What is GPI standard CW-FRP pipe

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1/12 Information CW-FRP Pipe " J-stage GPI Journal for Oil& Gas, Hot spring"

(V1)

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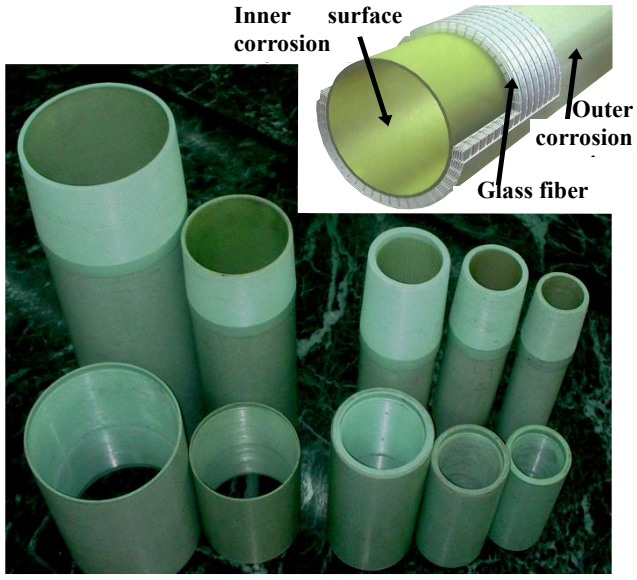
NBL International Co.,Ltd : nbl-technovator.com
NBL Material Co.,Ltd : nblmt.jp

Corrosion-resistant FRP pipe .

It is a pipe that does not corrode and can withstand high pressure as shown in the photo in Figure 1. On the other hand, oil and gas are hazardous materials and environmental pollutants. Safety takes precedence over everything else. International technical standards include American API standards and European There are ISO standards, etc. There are two types of oil fields: onshore oil fields and offshore oil fields. Used If the pipe is not in a corrosive environment, but the steel pipe, the pipe is in a corrosive environment FRP pipes are used. Shown on the right is the GPI standard FRP pipe and its structure. GPI pipes are subject to corrosion by seawater, such as offshore oil fields When or when you need the high temperature, high pressure and corrosion resistance required for reclaimed oil fields used. GPI tubes have a pH of 2 or higher, which is not applicable to API / ISO. It is applied to a withstand pressure of 20 MPa or more. FRP began to be used in OCTG about 50 years ago. When the average depth of the oil field in Rica was about 1100 m, Figure 3 (1) Approximately 20% of the reserves at the time of drilling are extracted by self-injection as shown in the lower right. It can be removed, but if the spontaneous injection stops, it will be mined by injecting water into the oil reservoir in (2) and about 30% of it is collected. Reduction of sampling by water injection and (3) proceeding to water injection of chemicals such as acids, and from the need for corrosion resistance It is necessary to change to the FRP pipe shown in the photo. The 14th Committee of API thus solves the problem of corrosion of steel pipes due to water injection FRP pipes are adopted for the solution and its technical standards are defined Was. Therefore, at that time, the 2000 m well was the application limit, and the resistance The pressure was 20 MPa, the heat resistance was 80 ° C., and the pH 2 was necessary and sufficient. However, the demand for oil has increased, and drilling deeper underground has been drilled The average is now 3,000 meters. On the other hand, mining technology has also recently increased from 45% mining of reserves in (1), (2) and (3) to The application of GPI pipes is utilizing geothermal heat at about 200°C at 7000m underground FIG. 3 Lower left, 200



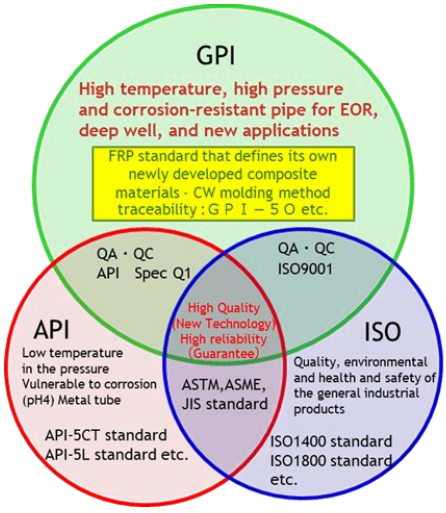


Fig 1 : International Standards for OCTG

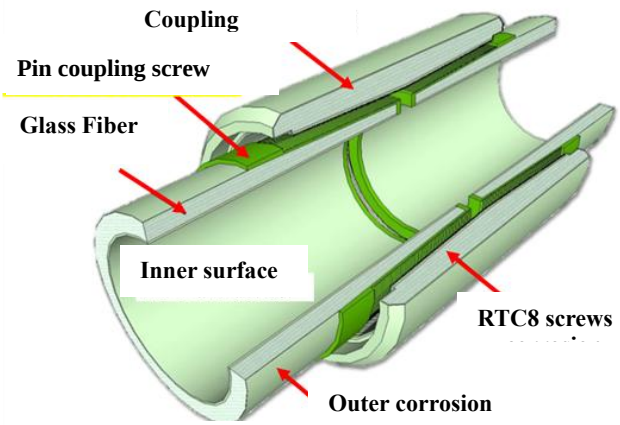


Fig 2 : GPI Joint Structure

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≪History of GPI standard CW-FRP pipe≫

Origin of CW technology: In 1963, Dr Yoshinori Nishino discovered the principle of centrifugal (CW) molding for the first time in the world in the laboratory of Professor Dr Shunpei Yamauchi of Osaka Institute of Technology, founder of NBL, and after working at the Hitachi Zosen Technology Research Institute, he established NBL in 1988, developed the technology for practical use with a NEDO grant in 2007~8, and released it internationally in 2009.

≪Development of OCTG≫

In 2007 and 2008, NBL was awarded a NEDO grant to develop FRP pipe manufacturing technology with pH 2, 100 MPa, and 200°C specifications for recycled oil fields that satisfies these requirements. At the same time, since there are no applicable standards for reclaimed oil fields and 7,000m drilling wells, the GPI Standardization Committee (international standard: Gloval Oil &Gas Pipe Institute, http:gpi-pipe.org) was established in Japan at the Institute of Scientific and Industrial Research (J-stage GPI) at the request of major oil companies. Published in Journal) was born. In 2009, this GPI standard was approved by China Petroleum, India ONGC, and Oman PDO, and joint ventures with oil majors led to the creation of manufacturing bases for GPI pipes. However, as of April 2021, due to the circumstances of each country and the unexpected era of oil surplus due to the outbreak of the coronavirus, the costly oil field revitalization project has been suspended, and the oil field revitalization project has become dormant. Due to other circumstances, the production of GPI pipes in India and China has also been suspended, and the only plant currently producing pipes is the NBL Materials Sennan Plant in Japan. The plant has a small production capacity of 10,000 pipes per year, and produces GPI-standard hot spring pipes for the domestic market.

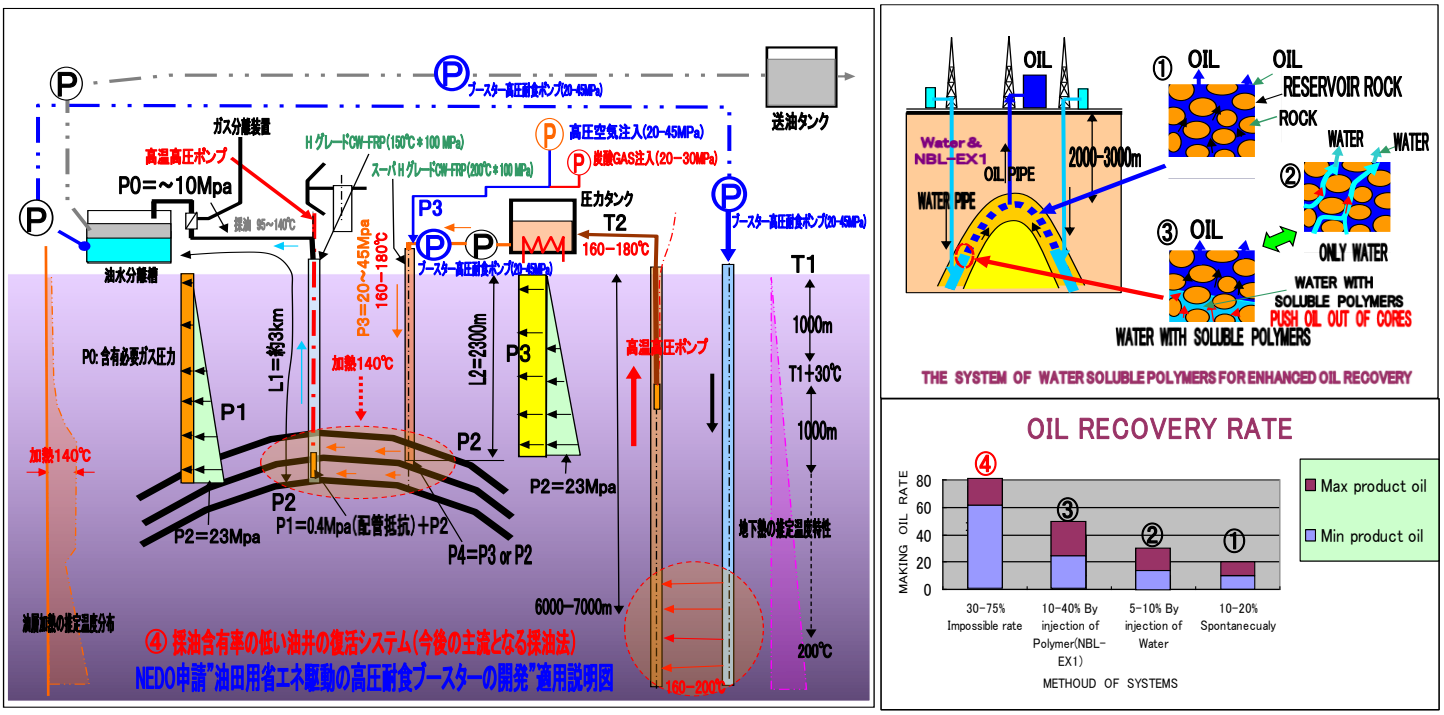

Fig 3 : Recycled oil field with pH2/200°C/100MPa required for OCTG

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Features of GPI Standard CW-FRP Pipe

Features of GPI Standard CW-FRP Pipe Centrifugal molding (CW) has a circumferential strength of about 450 MPa or more in which 80% effective fiber strength can be obtained by using 0.45 N / glass fiber, which is about twice as strong as the 180 MPa of conventional outer wound molding (FW).

