needs more detail test Equipment and exquisite technology.

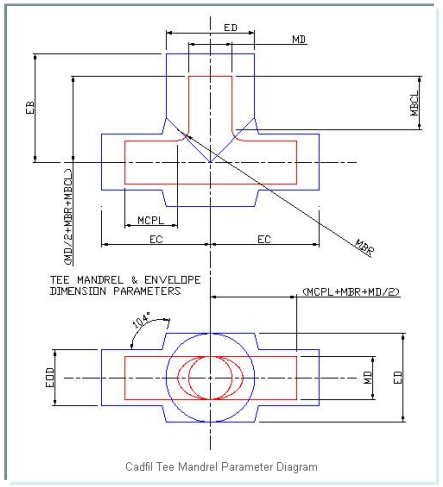


R&D

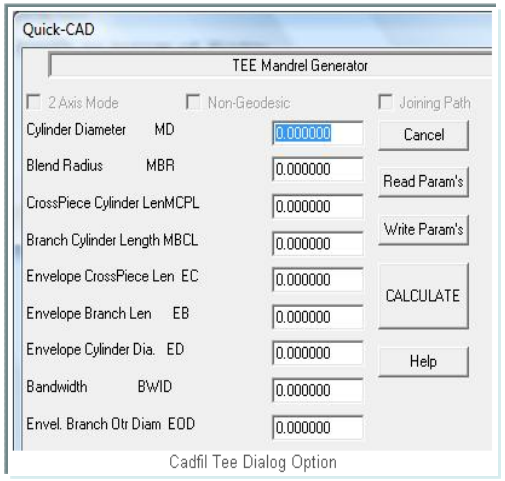
CADFIL winding program for fittings

Cadfil is a complete software solution for the Programming of Computer (NC) controlled Filament winding machines. Whatever your requirements we either have a standard solution or can supply a customised software solution to meet your needs. Follow this link for an overview of the Filament Winding Process and machinery.

- Tee winding method -



Cadfil Tee Mandrel Parameter Diagram



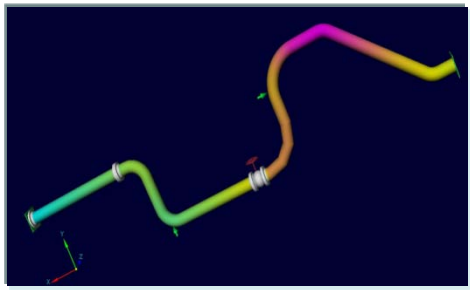
Cadfil Tee Dialog Option

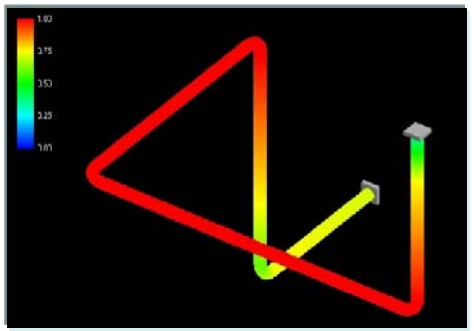
R&D

ANALYSIS OF GRE/GRP PIPE

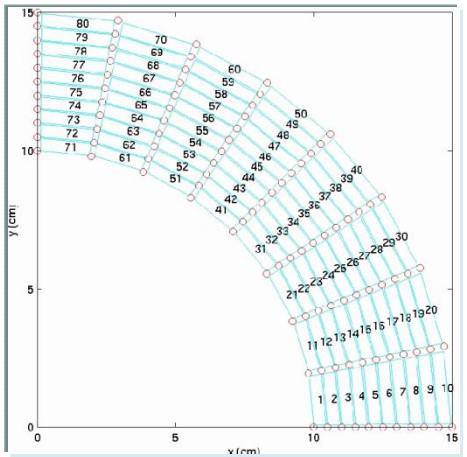
We do our best to improve pipe's quality from various angles. We carry out Stress analysis, FEM analysis, Filament winding method analysis service, if owner want.

