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ДЕЛОВОЙ ИНОСТРАННЫЙ ЯЗЫК
ТРУБОПРОВОДНЫЙ ТРАНСПОРТ УГЛЕВОДОРОДОВ

BUSINESS FOREIGN LANGUAGE
PIPELINE TRANSPORTATION OF HYDROCARBONS

Методические указания к практическим занятиям для студентов магистратуры направления 21.04.01

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Данные методические указания составлены для использования на практических занятиях по дисциплине «Деловой иностранный язык». Предлагаемый материал направлен на развитие навыков технического перевода, анализа оригинальной литературы по специальности, накопление и усвоение лексического материала в рамках профессиональной тематики и приобретение разговорных навыков по специальности.

Методические указания предназначены для студентов специальности 21.04.01 «Нефтегазовое дело», изучающих деловой иностранный язык.

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ВВЕДЕНИЕ

Данные методические указания к практическим занятиям по английскому языку предназначены для студентов специальности 21.04.01 «Нефтегазовое дело», специализация «Трубопроводный транспорт углеводородов». Методические указания составлены в соответствии с учебной программой по дисциплине «Деловой иностранный язык» для формирования иноязычной профессиональной компетенции будущих специалистов.

Предложенные методические материалы предназначены для аудиторной работы студентов и состоят из пяти разделов, содержащих информацию о трубопроводном транспорте углеводородов. Каждый текст сопровождается комплексом предтекстовых и послетекстовых заданий и упражнений, направленных на контроль понимания прочитанного материала, формирование умения ориентироваться в оригинальных научно-технических текстах, отработку и закрепление лексико-грамматического материала в устной речи, контроль навыков перевода.

Изучение предложенного материала имеет целью развитие и совершенствование навыков чтения и перевода оригинальной научной литературы по нефтегазовому делу, расширение словарного запаса и приобретение разговорных умений в сфере профессиональной деятельности.

UNIT 1 PIPING TYPES

TEXT 1.1 Flowlines

1 Read and translate the following words. Practice pronouncing them correctly.

Flowlines, crude, pumping, wells, pressurized, trunk lines, a diameter, a gasoline, batch-wise, an ethane, intermixing, refractionating, petroleum products, terminals, to distillate, density, commodities, sequentially.

2 Give the verbs corresponding to the following nouns:

An operation, a maintenance, a variation, a difference, an introduction, a segregation, a reduction.

3 Read and translate the text.

Flowlines are used as part of a crude gathering system in production areas to move produced oil from individual wells to a central point in the field for treating and storage. Flowlines are generally small-diameter pipelines operating at relatively low pressure. Typical in the United States flowlines are between 2 and 4 inches in diameters. The size required varies according to the capacity of the well being served, the length of the line, and the pressure available at the producing well to force the oil through the line. Some wells are not pressurized and require pumping to collection systems. Flowlines typically operate at pressures below 100 psi. Flowlines are normally made of steel, although various types of plastic have been used in a limited number of applications. Pipelines used for oil flowlines typically operate at low pressures, and therefore could be made of materials other than steel. Flowline pipe wall thicknesses of 0.216 inch for a 3-inch-diameter pipe are not uncommon, corresponding to a weight of 7.58 lb/lineal foot for a 3-inch-diameter pipe.

Crude is moved from central storage facilities over long-distance trunk lines to refineries or other storage facilities. Crude trunk lines operate at higher pressures than flowlines and could vary in size from 6 inches in diameter to as large as 4 feet.

Pipelines carrying products that are liquid at ambient temperatures and pressures do not have to operate at excessive pressures in order to maintain the product in a liquid state. However, liquids that

vaporize at ambient temperatures must be shipped at higher pressures. For instance, ethane pipelines can operate at pressures up to 1,440 psi. Product pipelines usually are 12 to 24 inches in diameter, but can be as large as 40 inches in the case of the Colonial Pipeline, which carries gasoline and distillate from the Gulf Coast to northeast markets. Product pipelines are unique, since they are typically used to transport a variety of petroleum distillate products concurrently in a batch-wise manner. The petroleum products jointly carried in the same pipeline are always chemically compatible with each other, but may differ in physical properties such as density. Some intermixing occurs at the interface of two products sequentially introduced into the pipeline. Operating methods allow for minimizing the interface between products. Regardless of how the commodities are separated while in the pipeline, any mixtures of two commodities are segregated from the rest of the flow at terminals and handled by downgrading (i.e., marketing them as product mixtures of lower quality than the original individual products) or by recovering and refractionating each mixture into the two original petroleum products.

Although primarily utilized to measure the volume, quality, and consistency of product for billing purposes and delivery receipts, storage tank monitoring and product metering can be used with line pressure monitors to verify that pipeline integrity has not been compromised. Any discrepancy could indicate some sort of system leak. Typically there is some "shrinkage" in volume when products are transferred from pipeline to tanks to pipeline. Systems and processes are in place to determine when the shrinkage observed is outside expected values.

