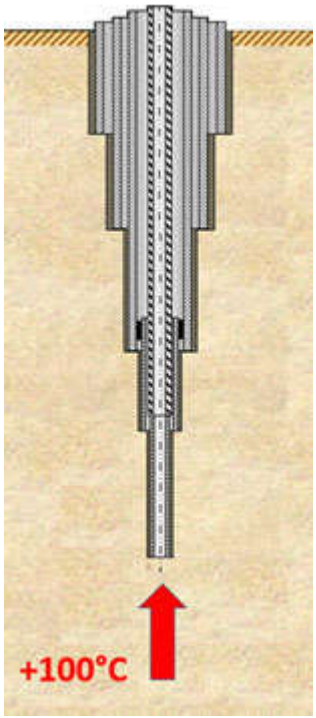
VACUUM INSULATED TUBING

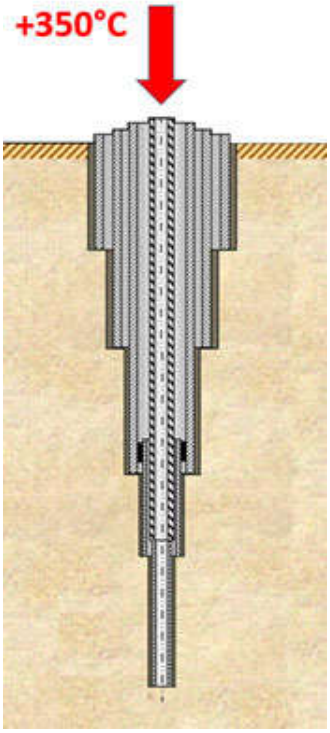
Vacuum Insulated Tubing (VIT) is designed to develop oil and gas fields located in the most challenging oil and gas production conditions in the permafrost and/or in zones characterized by high viscosity or paraffin deposition of extracted hydrocarbons.

Vacuum Insulated Tubing brochure

APPLICATION OF VACUUM INSULATED TUBING



- Prevention of wellbore thawing in permafrost zones
- Prevention of formation of gas hydrates, asphalt, resin, and paraffin depositions



- Injection of superheated fluids into the reservoir in order to heat up high-viscosity oils during development by cyclic steam heating methods (including such as CSS and SAGD)

TMK VIT MANUFACTURING FACILITY

TIMELINE OF VIT DEVELOPMENT IN TMK

Type of thermal insulation	Design features	Performance specifications
Since 2010		
Vacuum Insulated Tubing Vacuum shield thermal insulation 	In accordance with the design, a shield of foil and basalt fiber fabric (together with gas absorbers) is installed in the annular space. Vacuum is created in the annular space. A fluoroplastic coupling insert is placed inside the coupling. "Pre-stressing" of the internal pipe is performed in the VIT	Operating temperature: up to +350˚C Operating pressure: up to 16MPa Thermal conductivity (K-factor) along the pipe body, W/(m*K): up to 0.012 (+220˚C), up to 0.02 (+300˚C), up to 0.04 (+350˚C) Thermal conductivity (K-factor) of the fluoroplastic

	designed for operation at high temperatures.	coupling insert, W/(m*K): up to 0.25 The pipes are used for the following: - Prevention of wellbore thawing in permafrost zones - Injection of superheated fluids into the reservoir in order to heat up high-viscosity oils during development by cyclic steam heating methods (including such as CSS and SAGD) - Prevention of formation of gas hydrates, asphalt, resin, and paraffin depositions
Since 2015		
Non-Vacuum Insulated Tubing Insulation with inorganic thermal insulation materials 	In accordance with the design, a shield of foil and basalt fiber fabric is installed in the annular space. A fluoroplastic coupling insert is placed inside the coupling. The design was developed with account of additional requirements of our customers – oil companies.	Operating temperature: up to +300˚C Operating pressure: up to 16MPa Thermal conductivity (K-factor) along the pipe body, W/(m*K): up to 0.03 (+50˚C), up to 0.06 (+180˚C) Thermal conductivity (K-factor) of the fluoroplastic coupling insert, W/(m*K): up to 0.25 The pipes are used for the following: - Prevention of wellbore thawing in permafrost zones - Injection of superheated fluids into the reservoir in order to heat up high-viscosity oils during development by cyclic steam heating methods