FRP pipe was developed as a steel pipe corrosion prevention material shown in FIG. Therefore, the corrosion of iron pipes by hydrogen sulfide and carbon dioxide gas present in oil wells becomes the corrosion state shown in the photo in 1~2 years in some oil fields. The figure below shows the corrosion characteristics of an oil field. In some oil wells, even steel pipes using 15 chromium can deteriorate by about 40% in one year. When vinyl ester resin FRP pipes were used in these oil wells, the durability of the oil well, which required 10 years for about 30% deterioration, was increased by more than 10 times. On the other hand, FRP pipe products differ in performance depending on the molding method. The figure above shows the longitudinal axis strength showing the characteristics, and since FW molding is wound on the outside, the reinforcing fiber wound at the beginning becomes loose by squeezing out the resin by winding later, and the effective fiber strength is about 30% or less. On the other hand, in CW molding, uniform tension acts on the reinforcing fibers by centrifugal force in the resin, and the effective fiber strength is obtained by 80% or more, so even if the same material is used, the strength is different by 2 times or more.

NBL was the only company in the world that discovered, developed, and commercialized this centrifugal winding (CW method), and was the only company in the world that could produce it, and built production bases in India and China, and the applied technical standards published by the GPI Standardization Committee are new technologies and technical standards published on J-stage. In addition, the GPI standard is an applicable technical standard for CW molding method products because the applicable performance cannot be obtained in practical use of FW molded products. In addition, the GPI standard is an applicable technical standard for CW molding method products because the applicable performance cannot be obtained in practical use of FW molded products. In addition, since the GPI standard applies to the pipe and the fitting, the pipe tank is born by closing both ends of the pipe with an end coupling. That is, the GPI standard with a withstand pressure of 100 MPa applies to the high-pressure gas tank with a design withstand voltage of 100 MPa. In the FW molding method, it was found that it is not suitable for the production of ultra-high-pressure containers because the strength decreases when the tube thickness shown in the upper part of Fig. 4 is increased. It is not suitable for the production of high-pressure vessels with a working pressure of 80 MPa (design pressure of about 240 MPa or more), which is required for tanks with liquid hydrogen gas (LH2) and gaseous hydrogen gas (CH2).

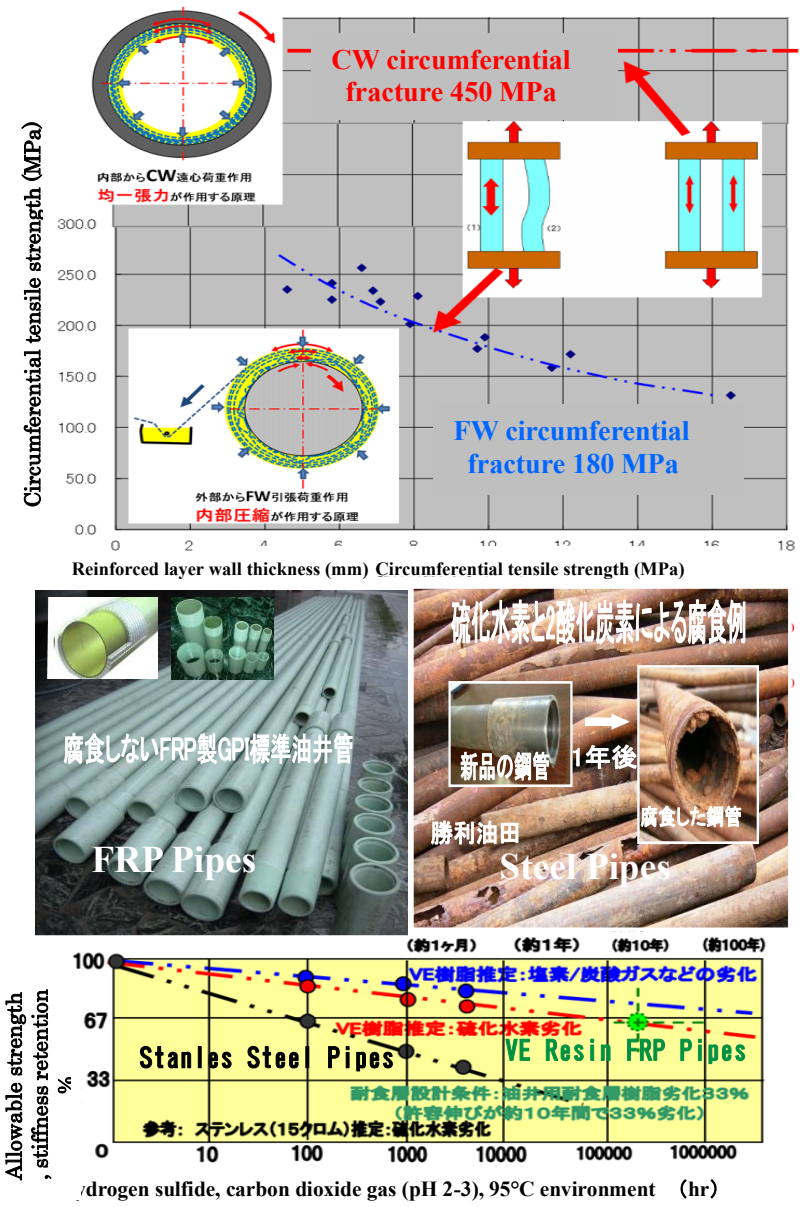

Fig 4 Steel pipe corrosion and stainless steel/ FRP pipe corrosion

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Development of unparalleled high-quality FRP OCTG

Tubing: 2-3/8”．2-7/8”．3-1/2”．4-1/2”
Casing: 5”．5-1/2”．7”．8-5/8” ．9-5/8”．13-3/8”．20”，23-5/8”．30”

Here, the application specifications of the CW molding method are introduced. Since the fibers of the applied reinforcing fiber are cloth-like with a straight arrangement and are wound from the inner surface in a seaweed wrap on the inner surface of the mold, orthogonal anisotropic reinforcing fiber cloth in the circumferential and axial directions is suitable. Normally 50% Vol filling, the product can be molded by lamination hardening with uniform tension in the circumferential direction. In addition, since the impregnating force of the resin in the fiber layer is molded at 100 times the acceleration of gravity, after the dry fiber lamination, it is input into the liquid resin and impregnated defoaming and molded, so that the impregnation and defoaming function is 100 times that of the FW method.

It will be. In addition, it is said to be an ideal molding method for corrosion-resistant FRP pipes, which has the characteristic of being able to form a 100% resin layer on the inner surface side (formation of a corrosion-resistant layer).The standard specifications for products produced by the CW method are as follows: When E-Glass 23 micron 0.45 N/tex reinforced fiber is used, 50% VolVE resin (18% elongation) is applied, and when the effective fiber strength is 80%, the reinforced layer physical properties of FRP pipe products are ● Circumferential strength 521 MPa ● Axial strength 283 MP FRP pipes for high-pressure tanks using 9 micron 0.65 N/tex reinforced fibers are compatible with H grades and above.● Intake strength 747 MPa ● Axial strength 404 MPa