Source: Pharris, T. C., Kolpa, R. L. (2008) Overview of the Design, Construction, and Operation of Interstate Liquid Petroleum Pipelines. - p. 7

4 Work with a partner. Discuss the questions below.

- Why do we need to use flowlines?
- What materials could be used to build flowlines?
- What is the difference between flowlines and crude trunk lines?
- What is unique feature of product pipelines?
- What are metering stations used for?

5 Translate into Russian paying attention to the form of the verb-predicate in the Passive Voice.

1. The refined oil pipelines in the oil pipelines are mainly used to transport refined oil products to oil sales companies, or pipelines for transporting semi-finished oils to refining and chemical enterprises. 2. At the same time, the oil is exported in many varieties, in large quantities, and has many oil distribution points. 3. The gas has compressibility, so only a large gas storage tank is installed in the gas storage station, and a pressurized method is adopted, and the reserve is adjusted by the pipeline to control the output. 4. It has been affected by climatic factors such as typhoon and can maintain long-term stable and continuous transportation, and had little pollution to the environment. 5. Booster pumps positioned along the pipelines ensure a consistent flow is maintained and product safely moves without interruption 24/7. 6. Pipelines use less energy than trucks and trains, giving them a low carbon footprint, and because most are buried deep underground, they go largely unnoticed. 7. Here in Louisiana, pipelines safely transported crude oil from onshore and offshore fields to refineries along the Mississippi River, where crude has been transformed into fuels and other products. 8. The refined products then travel by pipeline to petrochemical facilities where they are used as feedstock, or to terminals from which they are trucked to retail outlets. 9. Natural gas, meanwhile, is delivered from source to midstream processors via large distribution lines called "mains" and then directly to homes and businesses through local distribution lines. 10. The Cameron LNG liquefaction facility and Cheniere LNG's Sabine Pass LNG facility were both connected to extensive pipeline networks. 11. If hydrogen fuel gets extensively developed, pipelines will be needed to transport this secondary fuel. 12. Some liquids pipelines have also been used to transport distilled petroleum products such as gasoline to distribution centers. 13. Natural gas pipelines are used solely for the transport of natural gas to processing plants and are used for distribution. 14. For liquid pipelines that transport crude oil and liquefied petroleum products, small diameter gathering lines collect the product from where it is extracted.

Source: https://www.bicmagazine.com/industry/pipelines/lmoga-pipelines-safely-transport-la-oil-and-gas/

TEXT 1.2 Pumping Stations

1 Translate the following words.

A batch, to shutdown, a manufacturer, blending, to leak, to elaborate, to manifold, a conjunction, a sludge, an overhaul, interstate, waste-handling, viscosity, an injection, hydraulic, corrosion, maintenance, to propel, the internal diameter.

2 Match the words to make collocations. Translate into Russian.

1 smart	**A** diameter
2 viscosity	**B** facilities
3 centralized	**C** control
4 data	**D** maintenance
5 blending	**E** pigs
6 internal	**F** manifolds
7 preventative	**G** reduction
8 supervisory	**H** acquisition
9 valve	**I** corridor

3 Scan the text to discover the right variant of mentioned above collocations.

As with storage tanks, pump stations require an infrastructure of their own. They require waste handling, such as nearby sewer facilities or holding facilities for transfer in batches to an off-site waste-handling facility. Also, the handling and injection of additives, such as for viscosity reduction, often occurs at pump stations. Pumps **are** typically **driven** by electric motors; however, engines operating on a variety of fuels (but typically obtained from sources other than the pipeline itself) can also **be used** to drive the pumps. Depending on location, power may be an issue. In the event of power failures or other significant upset conditions, pump stations **are** typically **equipped** with sufficient emergency power generation to support monitoring and control systems to accomplish an immediate safe shutdown.

Valves **are installed** at strategic locations along the mainline pipe to control flows and pressures within the pipe and to isolate pipe segments in the event of upset or emergency conditions. Regardless of design, all valves require regular monitoring and maintenance. Along with pump seals that require continuous leak detection and repair, valve

manifolds must **be** closely **monitored** and periodically **overhauled** based on schedules established by the manufacturer (preventative maintenance), reduced performance, and/or observed deterioration and wear.

Depending on the facility, the presence of piping manifolds can result in a very significant and complex operation at either the origin or destination of a pipeline. Since many interstate pipelines have blending facilities on one end or the other, the manifolds in which such blending **is accomplished** can be elaborate and have much more piping than what would normally **be required** for simple movements from one location to another. Such blending facilities may also be present within a pipeline ROW (right of way) in a centralized corridor.