		(including such as CSS and SAGD) - Prevention of formation of gas hydrates, asphalt, resin, and paraffin depositions

KEY PERFORMANCE AND TECHNICAL PARAMETERS OF VIT

Performance parameters	Limit value
Operating temperature, °C	up to +350
String length, max	determined by calculation and depends on the type of threaded connection
Thermal conductivity coefficient (k-factor) along the pipe body, max	see table below
Thermal conductivity coefficient (k-factor) of coupling insert, max, W/(m*K)	0.25

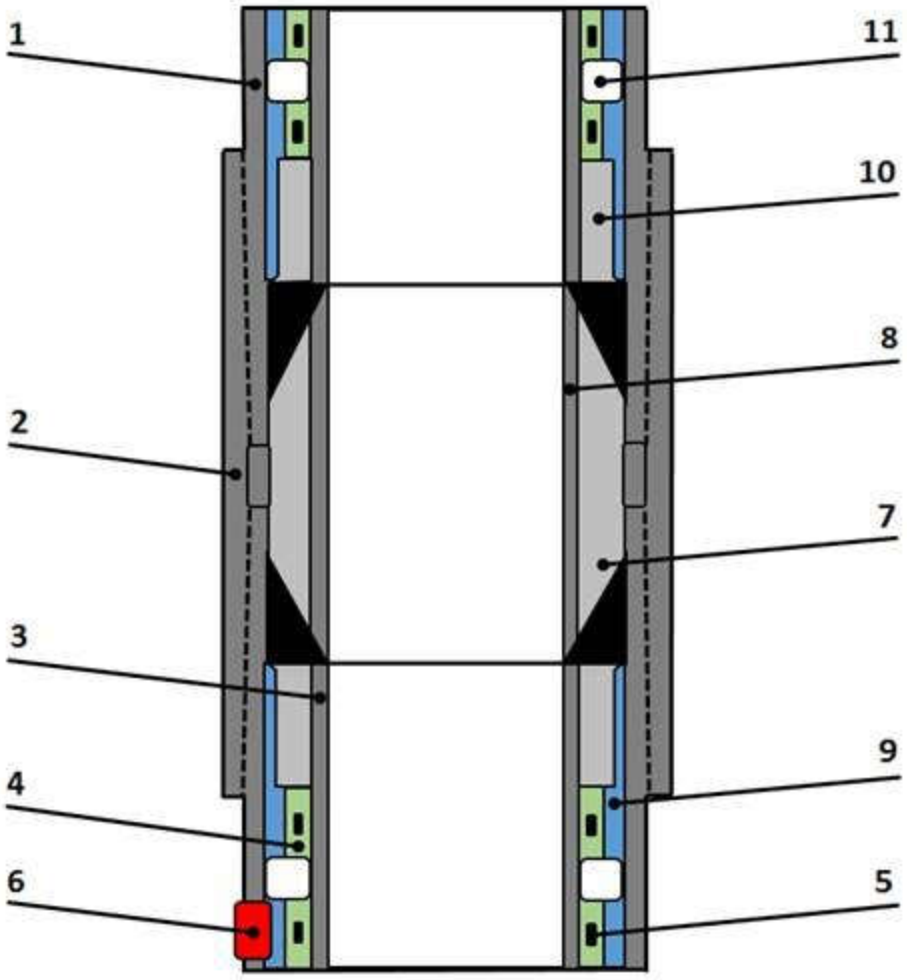
Indicator	Non-Vacuum		Vacuum		
VIT operating temperature, °C	up to +50	up to +180	up to +220	up to +300	up to +350
K-factor, W/(m*K)	0.03	0.06	0.012	0.02	0.04