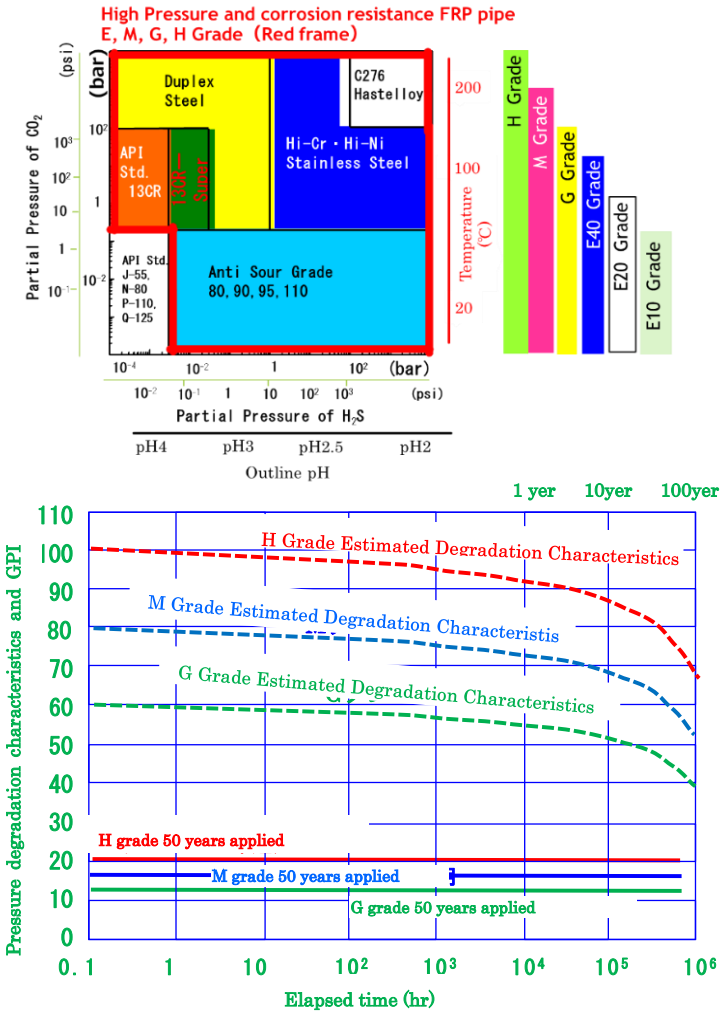

Fig 5 Degradation characteristics and applicable performance of GPI pipes

Figure 5 shows a summary of the quality application range, stress corrosion deterioration characteristics, and GPI applicable pressure resistance standards, which are superimposed on GPI standard FRP pipe application products superimposed on API standard corrosion-resistant steel pipe applications. The application standards for corrosion-resistant metal pipes shown in the figure above (vertical axis carbon dioxide gas concentration, horizontal axis hydrogen sulfide concentration, and nickel-chromium content contained in steel pipes) and the application of GPI's pressure-resistant grade standard pipes are shown in the red frame. In addition, the pH concentration to be contrasted with hydrogen sulfide and the temperature to be compared with carbon dioxide gas are also described. In other words, the largest corrosion application area (recycled oil field) is applied to Ni/Cr of Hastelloy alloy, an expensive rare material, but in the pH 2, 200°C, and high pressure range, GPI's inexpensive corrosion-resistant FRP pipe H-grade tube is applied.

In addition, durability is more than 50 years old, as shown by the application technology of the Al Jubert II project in Saudi Arabia, so semi-permanent use may be suitable. This became the most important technology project in the well reclamation project and influenced the revision of oil reserves. We are now in the era of carbon neutral tramps, but it is a product that is absolutely necessary for the future when the use of recycled oil fields resumes for the extraction of necessary oil and natural gas.

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Development of FRP hot spring pipes

Tubing: 1-1/2”.2-3/8”.2-7/8”.3-1/2”
Casing: 5”.7”

≪ Applied to the application of hot spring well pipes≫

In 2008, we developed a 5-inch FRP casing specifically for 6-inch steel pipes in collaboration with Oku Boring Co., Ltd. With the advent of this W-casing, it has become possible to regenerate hot spring wells in the same way as oil fields. FIG. 6 shows the construction of a regenerated hot spring well using a W casing. The feature of this casing tube began with the development of GPI semi-flush couplings, which made it possible to have thin-walled casing tube fittings. If the pumping pipe is also an FRP pipe, the cleaning acid for cleaning from the ground is injected into the casing pipe on a regular basis, and maintenance is performed by draining the scale by the pumping pipe, eliminating the need for large-scale maintenance work that was required in the past. In addition, if the piping system is also equipped with a maintenance chemical injection loop, it is possible to automatically clean it on a regular basis. We have developed a 5-inch FRP casing specifically for steel pipes. With the advent of this W-casing, it has become possible to regenerate hot spring wells in the same way as oil fields. FIG. 6 shows the construction of a regenerated hot spring well using a W casing. The feature of this casing tube began with the development of GPI semi-flush couplings, which made it possible to have thin-walled casing tube fittings. If the pumping pipe is also an FRP pipe, the cleaning acid for cleaning from the ground is injected into the casing pipe on a regular basis, and maintenance is performed by draining the scale by the pumping pipe, eliminating the need for large-scale maintenance work that was required in the past.

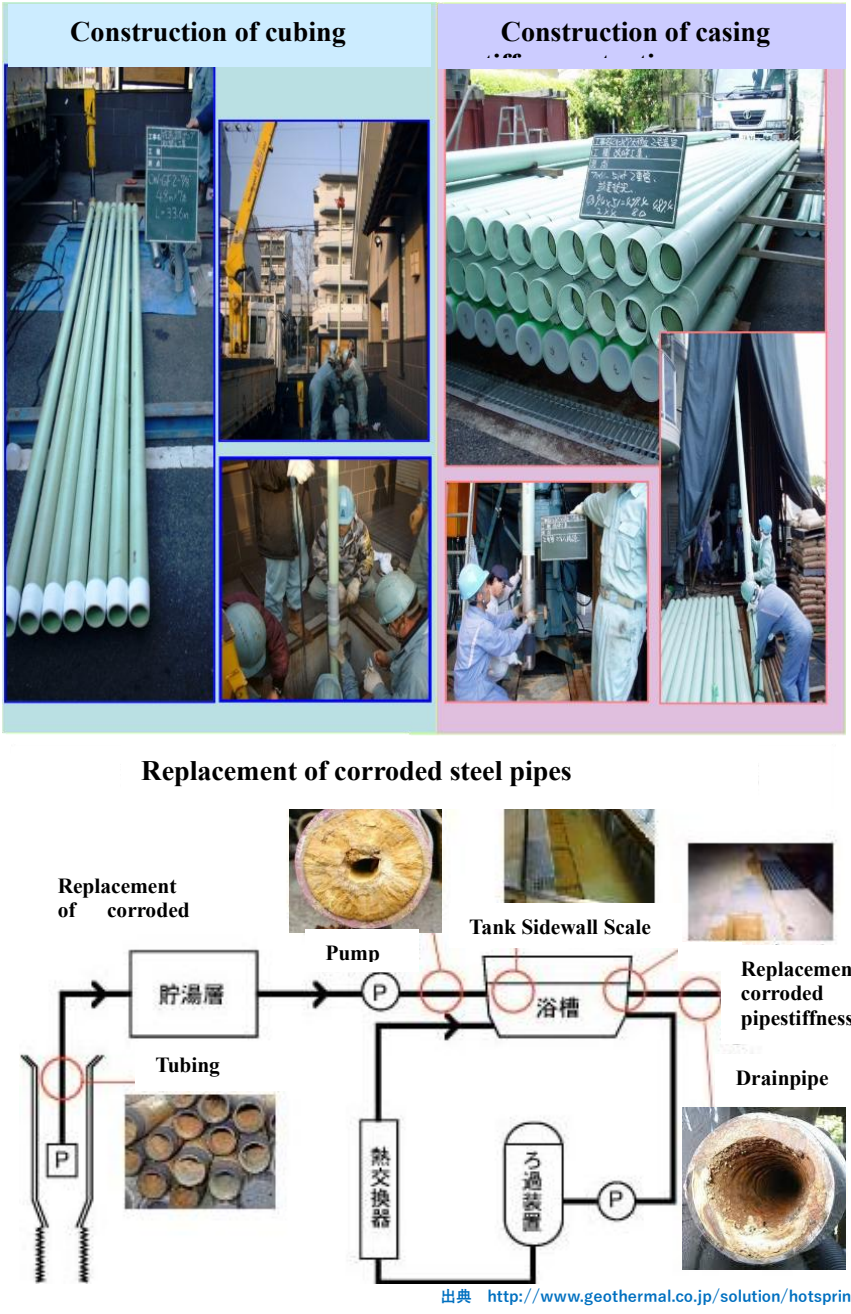

Fig 6 GPI pipes solve the scale corrosion problem of steel pipes

In addition, if the piping system is also equipped with a maintenance chemical injection loop, it is possible to automatically clean it on a regular basis.

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Development of FRP hot spring pipes

Tubing: 1-1/2”.2-3/8”.2-7/8”.3-1/2”
Casing: 5”.7”

≪Varieties of GPI Pipes≫

The pressure-resistant and heat-resistant grades of the GPI tubes shown in FIG. 7 are divided into six types. The application of each grade is specified to be suitable from a water well to a deep well of 4000 m. The allowable load is divided into six types: design load, short-term load, 10-year load, and 50-year load, and the heat-resistant grade is divided into 6 types as well as 60, 80, 110, 150, 200, and 250°C.

The high-pressure pipe required for high-pressure pipe tanks is called S grade, and is a high-pressure pipe for tanks that is not standard. Design Pressure.

There are fields where 240MPa is applied.

Fig 7 Application of GPI pipes

Pressure-resistant grade	Tubing Casing Line Pipes		Burst pressure	Short-term load	10 years durability	50 years durability
E10	Water source wells＜100m		10 MPa	5 MPa	3 MPa	2 MPa
E20	Water source wells＜200m		20 MPa	10 MPa	6 MPa	4 MPa
E40	Hot spring wells＜1500m	Water-soluble natural gas	40 MPa	20 MPa	12 MPa	8 MPa
G	Oil&Gas well＜2000m	Shale gas	60 MPa	30 MPa	20 MPa	12 MPa
M	Oil&Gas well＜3000m	Offshore Petroleum	80 MPa	40 MPa	26 MPa	16 MPa
H	Oil&Gas well＜4000m	Reclaimed oil fields	100 MPa	50 MPa	33 MPa	20MPa
Heat Resistant	－20～60℃	－10～80℃	0～100℃	25～150℃	25～200℃	～250℃
	60	80	110	150	200	250
Application of GPI abbreviations	Product Example 2-7/8G-80: GPI Pipe with coupling on one side and pin thread on the other, meaning 2-7/8" OD, G grade pres resistance, 110° C heat resistance.。					
	Product example 5 (W) E20-80: GPI pipe with pin threads at both ends, meaning 5 inch outer diameter (inner tube in casing), E20 pressure resistance, 80° C heat resistance.。					
	Product Example 3-1/2JM-100: 3-1/2 inch with GPI coupling, pressure resistant M grade, meaning heat resistant to 100°C					

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GPI standard pipe fitting threads and couplings

2 types of coupling screws, 3 types of couplings

≪Joint≫ The GPI standard screw coupling is a round screw (round head shaped screw) used for tubing, line pipes, tanks, etc., and uses a thread called R8 with an inch 8 round at 1/16 taper and the standard dimensions shown at the top of Figure 8. The feature is different from API steel pipe screws, and consists of a sealed structure with zero gap between the coupling screw and the pin cap screw (female thread and male thread). Lubrication sealing functional materials include line pipes and casing pipes that serve as fixed joints for the same purpose as welding using an epoxy adhesive material. In addition, VE resin is used as a connection lubrication sealing material for M-grade tubing, which requires release assembly more than 5 times. The low-pressure seal can be bonded with Teflon seal tape. On the other hand, for the fitting screw of the casing tube, which requires a special compressive force, a buttress screw with the sealing function of a square screw is adopted. The standard is 5B (5 mountain inches) with a 1/16 taper, details are shown in Figure 8. Applications include shale gas, coal gas, casing pipes, and other long-distance drilling.