Pipeline operators may incorporate the use of pigs, depending on the nature and quality (purity) of the materials being transported. Pigs can **be designed** to clean accumulated sludge and debris off the inside walls of a pipe, or to monitor the pipe for conditions such as corrosion (known as "smart pigs"). Pigs **are introduced** at launching facilities located along the mainline pipe ROW, often in conjunction with a pump station. The pig's outer diameter is the same as, or slightly larger than the internal diameter of the pipe, so that a portion of the pig **is compressed** when placed inside. In most instances, the pig itself has no power source to propel it along the pipe, but instead **is carried** along the pipe by the flow of the liquid in the pipe. Obviously, pigs must **be removed** before reaching the next pump station. Such pig recovery stations are typically immediately upstream of the next downstream pump station. Depending on the product and the age of the pipeline, cleaning and monitoring pigs **are** routinely **introduced** into and **recovered** from the pipeline without any interruption of pipeline operations. Data recorded by smart pigs **are** typically **integrated** with the data from the pipeline's supervisory control and data acquisition (SCADA) system and **are used** to control inspection, maintenance, and repair activities.

Pipelines **are monitored** and **operated** using sophisticated SCADA systems. SCADA systems regulate pressure and flow by monitoring and controlling pump operation and the positions of valves. SCADA systems also perform a variety of additional functions including alarm processing, leak detection, hydraulic analysis and other functions deemed critical to the safe operation of the pipeline.

SCADA systems, regardless of their degree of sophistication, are only as good as the communication system that transmits data and commands throughout the pipeline system. A communication system includes equipment, such as telecommunication towers, and cabling to provide voice and/or data communications to the various facilities along the pipeline as well as to the SCADA system components. Real-time data communications are necessary between the control center, the various pump stations, storage/distribution terminals, delivery facilities, and mainline block valve sites.

Source: Pharris, T. C., Kolpa, R. L. (2008) Overview of the Design, Construction, and Operation of Interstate Liquid Petroleum Pipelines. - p. 8

4 Translate the text above from English into Russian noticing the form of the verb-predicate in the Passive Voice.

5 Decide whether the statements are *TRUE* (T) or *FALSE* (F).

1. Pumps can be driven only by electric motors.
2. Regardless of design, valves do not require regular monitoring and maintenance.
3. The use of pigs may be incorporated by pipeline operators, depending on the nature and quality of the transported materials.
4. Pigs may not be removed before reaching the next pump station.
5. Data from the pipeline's supervisory control are typically integrated with the data recorded by smart pigs.
6. Pipelines are constructed and cleaned using sophisticated SCADA systems.
7. The handling and injection of additives, such as for viscosity reduction, often occurs at pump stations.

6 Scan the text above and complete the sentences.

1) Valve manifolds must be …
2) The pig's outer diameter is …
3) Valves are installed at …
4) SCADA systems regulate …
5) Cleaning and monitoring pigs are …
6) Pump stations are typically …
7) Communication system includes …

UNIT 2 PIPELINE DESIGN: PART I

TEXT 2.1 Influencing Factors

1 Read and translate the following words. Practice pronouncing them correctly.

Throughput, yield strengths, hydraulic, adhering, promulgated, extruded, corrosive products, the precoated pipe, moisture, hazards, a counterpart.

2 Read and translate the text.

The major steps in pipeline system design involve establishment of critical pipeline performance objectives and critical engineering design parameters such as: required throughput (volume per unit time for most petroleum products; pounds per unit time for petrochemical feedstocks); origin and destination points; product properties such as viscosity and specific gravity; topography of pipeline route; maximum allowable operating pressure (MAOP); and hydraulic calculations to determine: pipeline diameter, wall thickness, and required yield strengths; number of, and distance between, pump stations; and pump station horsepower required.

Safety in pipeline design and construction is achieved by the proper design and application of the appropriate codes and system hardware components, as detailed above. Design codes as set forth in U.S. Department of Transportation's (DOT's) Office of Pipeline Safety (OPS) regulations provide appropriate safety factors and quality control issues during construction. Metering stations and SCADA (supervisory control and data acquisition) systems provide continuous monitoring oversight of pipeline operations. Training of pipeline operating and maintenance personnel is also a key ingredient in the ongoing efforts to insure system integrity and safety. Safe operations result from developing and strictly adhering to standard procedures and providing the workforce with adequate training, safety devices, and appropriate personal protective equipment. Standard operating procedures typically are developed with reference to government and standard industry practices, as well as corporate safety policies, experience, philosophy, and business practices. Regulations promulgated by the Occupational Safety and Health Administration (OSHA) and by counterpart agencies at the state

level specify the procedures and controls required to ensure workplace safety, including, in some instances, the performance of process safety analyses and the development of very specific procedures for activities thought to represent potentially significant hazards to workers and the public.