<STRESS ANALYSIS>

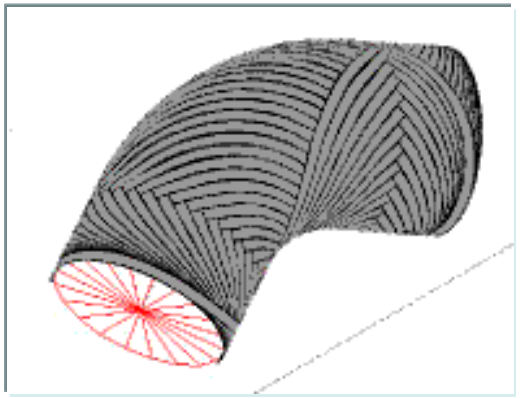




<FEM ANALYSIS>

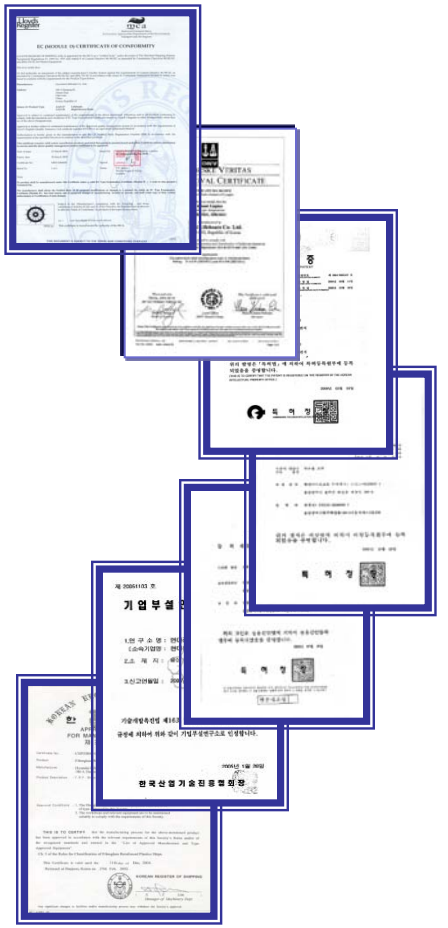


<Filament winding method>



The Present Possession of Certificates & Patents

No.	Name	Product	Approval Organization	Remark
1	ISO 9001:2008	GRP PIPE & lifeboat	Lloyd's Register	
2	KS ISO 14001:2009	GRP PIPE & lifeboat	KSA	
3	Fire pipe Approval	GRP PIPE	KFI	40A~900A 16BAR
4	Certificate of 1st product of the world	Lifeboat	Korea Government	
5	Inspection of Reinforced Plastic Works	GRP PIPE & FITTNGS	Lloyd's Register	
6	Certificate of Manufacture	GRP PIPE & FITTNGS	Korea Register	
7	Samsung Q MARK GOLD	GRP PIPE & Lifeboats	Samsung Heavy Industries	
8	Type Approval Certificate	GRP PIPE & FITTNGS	Det Norske Veritas	
9	Type Approval Certificate	GRP PIPE & FITTNGS	Korea Register	



WORLD CLASS PRODUCT OF KOREA
세계일류상품

The Present Possession of Certificates & Patents

No.	Name of Patent	The Application Number	Remark
1	Filament Winding Machine	Patent No. 10-111964	
2	Filament Winding Machine	Patent No. 10-111965	

특 허 증
CERTIFICATE OF PATENT

특 허 제 10-1111965 호 (PATENT NUMBER)
출원번호 (APPLICATION NUMBER) 제 2010-0003479 호
출 원 일 (FILING DATE:YY/MM/DD) 2010년 01월 14일
등 록 일 (REGISTRATION DATE:YY/MM/DD) 2012년 01월 27일

발명의명칭 (TITLE OF THE INVENTION)
필라멘트 와인딩 장치

특허권자 (PATENTEE)
등록사항란에 기재

발명자 (INVENTOR)
등록사항란에 기재

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(THIS IS TO CERTIFY THAT THE PATENT IS REGISTERED ON THE REGISTER OF THE KOREAN INTELLECTUAL PROPERTY OFFICE.)

2012년 01월 27일

특 허 청
COMMISSIONER, THE KOREAN INTELLECTUAL PROPERTY OFFICE

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특 허 증
CERTIFICATE OF PATENT

특 허 제 10-1111964 호 (PATENT NUMBER)
출원번호 (APPLICATION NUMBER) 제 2010-0020676 호
출 원 일 (FILING DATE:YY/MM/DD) 2010년 03월 09일
등 록 일 (REGISTRATION DATE:YY/MM/DD) 2012년 01월 27일

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특허권자 (PATENTEE)
등록사항란에 기재

발명자 (INVENTOR)
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