≪Coupling≫

There are three types of GPI standard couplings: standard couplings with round threads, casing tubes that use thin-walled coupling joints called semi-flushes, and couplings that do not protrude the joints that construct buttress screws inside the tube thickness of the GPI tube. The threads for the standard and semi-flush couplings are RTC8 (1/16 tapered round screw 8 chevrons), and the full flush coupling screws are BTC5 (1/16 tapered buttresses 5 mountain inches). The applicable internal pressure grades are E~H grade for standard couplings, E~G grades for semi-flush couplings, and E grades for full flush. In addition, the sealing setting of the coupling screw requires GPI standard piping construction that strictly adheres to the construction conditions of tightening torque and use of lubricant to ensure the breaker operating pressure stipulated in the applicable quality assurance program.

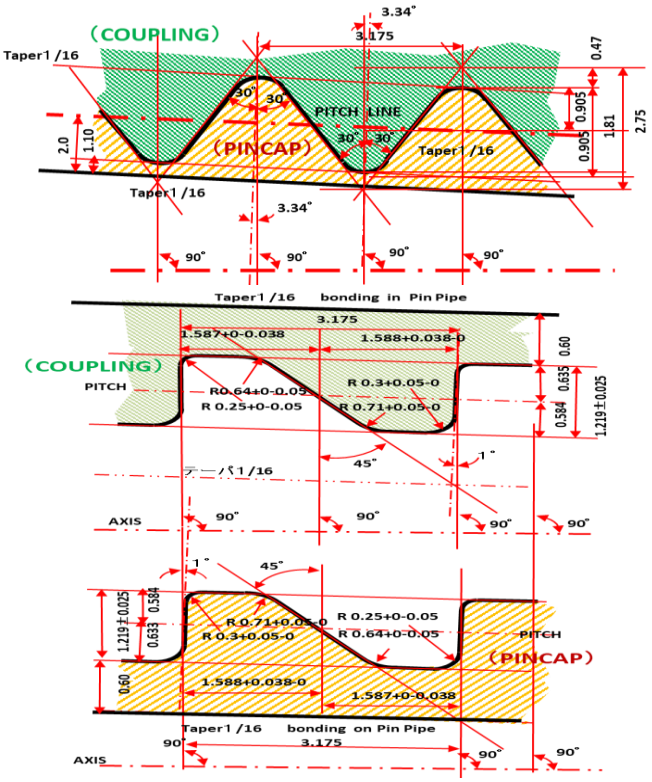

Fig.8 GPI Round Screw and Buttress Screw

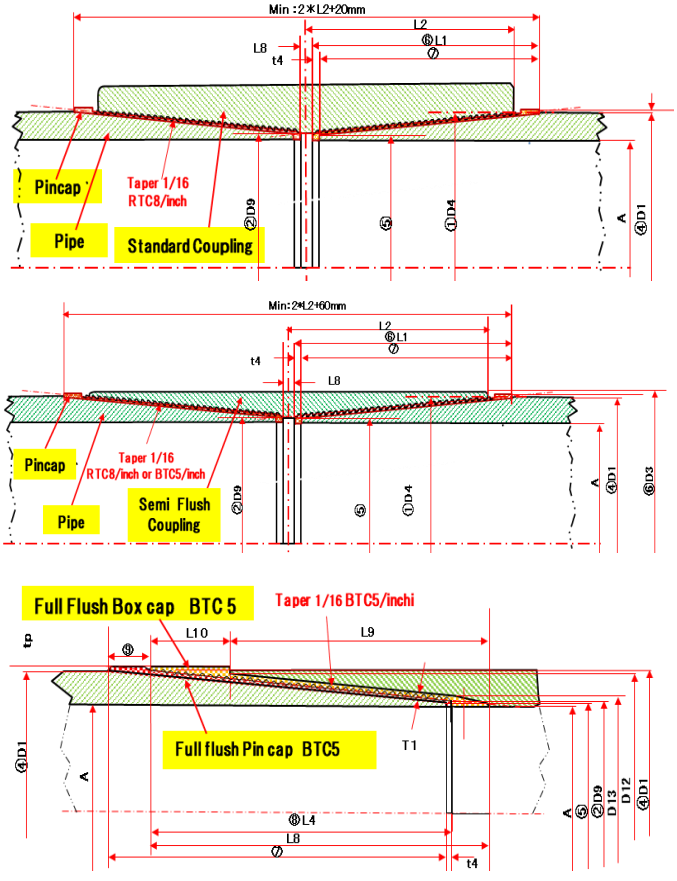

Fig.9 GPI Coupling

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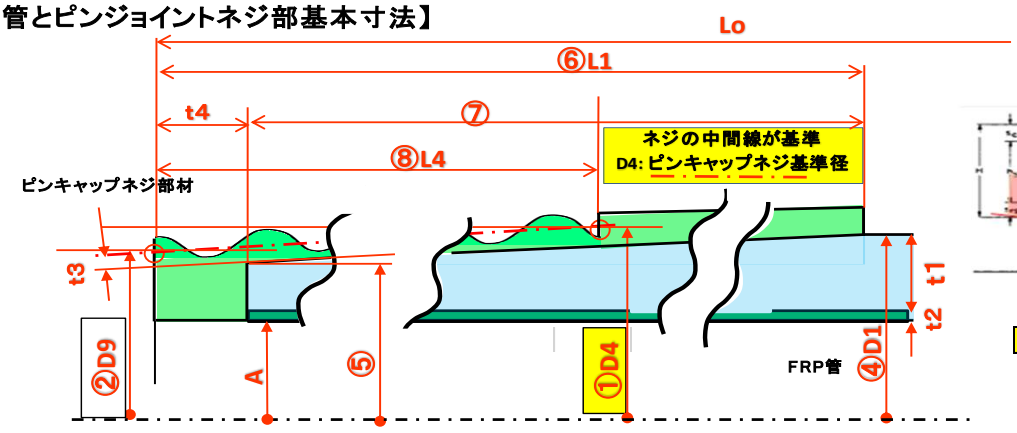
GPI Pipe Standard Dimensions(1)

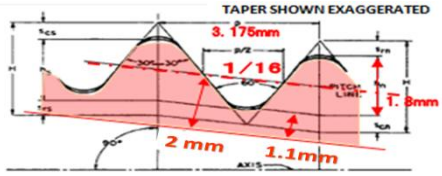
(The Sennan Plant's standard stock is hot spring pipes for Japan domestic market : 2-3/8", 2-7/8", 3-1/2", 5", 7")

≪Standard Dimensions of GPI Pipes≫

This is the standard dimension of the GPI pipes. Both ends are glued with RTC8 GPI standard pin caps. GPI pipes are available in six pressure-resistant grades: E10, E20, E40, and G.M.H. grades. The connecting threads are common. Heat-resistant grades are 60° C, 80°C, 110°C, 150°C .There are products made of 6 different resins at 200°C and 250°C.

【管とピンジョイントネジ部基本寸法】





GPI 標準ネジ詳細図

基準:	ネジ底厚さが基本	1.1 mm
	H=0.866P	2.75 mm
	P=0.125	3.175 mm
	Hs=0.07125	1.81 mm

【設計値】 GPI 標準チュービング管

(単位:mm)