Corrosion-resistant coatings are applied to the exteriors of most pipes to inhibit corrosion. These may be applied at the manufacturing plant or a pipe coating plant located separately. However, coatings are also sometimes applied at the construction site. Even for precoated pipe, field dressings of joints and connections are also performed at the construction site just prior to burial. For particularly corrosive products (including some crude oils with high total acid numbers), pipes are also sometimes coated on the inside for corrosion resistance. In addition to the resistance to corrosion they provide, some interior coatings are also designed to reduce frictional losses between the product and the interior walls of the pipe, thereby reducing the total amount of energy required to move the materials along the pipeline. Protective wrappings, followed by the application of tape to the edges of the spirally applied overlapping wrapping, are often installed on the exterior of the pipe to further assist in corrosion control, but also to primarily protect the pipe from mechanical damage at installation. Wraps and tape often are impregnated with tar or other asphalt-based materials and heated in place once applied, to ensure uniform coverage. Once cured, the exterior coatings are chemically stable and environmentally inert, resisting degradation by soil moisture and bacteria, yet remaining sufficiently flexible that they continue to provide a protective coating on the pipe throughout a wide temperature range. Likewise, wrapping materials and tape are stable and inert (including toward the material being transported in the pipeline) and do not pose a potential for adverse environmental impacts. Other coatings, such as thin-film epoxy and extruded polymers are also used as alternative to wraps.

Source: Pharris, T. C., Kolpa, R. L. (2008) Overview of the Design, Construction, and Operation of Interstate Liquid Petroleum Pipelines. - p. 13

3 Work with a partner. Discuss the questions below.

- What is a key ingredient to insure pipeline system integrity and safety?
- What coatings are applied to inhibit corrosion?

4 Give the Russian equivalents of the following word combinations.

The maximum allowable operating pressure; to provide appropriate safety factors; to insure system integrity and safety; to represent potentially significant hazards; to reduce frictional losses; to move the materials along the pipeline; to ensure uniform coverage; to provide a protective coating; to be used as alternative.

5 Translate the sentences noticing the words if-then**.**

1. **If** the pipe has a slope **then** pipe local axes loads will be inclined, that can not be accepted. 2. However, **if** the oil play works, **then** oil **pipe** infrastructure to Waha looks required. 3. **If** you own your own house, **then** gas pipe floor flanges lag screwed to the studs would make it different. 4. **If** pipeline forms a DAG, **then** each stage must be designated as topologically ordered. 5. **If** oil pipe and sealing part is leaking, **then** call immediately to engineering department and follow their instructions before emergency team's arrival. 6 **If** gas pipe is cheap enough to not fret over replacing, **then** go for it as far as it is possible. 7. **If** gas pipe is metal **then** it should be coated and/or taped to galvanically. 8. **If** gas pipe runs horizontally in wall, which is not recommended, and a fitting occurs in a concealed chase, **then** two holes shall be required. 9. **If** gas pipe is cut, on fire, damaged or has leakage, **then** it will be stopped automatically by excess flow safety device. 10. **If** pipeline leak is on fire, **then** do not attempt to extinguish any flames.

6 Fill in the gaps using the words in the box. Translate the text.

ensure	serves	stabilization	installed	bedding	tamped

The thin-film epoxy and extruded polymers may also be **1** _____ around the sides and top of the pipe before the trench is filled with indigenous soils. Such bedding material **2** _____ two principal functions: protection of the pipe from mechanical damage during installation and trench filling, and **3** _____ of the pipe in the event of seismic shifts or frost heaves. Sands and gravels are typical **4** _____ materials and are **5** _____ in lifts of 12 to 18 inches per lift to **6** _____ adequate compaction and avoid future subsidence.

TEXT 2.2 Bedding and Sizing

1 Read and translate the following text. Make up the plan of the text.

Bedding materials also assist in draining accumulated water from the vicinity of the pipe. All newly coated pipe used to transport hazardous liquids must be electrically inspected prior to backfilling to check for faults not observable by visual examination. Material faults such as microcracks demonstrate a characteristic response to applied current when the detector is operated in accordance with the manufacturer's instructions and at the voltage level appropriate for the electrical characteristics of the coating system being tested.

The dimensions of a pipeline — both the sizes and capacities of the various components — as well as the conditions under which the pipeline system operates dictate the system's capacity. Larger diameter pipes allow for higher mass flows of materials provided other components of the pipeline system, primarily pumps and pressure management devices, are properly sized and positioned. In general, the longer the segment of mainline pipes between pump stations, the greater the drop in line pressure. However, grade changes and the viscosity of the materials being transported can also have major influences on line pressures. API Standard 5L provides dimensions, weights, and test pressures for plain-end line pipe in sizes up to 80 inches in diameter. Several weights are available in each line pipe diameter. The weight of the pipe in lb/ft, in turn, varies as the wall thickness for a given outside diameter. For instance, API Spec 5L lists 24 different weights in the 16-inch-diameter size (five weights are special weights), ranging from 31.75 lb/foot to 196.91 lb/foot. The corresponding wall thickness ranges from 0.188 inch to 1.250 inches. As the wall thickness increases for a given outside diameter, the inside diameter of the pipe decreases from 15.624 inches for the lightest weight pipe to 13.500 inches for line pipe weighing 196.91 lb/foot. Greater wall thicknesses are selected for high-pressure applications or when the pipe segment might be subjected to unusual external forces such as seismic activities and landslides. Also, in hard-to-reach places, such as beneath transportation routes and at river crossings or difficult-to-access environmentally sensitive areas, overbuilding in size or quality is sometimes chosen to accommodate future expansion requirements.