Technical parameters	Limit value
Residual air pressure in the annular space, Pa (mm Hg), max	$8*10^{-2}$ ($6*10^{-4}$)
Pipe length, m	10-11.7*
Weld seam requirements	The seams should be heat treated
Hydrotesting	VIT with made up couplings is subjected to hydrotesting at R = 0.8 σ_T

Grades	Carbon (55-95 ksi); 13Cr (80 ksi)
Charpy test	Not less than 50 J/cm^2 at -60°C

*based on customer requirements we can produce pipe with the length of 6-10 m

BASIC DESIGN OF VIT (VACUUM SHIELD THERMAL INSULATION)



1 – External pipe

2 – Coupling

3 – Internal pipe

4 – Shield insulation

5 – Getter (gas absorber)

6 – Vacuum valve

7 – Coupling insert (fluoroplastic)

8 – Bowl protector

9 – Vacuum created in the annular space

10 – Connection element

11 – Stabilizing ring

PRODUCT MIX

VIT size	External supporting pipe	
	OD, mm	WT, mm
9 5/8 x 0.395 – 6 5/8 x 0.352	9 5/8	0.395
7 x 0.317 – 5 1/2 x 0.304	7	0.317
7 x 0.408 – 5 x 0.296	7	0.408
7 x 0.362 – 5 x 0.296	7	0.362
6 5/8 x 0.352 – 5 x 0.296	6 5/8	0.352
6 5/8 x 0.352 – 4 1/2 x 0.290	6 5/8	0.352
6 5/8 x 0.352 – 4 1/2 x 0.271	6 5/8	0.352
6 5/8 x 0.352 – 4 x 0.262	6 5/8	0.352
6 5/8 x 0.352 – 4 x 0.226	6 5/8	0.352
5 3/4 x 0.374 – 4 x 0.262	5 3/4	0.374
5 3/4 x 0.374 – 4 x 0.226	5 3/4	0.374
5 1/2 x 0.361 – 4 x 0.262	5 1/2	0.361
5 1/2 x 0.361 – 4 x 0.226	5 1/2	0.361
5 1/2 x 0.361 – 3 1/2 x 0.254	5 1/2	0.361
5 x 0.362 – 3 1/2 x 0.254	5	0.362
5 x 0.296 – 3 1/2 x 0.254	5	0.296
4 1/2 x 0.271 – 3 1/2 x 0.254	4 1/2	0.271
4 1/2 x 0.271 – 2 7/8 x 0.217	4 1/2	0.271
4 1/2 x 0.250 – 3 1/2 x 0.254	4 1/2	0.250
4 1/2 x 0.250 – 2 7/8 x 0.217	4 1/2	0.250
4 x 0.262 – 2 7/8 x 0.217	4	0.262
4 x 0.226 – 2 7/8 x 0.217	4	0.226
3 1/2 x 0.256 – 2 3/8 x 0.197	3 1/2	0.256
3 1/2 x 0.254 – 2 3/8 x 0.190	3 1/2	0.254
3 1/2 x 0.256 – 1.900 x 0.157	3 1/2	0.256

Developed product mix

Product mix that is currently being developed

VIT PRODUCTION PROCESS

Rolling, heat treatment, testing, measure cutting, surface cleaning → Assembly of the external and the internal pipe → Welding of the external and the internal pipe with vacuum-tight seams → Inspection of the weld joints → Creation of vacuum in the VIT at the exhaust cart and tightness testing of the weld joints → Thermal conductivity testing and finishing of VIT

CONTACT US

E-mail: vit@tmk-group.com

In case of any questions regarding performance, technical parameters of VIT and for purchasing of pipes please call:
+7 (495) 775 7600, ext. 2479 (Denis Korobeynikov), 2756 (Pavel Stepnov)

CONTACT US

TMK 40/2a Pokrovka Street, Moscow, 105062, Russia

Phone: +7 (495) 775 7600**Fax:** +7 (495) 775 7601**E-mail:** tmk@tmk-group.com