呼びインチ	グレード	t1	t2	t3	t4	Lo	A	①D4	④D1	⑤	⑥L1	⑦	⑧L4	②D9	参考:設計強度 内圧 MPa	参考:設計強度 軸力 ton
1.9″	E10	2.0	1.0	2.0	3.0	9500	46.0	54.8	52	46.6	90	87	70	47.6	27	6
標準径	E20	3.0	1.0	2.0	3.0	9500	44.0	54.8	52	46.6	90	87	70	47.6	41	8
φ52mm	E40	4.0	1.0	2.0	3.0	9500	42.0	54.8	52	46.6	90	87	70	47.6	56	11
基準ネジ径	G	5.0	1.0	2.0	3.0	9500	40.0	54.8	52	46.6	90	87	70	47.6	71	13
(52.07mm)	M	6.0	1.0	2.0	3.0	9500	38.0	54.8	52	46.6	90	87	70	47.6	87	16
長さ 9.5m	H	7.0	1.0	2.0	3.0	9500	36.0	54.8	52	46.6	90	87	70	47.6	104	18
2-3/8″	E10	3.5	1.0	2.0	3.0	9500	57.0	66.8	64.0	57.9	100	97	80	61.8	36	11
標準径	E20	4.0	1.0	2.0	3.0	9500	56.0	66.8	64.0	57.9	100	97	80	61.8	43	13
φ64mm	E40	5.5	1.0	2.0	3.0	9500	53.0	66.8	64.0	57.9	100	97	80	61.8	65	19
基準ネジ径	G	6.0	1.0	2.0	3.0	9500	52.0	66.8	64.0	57.9	100	97	80	61.8	72	21
(66.75mm)	M	7.0	1.0	2.0	3.0	9500	50.0	66.8	64.0	57.9	100	97	80	61.8	86	25
長さ 9.5m	H	7.5	1.0	2.0	3.0	9500	49.0	66.8	64.0	57.9	100	97	80	61.8	112	27
2-7/8″	E10	4.0	1.0	2.0	3.0	9500	69.0	79.8	77.0	70.3	110	107	90	74.1	36	16
標準径	E20	4.5	1.0	2.0	3.0	9500	68.0	79.8	77.0	70.3	110	107	90	74.1	42	18
φ77mm	E40	6.0	1.0	2.0	3.0	9500	65.0	79.8	77.0	70.3	110	107	90	74.1	60	26
基準ネジ径	G	6.5	1.0	2.0	3.0	9500	64.0	79.8	77.0	70.3	110	107	90	74.1	66	28
(79.75mm)	M	8.0	1.0	2.0	3.0	9500	61.0	79.8	77.0	70.3	110	107	90	74.1	84	35
長さ 9.5m	H	9.0	1.0	2.0	3.0	9500	59.0	79.8	77.0	70.3	110	107	90	74.1	114	39
3-1/2″	E10	4.5	1.0	2.0	3.0	9500	83.0	94.8	92.0	83.8	135	132	115	87.6	35	22
標準径	E20	5.0	1.0	2.0	3.0	9500	82.0	94.8	92.0	83.8	135	132	115	87.6	40	25
φ92mm	E40	6.5	1.0	2.0	3.0	9500	79.0	94.8	92.0	83.8	135	132	115	87.6	55	34
基準ネジ径	G	7.5	1.0	2.0	3.0	9500	77.0	94.8	92.0	83.8	135	132	115	87.6	65	40
(94.75mm)	M	9.5	1.0	2.0	3.0	9500	73.0	94.8	92.0	83.8	135	132	115	87.6	85	51
長さ 9.5m	H	10.0	1.0	2.0	3.0	9500	72.0	94.8	92.0	83.8	135	132	115	87.6	108	53
4-1/2″	E10	5.2	1.0	2.0	3.0	9500	104.0	117.1	114.3	105.1	150	147	130	108.9	33	33
標準径	E20	5.7	1.0	2.0	3.0	9500	103.0	117.1	114.3	105.1	150	147	130	108.9	37	36
φ114.3mm	E40	7.7	1.0	2.0	3.0	9500	99.0	117.1	114.3	105.1	150	147	130	108.9	54	51
基準ネジ径	G	9.7	1.0	2.0	3.0	9500	95.0	117.1	114.3	105.1	150	147	130	108.9	70	65
(117.05mm)	M	11.7	1.0	2.0	3.0	9500	91.0	117.1	114.3	105.1	150	147	130	108.9	86	79
長さ9.5m	H	12.2	1.0	2.0	3.0	9500	90.0	117.1	114.3	105.1	150	147	130	108.9	107	82

ブラック欄: GPI標準ピンキャップネジの接合する管のピン最小肉厚tEが2mm以下となるため、特殊用途の適用以外、一般には適用基準外。
2-3/8″E10・E20, 2-7/8″E10・E20, 3-1/2″E10・E20, 4-1/2″E10・E20, 5″E10, 5-1/2E10

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GPI Pipe Standard Dimensions(2)

(The Sennan Plant's standard stock is hot spring pipes for Japan domestic market : 2-3/8" , 2-7/8" , 3-1/2" , 5" , 7")

呼びインチ	グレード	t1	t2	t3	t4	Lo	A	①D4	④D1	⑤	⑥L1	⑦	⑧L4	②D9	内圧 MPa	軸力 ton
5″ 標準径 φ127mm 基準ネジ径 (129.75mm) 長さ9.5m	E10	4.5	1.0	2.0	3.0	9500	118.0	129.8	127.0	120.9	100	97	80	124.8	25	31
	E20	5.0	1.0	2.0	3.0	9500	117.0	129.8	127.0	120.9	100	97	80	124.8	29	35
	E40	7.5	1.0	2.0	3.0	9500	112.0	129.8	127.0	120.9	100	97	80	124.8	47	56
	G	9.5	1.0	2.0	3.0	9500	108.0	129.8	127.0	120.9	100	97	80	124.8	62	72
	M	12.0	1.0	2.0	3.0	9500	103.0	129.8	127.0	119.4	125	122	105	123.2	80	91
	H	12.5	1.0	2.0	3.0	9500	102.0	129.8	127.0	119.4	125	122	105	123.2	100	95
5-1/2″ 標準径 φ139.7mm 基準ネジ径 (142.45mm) 長さ9.5m	E10	5.3	1.0	2.0	3.0	9500	129.0	142.5	139.7	132.7	115	112	95	136.5	29	42
	E20	6.3	1.0	2.0	3.0	9500	127.0	142.5	139.7	132.7	115	112	95	136.5	35	52
	E40	7.8	1.0	2.0	3.0	9500	124.0	142.5	139.7	132.7	115	112	95	136.5	45	65
	G	11.4	1.0	2.0	3.0	9500	117.0	142.5	139.7	132.7	115	112	95	136.5	68	96
	M	12.9	1.0	2.0	3.0	9500	114.0	142.5	139.7	131.1	140	137	120	135.0	78	109
	H	13.9	1.0	2.0	3.0	9500	112.0	142.5	139.7	131.1	140	137	120	135.0	101	117
7″ 標準径 E・G φ176mm M・H φ177.8mm 基準ネジ径 (178.75mm) (180.55mm) 長さ9.5m	E10	6.5	1.0	2.0	3.0	9500	163.0	178.8	176.0	168.1	130	127	110	171.9	29	67
	E20	7.0	1.0	2.0	3.0	9500	162.0	178.8	176.0	168.1	130	127	110	171.9	31	73
	E40	9.0	1.0	2.0	3.0	9500	158.0	178.8	176.0	168.1	130	127	110	171.9	42	96
	G	13.0	1.0	2.0	3.0	9500	150.0	178.8	176.0	168.1	130	127	110	171.9	63	141
	M	16.9	1.0	2.0	3.0	9500	144.0	180.6	177.8	166.7	180	177	160	170.6	82	185
	H	17.9	1.0	2.0	3.0	9500	142.0	180.6	177.8	166.7	180	177	160	170.6	105	195
8-5/8″ 標準径 φ219.1mm 基準ネジ径 (221.85mm) 長さ9.5m	E10	8.1	1.0	2.0	3.0	9500	203.0	221.9	219.1	210.2	145	142	125	214.0	30	107
	E20	9.6	1.0	2.0	3.0	9500	200.0	221.9	219.1	210.2	145	142	125	214.0	36	129
	E40	11.6	1.0	2.0	3.0	9500	196.0	221.9	219.1	210.2	145	142	125	214.0	44	158
	G	16.6	1.0	2.0	3.0	9500	186.0	221.9	219.1	206.8	200	197	180	210.6	65	227
	M	20.6	1.0	2.0	3.0	9500	178.0	221.9	219.1	206.8	200	197	180	210.6	82	280
	H	21.6	1.0	2.0	3.0	9500	176.0	221.9	219.1	206.8	200	197	180	210.6	103	293
9-5/8″ 標準径 φ247.5mm 基準ネジ径 (247.25mm) 長さ 9.5m	E10	8.8	1.0	2.0	3.0	9500	227.0	247.3	244.5	234.7	160	157	140	238.5	29	132
	E20	10.3	1.0	2.0	3.0	9500	224.0	247.3	244.5	234.7	160	157	140	238.5	35	156
	E40	13.3	1.0	2.0	3.0	9500	218.0	247.3	244.5	234.7	160	157	140	238.5	46	205
	G	17.3	1.0	2.0	3.0	9500	210.0	247.3	244.5	230.3	230	227	210	234.1	61	267
	M	22.3	1.0	2.0	3.0	9500	200.0	247.3	244.5	230.3	230	227	210	234.1	80	341
	H	23.3	1.0	2.0	3.0	9500	198.0	247.3	244.5	230.3	230	227	210	234.1	100	356
13-3/8″ 標準径 φ352.4mm 基準ネジ径 (355.15mm) 長さ9.5m	E10	12.7	1.0	2.0	3.0	9500	327.0	355.2	352.4	338.8	220	217	200	342.7	31	287
	E20	13.2	1.0	2.0	3.0	9500	326.0	355.2	352.4	338.8	220	217	200	342.7	32	299
	E40	17.7	1.0	2.0	3.0	9500	317.0	355.2	352.4	338.8	220	217	200	342.7	44	404
	G	24.2	1.0	2.0	3.0	9500	304.0	355.2	352.4	332.6	320	317	300	336.4	61	550
	M	32.2	1.0	2.0	3.0	9500	288.0	355.2	352.4	332.6	320	317	300	336.4	81	721
	H	33.2	1.0	2.0	3.0	9500	286.0	355.2	352.4	332.6	320	317	300	336.4	101	742
20″ 標準径 φ508mm 基準ネジ径 (510.75mm) 長さ9.5m	E10	18.0	1.0	2.0	3.0	9500	472.0	510.8	508.0	493.2	240	237	220	497.0	31	602
	E20	19.0	1.0	2.0	3.0	9500	470.0	510.8	508.0	493.2	240	237	220	497.0	33	636
	E40	24.0	1.0	2.0	3.0	9500	460.0	510.8	508.0	493.2	240	237	220	497.0	42	804
	G	34.0	1.0	2.0	3.0	9500	440.0	510.8	508.0	483.2	400	397	380	487.0	60	1130
	M	46.0	1.0	2.0	3.0	9500	416.0	510.8	508.0	483.2	400	397	380	487.0	81	1501
	H	47.0	1.0	2.0	3.0	9500	414.0	510.8	508.0	483.2	400	397	380	487.0	100	1531
23-5/8″ 標準径 φ600mm 基準ネジ径 (602.75mm) 長さ9.5m	E10	21.0	1.0	2.0	3.0	9500	558.0	602.8	600.0	582.7	280	277	260	586.5	31	836
	E20	22.0	1.0	2.0	3.0	9500	556.0	602.8	600.0	582.7	280	277	260	586.5	32	877
	E40	28.0	1.0	2.0	3.0	9500	544.0	602.8	600.0	582.7	280	277	260	586.5	41	1115
	G	40.0	1.0	2.0	3.0	9500	520.0	602.8	600.0	568.9	500	497	480	572.8	60	1577
	M	53.0	1.0	2.0	3.0	9500	494.0	602.8	600.0	568.9	500	497	480	572.8	80	2054
	H	56.0	1.0	2.0	3.0	9500	488.0	602.8	600.0	568.9	500	497	480	572.8	101	2161
30″ 標準径 φ762mm 基準ネジ径 (764.75mm) 長さ9.5m	E10	27.0	1.0	2.0	3.0	9500	708.0	764.8	762.0	747.2	240	237	220	751.0	31	1380
	E20	29.0	1.0	2.0	3.0	9500	704.0	764.8	762.0	747.2	240	237	220	751.0	34	1482
	E40	36.0	1.0	2.0	3.0	9500	690.0	764.8	762.0	747.2	240	237	220	751.0	42	1835
	G	52.0	1.0	2.0	3.0	9500	658.0	764.8	762.0	720.9	660	657	640	724.8	62	2615
	M	68.0	1.0	2.0	3.0	9500	626.0	764.8	762.0	720.9	660	657	640	724.8	81	3358
	H	72.0	1.0	2.0	3.0	9500	618.0	764.8	762.0	720.9	660	657	640	724.8	102	3538