Operating pressure of a pipeline is determined by the design flow rate vapor pressure of the liquid, the distance the material has to be transferred, and the size of line that carries the liquid. Pipe operating pressure and pump capabilities and cost typically drive decisions on linesize, the number of pump stations, and the like. Grades notwithstanding, line pressure follows a saw-tooth curve between pump stations. The maximum and minimum line pressure that can be tolerated, together with the physical properties of the materials noted earlier, dictate the spacing of the pump stations and the motive horsepower of the pumps.

Source: Pharris, T. C., Kolpa, R. L. (2008) Overview of the Design, Construction, and Operation of Interstate Liquid Petroleum Pipelines. - p. 19

2 Answer the following questions.

- What is importance of pipeline's dimensions?
- How does the corresponding wall thickness range?
- What does larger diameter pipes allow?
- When is the greater wall thicknesses selected?
- How the operating pressure of a pipeline is determined?

3 Match the left and the right columns.

1) Larger diameter pipes allow for higher mass flows of materials provided other components of the pipeline system,	prior to backfilling to check for faults not observable by visual examination.
2) Pipe operating pressure and pump capabilities and cost typically drive decisions	ranging from 31.75 lb/foot to 196.91 lb/foot.
3) All newly coated pipe used to transport hazardous liquids must be electrically inspected	primarily pumps and pressure management devices, are properly sized and positioned.
4) For instance, API Spec 5L lists 24 different weights in the 16-inch-diameter size	on linesize, the number of pump stations, and the like.

4 Match the words to make collocations. Translate into Russian.

1 mainline	**A** pressure
2 wall	**B** pressure
3 beneath	**C** examination
4 coating	**D** thickness
5 seismic	**E** system
6 visual	**F** activities
7 operating	**G** properties
8 physical	**H** pipes
9 line	**I** transportation

5 Translate the sentences noticing the word ***since*****.**

1. The third region is occupied by the cold oil which stays in the pipeline **since** shutdown. 2. Turkmenistan, Kazakhstan and Uzbekistan, has transported 270 billion m3 of natural gas to China **since** it was put into operation some 10 years ago, said the company, which is also known as PetroChina, China Daily reports. 3. **Since** pipeline construction requires long lead times and a large investment, vertical integration was the preferred model. 4. **Since** pipeline transportation is the most reliable and cheap method of oil transportation there would emerge a potential base for refinery industry in the Kray. 5. **Since** pipeline stages tend to be logically important steps, they're a natural place to record timestamps. 6. The blast is one of 29 "significant incidents" with the Texas Eastern Transmission pipeline **since** 2011, the Kentucky Courier Journal reports. 7. However, **since** pipeline operations can fluctuate due to environmental and business factors, running a predictive or simulation model maximizes a pipeline’s efficiency. 8. **Since** pipeline pressure and pipe strain are directly related, the strain gauge at the location 13 is responsive to the pipe strain to show the increase in pressure. 9. The strain gauge at the location 14 however is not expanded by the pipe strain **since** it is downstream of the blockage. 10. **Since** various modifications can be made in my invention as herein above described, and many apparently widely different embodiments of same made within the spirit and scope of the claims without departing from such spirit and scope.

UNIT 3 PIPELINE DESIGN: PART II

TEXT 3.1 Product Qualities

1 Read and translate the following terms.

Solidification, frictional drag, turbine fuel, bitumen, refineries, commodity, throughput capacity, viscosity, centistokes, compressibility, common diluents.

2 Read and translate the text.

As noted earlier, critical physical properties of the materials being transported dictate the design and operating parameters of the pipeline. Specific gravity, compressibility, temperature, viscosity, pour point, and vapor pressure of the material are the primary considerations. These and other engineering design parameters are discussed in the following sections in terms of their influence on pipeline design.

The density of a liquid is its weight per unit volume. Density is usually denoted as pounds of material per cubic foot. The specific gravity of a liquid is typically denoted as the density of a liquid divided by the density of water at a standard temperature (commonly 60°F). By definition, the specific gravity of water is 1.00. Typical specific gravities for the distilled petroleum products gasoline, turbine fuel, and diesel fuel are 0.73, 0.81, and 0.84, respectively.