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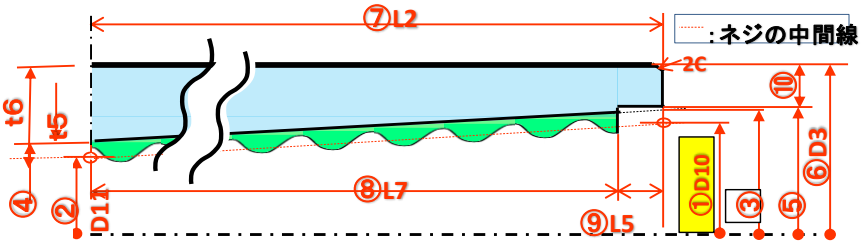
GPI Coupling Standard Dimensions(1)

(The Sennan Plant's standard stock is hot spring pipes for Japan domestic market : 2-3/8" , 2-7/8" , 3-1/2" , 5" , 7")

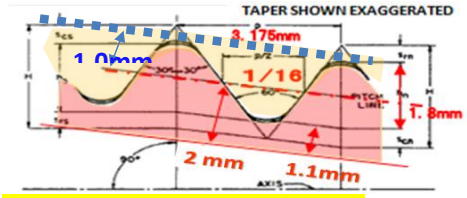
≪GPI coupling standard dimensions≫

The connection is applied by the API standard RTC8. For construction, be sure to connect with an appropriate specified torque (standard residual thread) using a lubricant that serves as the breaker setting pressure. The heat-resistant grade is 60° C, 80° C, 110° C, 150° C, 200° C, 250° C, and there are products made of 6 different resins, which are the standard dimensions of GPI couplings. The coupling application screw is RTC8, which is commonly applied up to H grade

【カップリング部基本寸法】



【ネジ詳細図】



ネジ底厚さが基本	1.00 mm
H=0.866P	2.75 mm
P=0.125	3.18 mm
Hs=0.07125	1.81 mm

【設計値】 チュービング用

単位:mm　　D4: ピンキャップネジ基準径　　t1; 管強化層肉厚

呼びインチ	グレード	t5	t6	D4	⑦＊2	①D10	②D11	③	④	⑤	⑥D3	⑦L2	⑧L7	⑨L5	⑩	参考: t6/t1	参考: J
1.9″ 標準径 φ52mm 基準ネジ径 (52.07mm) 長さ 9.5m	E10	1.0	7.45	54.8	160	54.8	47.6	56.6	49.6	58	64.5	80	70	10	6.5	3.7	1.9J
	E20	1.0	7.45	54.8	160	54.8	47.6	56.6	49.6	58	64.5	80	70	10	6.5	2.5	
	E40	1.0	7.45	54.8	160	54.8	47.6	56.6	49.6	58	64.5	80	70	10	6.5	1.9	
	G	1.0	7.45	54.8	160	54.8	47.6	56.6	49.6	58	64.5	80	70	10	6.5	1.5	
	M	1.0	7.45	54.8	160	54.8	47.6	56.6	49.6	58	64.5	80	70	10	6.5	1.2	
	H	1.0	7.45	54.8	160	54.8	47.6	56.6	49.6	58	64.5	80	70	10	6.5	1.1	
2-3/8″J 標準径 φ64mm 基準ネジ径 (66.75mm) 長さ 9.5m	E10	1.0	10.8	66.75	180	65.9	60.3	67.9	62.3	69	84	90.0	80	10	7.5	3.1	2-3/8J
	E20	1.0	10.8	66.75	180	66.0	60.3	68.0	62.3	69	84	90.0	80	10	7.5	2.7	
	E40	1.0	10.8	66.75	180	66.0	60.4	68.0	62.4	69	84	90.0	80	10	7.5	2.0	
	G	1.0	10.8	66.75	180	66.0	60.4	68.0	62.4	69	84	90.0	80	10	7.5	1.8	
	M	1.0	10.8	66.75	180	66.0	60.4	68.0	62.4	69	84	90.0	80	10	7.5	1.5	
	H	1.0	10.8	66.75	180	66.0	60.4	68.0	62.4	69	84	90.0	80	10	7.5	1.4	
2-7/8″J 標準径 φ77mm 基準ネジ径 (79.75mm) 長さ 9.5m	E10	1.0	11.2	79.75	200	79.0	72.7	81.0	74.7	82	97	100.0	90	10	7.5	2.8	2-7/8J
	E20	1.0	11.1	79.75	200	79.0	72.7	81.0	74.7	82	97	100.0	90	10	7.5	2.5	
	E40	1.0	11.1	79.75	200	79.0	72.8	81.0	74.8	82	97	100.0	90	10	7.5	1.8	
	G	1.0	11.1	79.75	200	79.0	72.8	81.0	74.8	82	97	100.0	90	10	7.5	1.7	
	M	1.0	11.1	79.75	200	79.0	72.8	81.0	74.8	82	97	100.0	90	10	7.5	1.4	
	H	1.0	11.1	79.75	200	79.1	72.8	81.1	74.8	82	97	100.0	90	10	7.5	1.2	
3-1/2″J 標準径 φ92mm 基準ネジ径 (94.75mm) 長さ 9.5m	E10	1.0	14.9	94.75	250	93.9	86.1	95.9	88.1	100	118	125.0	115	10	9.0	3.3	3-1/2J
	E20	1.0	14.9	94.75	250	93.9	86.1	95.9	88.1	100	118	125.0	115	10	9.0	3.0	
	E40	1.0	14.9	94.75	250	94.0	86.2	96.0	88.2	100	118	125.0	115	10	9.0	2.3	
	G	1.0	14.9	94.75	250	94.0	86.2	96.0	88.2	100	118	125.0	115	10	9.0	2.0	
	M	1.0	14.9	94.75	250	94.0	86.2	96.0	88.2	100	118	125.0	115	10	9.0	1.6	
	H	1.0	14.9	94.75	250	94.0	86.2	96.0	88.2	100	118	125.0	115	10	9.0	1.5	
4-1/2″J 標準径 φ114.3mm 基準ネジ径 (117.05mm) 長さ9.5m	E10	1.0	17.8	117.05	280	116.2	107.5	118.2	109.5	119	145	140.0	130	10	13.0	3.4	4-1/2J
	E20	1.0	17.8	117.05	280	116.2	107.5	118.2	109.5	119	145	140.0	130	10	13.0	3.1	
	E40	1.0	17.7	117.05	280	116.3	107.5	118.3	109.5	119	145	140.0	130	10	13.0	2.3	
	G	1.0	17.7	117.05	280	116.3	107.6	118.3	109.6	119	145	140.0	130	10	13.0	1.8	
	M	1.0	17.7	117.05	280	116.3	107.6	118.3	109.6	119	145	140.0	130	10	13.0	1.5	
	H	1.0	17.7	117.05	280	116.3	107.6	118.3	109.6	119	145	140.0	130	10	13.0	1.5	

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GPI coupling standard dimenstions(2)

10/12
(V1)

(The Sennan Plant's standard stock is hot spring pipes for Japan domestic market : 2-3/8" , 2-7/8" , 3-1/2" , 5" , 7")

呼びインチ	グレード	t5	t6	D4	⑦＊2	①D10	②D11	③	④	⑤	⑥D3	⑦L2	⑧L7	⑨L5	⑩	t6/t1	J
5″J 標準径 φ127mm 基準ネジ径 (129.75mm) 長さ9.5m	E10	1.0	4.6	129.8	174.0	129.2	123.8	131.2	125.8	132	135	87	80	7	1.5	1.0	5JE
	E20	1.0	4.6	129.8	174.0	129.3	123.8	131.3	125.8	132	135	87	80	7	1.5	0.9	
	E40	1.0	4.8	129.8	180.0	129.1	123.5	131.1	125.5	132	135	90	80	10	1.5	0.6	
	G	1.0	7.9	129.8	180.0	129.1	123.4	131.1	125.4	132	141.3	90	80	10	4.65	0.8	5J
	M	1.0	7.9	129.8	180.0	129.1	123.5	131.1	125.5	132	141.3	90	80	10	4.65	0.7	
	H	1.0	7.9	129.8	180.0	129.1	123.5	131.1	125.5	132	141.3	90	80	10	4.65	0.6	
5-1/2″J 標準径 φ139.7mm 基準ネジ径 (142.45mm) 長さ9.5m	E10	1.0	8.3	142.5	210.0	141.7	135.2	143.7	137.2	145	153.7	105	95	10	4.35	1.5	5-1/2J
	E20	1.0	8.3	142.5	210.0	141.7	135.2	143.7	137.2	145	153.7	105	95	10	4.35	1.3	
	E40	1.0	8.3	142.5	210.0	141.8	135.2	143.8	137.2	145	153.7	105	95	10	4.35	1.0	
	G	1.0	8.2	142.5	210.0	141.8	135.2	143.8	137.2	145	153.7	105	95	10	4.35	0.7	
	M	1.0	8.2	142.5	210.0	141.8	135.2	143.8	137.2	145	153.7	105	95	10	4.35	0.6	
	H	1.0	8.2	142.5	210.0	141.8	135.2	143.8	137.2	145	153.7	105	95	10	4.35	0.6	
7″J 標準径 E・G φ176mm M・H φ177.8mm 基準ネジ径 (178.75mm)(180.55mm) 長さ 9.5m	E10	1.0	5.7	178.8	240.0	178.1	170.6	180.1	172.6	180.3	184	120	110	10	1.85	0.9	7JE
	E20	1.0	5.7	178.8	240.0	178.1	170.6	180.1	172.6	180.3	184	120	110	10	1.85	0.8	
	E40	1.0	5.7	178.8	240.0	178.1	170.6	180.1	172.6	180.3	184	120	110	10	1.85	0.6	
	G	1.0	10.7	178.8	240.0	178.1	170.6	180.1	172.6	180.3	194	120	110	10	6.85	0.8	7J
	M	1.0	9.8	180.6	240.0	179.9	172.4	181.9	174.4	180.3	194	120	110	10	6.85	0.6	
	H	1.0	9.8	180.6	240.0	179.9	172.4	181.9	174.4	180.3	194	120	110	10	6.85	0.5	
8-5/8″J 標準径 φ219.1mm 基準ネジ径 (221.85mm) 長さ9.5m	E10	1.0	14.9	221.9	270.0	221.1	212.7	223.1	214.7	225	244.48	135	125	10	9.74	1.8	8-5/8J
	E20	1.0	14.9	221.9	270.0	221.1	212.7	223.1	214.7	225	244.48	135	125	10	9.74	1.6	
	E40	1.0	14.9	221.9	270.0	221.1	212.7	223.1	214.7	225	244.48	135	125	10	9.74	1.3	
	G	1.0	14.9	221.9	270.0	221.2	212.7	223.2	214.7	225	244.48	135	125	10	9.74	0.9	
	M	1.0	14.9	221.9	270.0	221.2	212.7	223.2	214.7	225	244.48	135	125	10	9.74	0.7	
	H	1.0	14.9	221.9	270.0	221.2	212.7	223.2	214.7	225	244.48	135	125	10	9.74	0.7	
9-5/8″J 標準径 φ247.5mm 基準ネジ径 (247.25mm) 長さ 9.5m	E10	1.0	9.0	247.3	300.0	246.6	237.2	248.6	239.2	251	257.2	150	140	10	3.1	1.0	9-5/8J
	E20	1.0	9.0	247.3	300.0	246.6	237.2	248.6	239.2	251	257.2	150	140	10	3.1	0.9	
	E40	1.0	9.0	247.3	300.0	246.6	237.2	248.6	239.2	251	257.2	150	140	10	3.1	0.7	
	G	1.0	9.0	247.3	300.0	246.6	237.2	248.6	239.2	251	257.2	150	140	10	3.1	0.5	
	M	1.0	9.0	247.3	300.0	246.6	237.2	248.6	239.2	251	257.2	150	140	10	3.1	0.4	
	H	1.0	9.0	247.3	300.0	246.6	237.2	248.6	239.2	251	257.2	150	140	10	3.1	0.4	
13-3/8″J 標準径 φ352.4mm 基準ネジ径 (355.15mm) 長さ9.5m	E10	1.0	10.9	355.2	420.0	354.5	341.3	356.5	343.3	357.5	365.1	210	200	10	3.8	0.9	13-3/8J
	E20	1.0	10.9	355.2	420.0	354.5	341.3	356.5	343.3	357.5	365.1	210	200	10	3.8	0.8	
	E40	1.0	10.9	355.2	420.0	354.5	341.4	356.5	343.4	357.5	365.1	210	200	10	3.8	0.6	
	G	1.0	10.9	355.2	420.0	354.5	341.4	356.5	343.4	357.5	365.1	210	200	10	3.8	0.4	
	M	1.0	10.9	355.2	420.0	354.5	341.4	356.5	343.4	357.5	365.1	210	200	10	3.8	0.3	
	H	1.0	10.9	355.2	420.0	354.5	341.4	356.5	343.4	357.5	365.1	210	200	10	3.8	0.3	
20″J 標準径 φ508mm 基準ネジ径 (510.75mm) 長さ9.5m	E10	1.0	17.9	510.8	460.0	510.1	495.7	512.1	497.7	514	533.4	230	220	10	9.7	1.0	20J
	E20	1.0	17.9	510.8	460.0	510.1	495.7	512.1	497.7	514	533.4	230	220	10	9.7	0.9	
	E40	1.0	17.8	510.8	460.0	510.1	495.7	512.1	497.7	514	533.4	230	220	10	9.7	0.7	
	G	1.0	17.8	510.8	460.0	510.1	495.7	512.1	497.7	514	533.4	230	220	10	9.7	0.5	
	M	1.0	17.8	510.8	460.0	510.1	495.7	512.1	497.7	514	533.4	230	220	10	9.7	0.4	
	H	1.0	17.8	510.8	460.0	510.1	495.7	512.1	497.7	514	533.4	230	220	10	9.7	0.4	
23-5/8″J 標準径 φ600mm 基準ネジ径 (602.75mm) 長さ9.5m	E10	1.0	18.9	602.8	540.0	602.1	585.2	604.1	587.2	606	625	270	260	10	9.5	0.9	23-5/8JE
	E20	1.0	18.9	602.8	540.0	602.1	585.2	604.1	587.2	606	625	270	260	10	9.5	0.9	
	E40	1.0	18.9	602.8	540.0	602.1	585.2	604.1	587.2	606	625	270	260	10	9.5	0.7	
	G	1.0	25.8	602.8	980.0	602.1	571.5	604.1	573.5	606	625	490	480	10	9.5	0.6	23-5/8J
	M	1.0	25.8	602.8	980.0	602.1	571.5	604.1	573.5	606	625	490	480	10	9.5	0.5	
	H	1.0	25.8	602.8	980.0	602.1	571.5	604.1	573.5	606	625	490	480	10	9.5	0.5	
30″J 標準径 φ762mm 基準ネジ径 (764.75mm) 長さ9.5m	E10	1.0	20.3	764.8	620.0	764.1	744.7	766.1	746.7	768	787.4	350	300	10	9.7	0.8	30JE
	E20	1.0	20.3	764.8	620.0	764.1	744.7	766.1	746.7	768	787.4	350	300	10	9.7	0.7	
	E40	1.0	20.3	764.8	620.0	764.1	744.7	766.1	746.7	768	787.4	350	300	10	9.7	0.6	
	G	1.0	31.0	764.8	1300.0	764.1	723.5	766.1	725.5	768	787.4	650	640	10	9.7	0.6	30JE
	M	1.0	31.0	764.8	1300.0	764.1	723.5	766.1	725.5	768	787.4	650	640	10	9.7	0.5	
	H	1.0	31.0	764.8	1300.0	764.1	723.5	766.1	725.5	768	787.4	650	640	10	9.7	0.4	

ブラック欄： GPI標準ケーシング用カップリング の管厚が最小肉厚比0.5以下となるため、特殊用途のみ適用、一般には適用基準外とする。

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Introduction of NBL's JAT Pump for Hot Springs

(Features: Vacuum insulation pipes and jet pumps that enable geothermal heating of recycled hot springs)

≪NBL Development Tubing Pump≫

A special feature of the NBL developed tubing pump is that it enables circulating geothermal heating of hot spring water through a casing tube by means of a jet pump in the tubing. Since geothermal heat generally rises by 20°C every 1,000 m, the average temperature on the surface is 20°C to about 50°C at a depth of 1,500 m. This is a pumping system in which a jet pump is inserted from the top into the 3-1/2" tubing of a vacuum insulated double tube developed to utilize this deep underground temperature, and pumps it to the required temperature of 46°C.