Many gases that are routinely transported by pipeline are highly compressible, some turning into liquids as applied pressure is increased. The compressibility of such materials is obviously critical to pipeline design and throughput capacity. On the other hand, crude oils and most petroleum distillate products that are transported by pipeline are only slightly compressible. Thus, application of pressure has little effect on the material's density or the volume it occupies at a given temperature; consequently, compressibility is of only minor importance in liquid product pipeline design. Liquids at a given temperature occupy the same volume regardless of pressure as long as the pressure being applied is always above the liquid's vapor pressure at that temperature.

Pipeline capacity is affected by temperature both directly and indirectly. In general, as liquids are compressed — for example, as they pass through a pump — they will experience slight temperature increases.

Most liquids will increase in volume as the temperature increases, provided the pressure remains constant. Thus, the operating temperature of a pipeline will affect its throughput capacity. Lowering temperatures can also affect throughput capacity, as well as overall system efficiency. In general, as the temperature of a liquid is lowered, its viscosity increases, creating more frictional drag along the inner pipe walls, requiring greater amounts of energy to be expended for a given throughput volume. Very viscous materials such as crude oils exhibit the greatest sensitivity to the operating temperatures of their pipelines. However, in the case of crude oils, the impacts are not only from increases to viscosity, but also due to the solidification of some chemical fractions present in the oils. For example, crude oils with high amounts of paraffin will begin to solidify as their temperature is lowered, and they will become impossible to efficiently transport via a pipeline at some point.

From the perspective of the pipeline design engineer, viscosity is best understood as the material's resistance to flow. It is measured in centistokes. One centistoke (cSt) is equivalent to $1.08 \times 10–5$ square feet per second. Resistance to flow increases as the centistoke value (and viscosity) increases. Overcoming viscosity requires energy that must be accounted for in pump design, since the viscosity determines the total amount of energy the pump must provide to put, or keep, the liquid in motion at the desired flow rate. Viscosity affects not only pump selection, but also pump station spacing. Typical viscosities for gasoline, turbine, and diesel fuels are 0.64, 7.9, and 5 to 6 cSt, respectively.

As the material's viscosity increases, so does its frictional drag against the inner walls of the pipe. To overcome this, drag-reducing agents are added to some materials (especially some crude oils). Such drag-reducing agents are large molecular weight (mostly synthetic) polymers that will not react with the commodity or interfere with its ultimate function. They are typically introduced at pump stations in very small concentrations and easily recovered once the commodity reaches its final destination. However, often, no efforts are made to separate and remove these agents. Drag reduction can also be accomplished by mixing the viscous commodity with diluents. Common diluents include materials recovered from crude oil fractionation such as raw naphtha. Diluents are

used to mix with viscous crude feedstocks such as bitumen recovered from tar sands and other very heavy crude fractions to allow their transport by pipeline from production areas to refineries.
Source: Pharris, T. C., Kolpa, R. L. (2008) Overview of the Design, Construction, and Operation of Interstate Liquid Petroleum Pipelines. - p. 20

3 Work with a partner. Discuss the questions below.

- How the specific gravity of a liquid is denoted?
- What materials exhibit sensitivity to the operating temperatures of their pipelines?
- What does the viscosity affect?

4 Translate into Russian noticing *there is, there are*.

1. If the fuel pumps are tripping in manual firing then **there is** the pump problem or back pressure. 2. According to the U.S. Energy Information Administration, **there are** 20 natural gas pipeline projects queued up in Louisiana. 3. **There are** pipeline sections on which the fluid moves with full cross section but alternates with the pipeline sections in which the fluid moves with only partially filled cross section of the pipe. 4. **There is** pump part wear because the rotor and stator are exposed to the slip.

5 Match the English terms with the Russian equivalents.

1	frictional drag	**a**	пропускная способность
2	pump station spacing	**b**	сопротивление материала
3	material resistance	**c**	вещество снижающее давление
4	tar sand	**d**	с высокой сжимаемостью
5	specific gravity	**e**	скорость потока
6	common diluents	**f**	сырая нефть
7	highly compressible	**g**	плотность жидкости
8	drag-reducing agents	**h**	битуминозный песок
9	throughput capacity	**i**	фрикционное сопротивление
10	raw naphtha	**j**	общие разбавители
11	density of a liquid	**k**	удельный вес
12	flow rate	**l**	расстояние между насосными станциями

TEXT 3.2 Pour Point

1 Fill in the table below.

760 mm Hg, 2 psia, 212°F, 15 psia, 2 psia.

one atmosphere pressure	vapor pressures for gasoline	vapor pressures for diesel fuel	the boiling point	vapor pressures for turbine fuel

2 Read the text and check your answers to the table above.

The pour point of a liquid is the temperature at which it ceases to pour. The pour point for oil can be determined under protocols set forth in the ASTM Standard D-97. In general, crude oils have high pour points. As with viscosity, pour points are very much a function of chemical composition for complex mixtures such as crude oils and some distillate products, with pour point temperatures being influenced by the precipitation (or solidification) of certain components, such as paraffins.

Once temperatures of materials fall below their respective pour points, conventional pipeline design and operation will no longer be effective; however, some options still exist for keeping the pipeline functional. These include: heating the materials and/or insulating the pipe to keep the materials above their pour point temperature until they reach their destination; introduce lightweight hydrocarbons that are miscible with the material, thereby diluting the material and lowering both its effective viscosity and pour point temperature; introduce water that will preferentially move to the inner walls of the pipe, serving to reduce the effective coefficient of drag exhibited by the viscous petroleum product; mix water with the petroleum material to form an emulsion that will exhibit an effective lower viscosity and pour point temperature; modify the chemical composition before introducing the material into the pipeline, removing those components that will be first to precipitate as the temperature is lowered. (This tactic is effective for crude oils, but is virtually unavailable when moving distillate products that must conform to a specific chemical composition.).

The vapor pressure of a liquid represents the liquid's tendency to evaporate into its gaseous phase with temperature. Virtually all liquids exhibit a vapor pressure, which typically increases with temperature. The vapor pressure of water increases steadily with temperature increases, reaching its maximum of one atmosphere pressure (760 mm Hg, or 14.7 psi absolute [psia]) at the boiling point (212°F).

Vapor pressures of petroleum liquids are determined using a standardized testing procedure and are represented as the Reid vapor pressure. Reid vapor pressures are critical to liquid petroleum pipeline design, since the pipeline must maintain pressures greater than the Reid vapor pressure of the material in order to keep the material in a liquid state. Blended (or "boutique") vehicle fuels, required over some periods of the year for air pollution control purposes in some parts of the country, have unique chemical compositions and unique Reid vapor pressures (as mixtures). Consequently, pipelines handling such fuels must constantly monitor their vapor pressure and adjust operating conditions accordingly. Pipelines carrying liquids with high vapor pressures can be designed to operate under a variety of flow regimes.

Single-phase flow regimes intend for the entire amount of the material in the pipeline to be in the liquid state. Operators of single-phase liquid pipelines attempt to control pressure and flow to maintain a "full face" of liquids in the pipeline, minimizing the amount of volatilization that is allowed to occur. This maximizes system efficiency and also the longevity of system components. Failure to maintain a full face of liquids in a single-phase liquid pipeline can result in increased risks of fires and explosions. Single-phase liquid pipelines are the most common designs for petroleum liquids. However, pipelines can also be designed as two-phase systems in which both vapor and liquid phases of the material are expected to be present. The variation of flow regimes in such two-phase systems can range from bubbles of vapor distributed in liquid to droplets of liquid suspended in vapor. Typical vapor pressures for gasoline, turbine fuel, and diesel fuel are 15, 2, and 2 psia, respectively.

Source: Pharris, T. C., Kolpa, R. L. (2008) Overview of the Design, Construction, and Operation of Interstate Liquid Petroleum Pipelines. - p. 21

3 Decide whether the statements are *TRUE* (T) or *FALSE* (F).

1) Pipelines carrying liquids with high vapor pressures can be designed to operate under a variety of flow regimes.
2) Only several liquids exhibit a vapor pressure, which typically increases with temperature.
3) Typical vapor pressures for gasoline, turbine fuel, and diesel fuel are 17, 2, and 4 psia, respectively.
4) In general, crude oils have low pour points.

4 Translate the following terms.

Distillate products, vehicle fuels, the amount of volatilization, petroleum liquids, the effective viscosity, the effective coefficient of drag, crude oils, a gasoline, lightweight hydrocarbons, the vapor pressure,

5 Open the brackets using Passive Voice.

1. Oil pipelines are steel or polyethylene tubes through which large quantities of crude and refined petroleum derivatives _____ (**can/be/channel**). 2. Pipelines _____ (**can/be/use**) to carry natural gas to homes, jet fuel to airports, and crude oil to refineries. 3. Domestic utility providers use pipelines to convey water and domestic use gases to residential areas where they _____ (**be/utilize**) as cooking gas and to provide indoor heating. 4. Refined petroleum fuels _____ (**can/be/transport**) across long distances directly to the industrial facilities that require them. 5. Due to the volatile and highly flammable nature of oil and natural gas, transportation _____ (**have/be/carry**) out as safely as possible. 6. Above-surface pipelines _____ (**be**) specifically _____ (**design**) to withstand adverse environmental temperature and weather changes without developing dangerous leaks. 7. The installation of an oil and gas carrier pipeline system _____ (**can/be/do**) in a fraction of the time required to construct a dedicated rail transportation system of similar length. 8. Typically, most pipeline systems _____ (**be/bury**) underneath the earth's surface. 9. Oil transport lines have a less damaging environmental effect that other forms of conveyance as they _____ (**be/seal**) and mostly subterranean.