When the structure is set up in an existing hot spring well, for example, additional drilling is carried out up to 1500 m, as shown in Fig. 10, to secure the required amount of hot springs and enable recycling of low-temperature hot springs.

This newly developed geothermal The economic effect of the heating system can minimize the boiler fuel required, for example, by city gas.

If you contact us, we will calculate the construction plan, energy saving effect, and reduced fuel cost free of charge. We will also provide an estimate for the additional construction work required.

In addition, we will estimate and plan a scale automatic cleaning system for the piping system.

Note: In order to make an inquiry, it is necessary to disclose detailed design documents such as construction drawings of existing source wells. This newly developed geothermal The economic effect of the heating system can minimize the boiler fuel required, for example, by city gas. If you contact us, we will calculate the construction plan, energy saving effect, and reduced fuel cost free of charge. We will also provide an estimate for the additional construction work required.

In addition, we will estimate and plan a scale automatic cleaning system for the piping system.

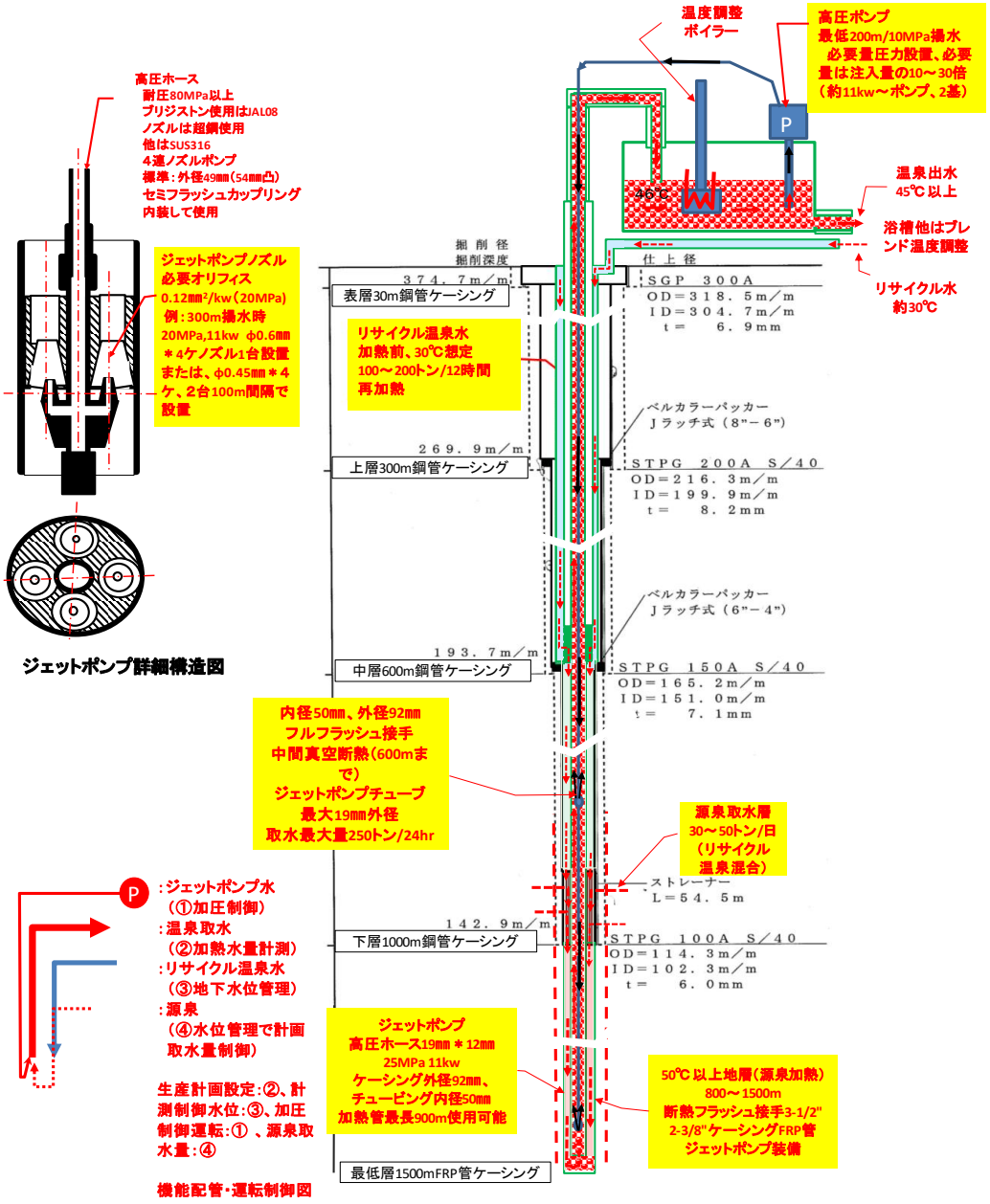

Fig. 10 Geothermal hot springs using vacuum-insulated jet pumps

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NBL Development: Advanced Drive Boring

(NBL's New Technology Development: Introduction of Low-Cost Hot Spring Drilling Technology, 3-1/2" (80mm inner diameter), jet pump

≪NBL Develops Advanced Driven Drilling ≫

For the drilling of new low-cost hot springs, there is a small-bore hot spring well with a state-of-the-art borehole system being developed by NBL. The principle is the excavation from the side of the specially equipped vehicle volume shown in Fig. 11. The drilling pipe is a 3-1/2" semi-flush coupling contact casing pipe with a hot spring sampling hole made of FRP special pipe, and it is a system that enables high-speed excavation by using a tip drive motor with water pressure inside the pipe, and slurry drainage of excavated sediment.

The basis of this system was shale forehead drilling, which is used for oil and gas drilling, and the system used for coal gas extraction.

It is a high-speed excavation system that assumes an applicable excavation depth of 1,500 m and can complete construction in as little as one month. In addition, it is a boring system that can drill up to 10,000 m in horizontal drilling.

The drilling drive source is high-pressure water, the drilling motor attached to the tip is a high-speed motor using high-pressure water, and the bit adopts three blades that are centrifugal expanding. The drainage pressure cleans the bit and conveys the slurry of the drilled rock to the ground, allowing for continuous drilling.

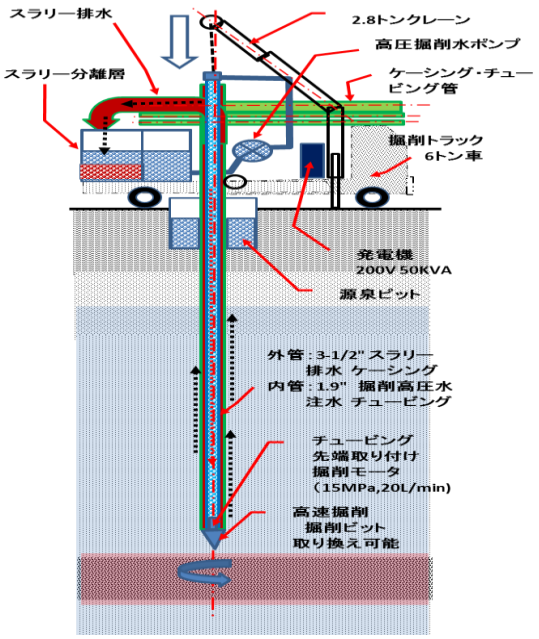
After drilling, the source can be extracted by taking out the internal drilling motor and drilling pipe and playing the jet pump from the top.

The biggest advantages of this system are that it is a future-oriented hot spring drilling system, such as low excavation costs, shortening the construction period, small construction equipment, and automation of post-construction maintenance.

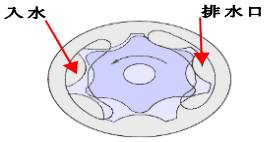
The new system is made possible by the development of NBL's special FRP drilling casing tube and tip drilling motor. This system is under development, and the installation service is scheduled to start in January 2022 or later. Inquiries and quotations are welcome. Please order at nblshop.

≪ postscript≫

For the public site of development technology, go to the public information site (GPI Journal) of R&D from the URL of nblshop and download the necessary technical materials.



特殊FRPケーシング掘削管と
高圧水掘削モータ使用



水圧駆動掘モータの構造

Fig. 11 Small-diameter hot spring drilling system

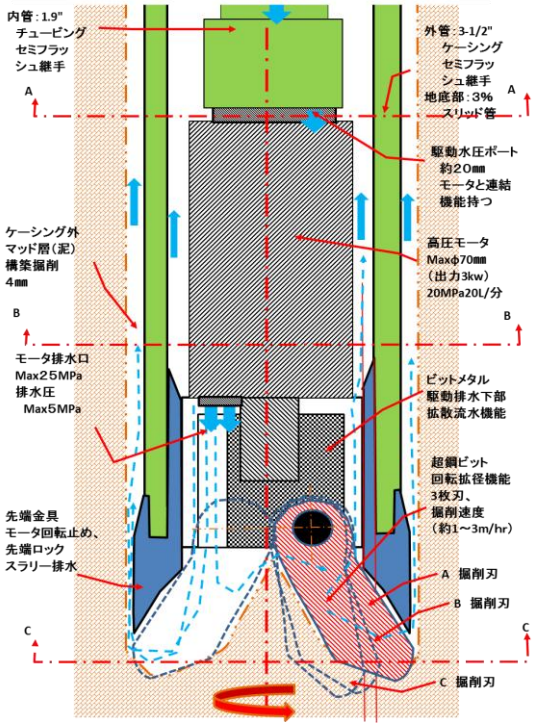


Fig. 12 Hydraulically driven high-speed drilling bit drilling

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