UNIT 4 PUMPS

TEXT 4.1 Pumping Facilities

1 Read and translate the following terms.

An impeller, elevation changes, the terminal destination, breakout tankage facilities, reciprocating pumps, ancillary functions, throughputs, accountability, positive displacement pumps, facilitate shutdowns, outfitting, operating pressures, prime movers, centrifugal pumps.

2 Read and translate the text.

Desired material throughput values as well as circumstantial factors along the pipeline route are considered in designing and locating pump stations. Desired operating pressures and grade changes dictate individual pump sizes and acceptable pressure drops (i.e., the minimum line pressure that can be tolerated) along the mainline; grade changes also dictate the placements of the pump stations. Pump stations are often fully automated, but can also be designed to be manned and to include ancillary functions such as serving as pig launching or recovery facilities or serving as the base from which inspections of mainline pipe are conducted. Because there are a multitude of ways in which the desired operating conditions can be obtained and sustained, the outfitting and location of pump stations are also often influenced by economics, typically representing a compromise between few large-capacity pump stations and a greater number of smaller-capacity stations. The overall length of the pipeline (to its terminal destination) and the flexibility needed to add or remove materials along the course of the pipeline also dictate pump station placement.

At a minimum, pump stations include pumps (components that actually contact the fluids in the pipeline and provide kinetic energy) and prime movers (power sources that provide power, typically some form of mechanical energy) to the pumps. To facilitate maintenance and to prevent disruptions of pipeline operation as a result of equipment failure, most pump stations use several pumps arranged in parallel fashion. Typically, all but one of the pumps is capable of producing the desired operating pressures and throughputs, so some pump is constantly off-line

and in standby. Pump stations also represent locations where ownership or custody of the material is transferred. For the sake of accountability, such pump stations are also equipped with flow monitoring devices. Pump stations typically also have colocated facilities that support pipeline operation or facilitate shutdowns or maintenance on pipeline segments. Thus, breakout tanks for temporary storage of materials or for use in managing line pressures and controlling product surges are also present at pump stations. Finally, pump stations are, in some instances, colocated with terminal or breakout tankage facilities. Although certain pump designs are preferred for certain applications, all pumps require regular maintenance and are subject to failure from a variety of factors. Pump maintenance, therefore, is critical to continued safe performance of pipeline systems.

Pumps of various designs are used in crude oil and petroleum product pipelines. Selection of pump design is based on desired efficiency as well as the physical properties of the materials being moved, especially viscosity and specific gravity. The pump's head pressure, or the pressure differential it can attain, is critical for selecting pumps that are capable of moving fluids over elevation changes.

Two fundamental pump designs are in common use: centrifugal pumps and positive displacement pumps. Centrifugal pumps are preferred for moving large volumes of material at moderate pressure, while positive displacement pumps are selected for moving small volumes of material at higher line pressures. Centrifugal pumps consist of two main components: the impeller and the volute. The impeller, the only rotating component of the pump, converts the energy it receives from the force that causes its rotation into kinetic energy in the fluid being pumped, while the volute converts the kinetic energy of the fluid into pressure. Positive displacement pumps can be of various designs; however, two designs predominate in pipeline applications: reciprocating and rotating pumps. Rotating pumps are often the pump design of choice for viscous fluids such as crude oils. Unlike a centrifugal pump where power demands rise sharply with increasing fluid viscosity, the performance of rotating pumps is generally unaffected by variations in either fluid viscosity or line pressure.

Source: Devold, H. (2013) Oil and Gas Production Handbook: An Introduction to Oil and Gas Production, Transport, Refining. – p. 68

3 Work with a partner. Discuss the questions below.

- What should be used for most pump stations in order to facilitate maintenance and to prevent disruptions of pipeline operation?
- What is critical to continued safe performance of pipeline systems?
- Where are used pumps of various designs?
- What are two fundamental pump designs?
- What pump design is often chosen for viscous fluids such as crude oils?
- What dictates individual pump sizes and acceptable pressure drops?

4 Match the English terms with the Russian equivalents.

1	elevation changes	**a**	магистральная труба
2	ancillary functions	**b**	удельный вес
3	prime movers	**c**	конечный пункт назначения
4	operating pressures	**d**	маршрут трубопровода
5	colocated facilities	**e**	насосные станции
6	pipeline route	**f**	перепады высот
7	mainline pipe	**g**	рабочее давление
8	specific gravity	**h**	вспомогательные функции
9	pump stations	**i**	размещенные объекты
10	terminal destination	**j**	первичные двигатели

5 Insert the appropriate form of the Predicate.

1. Initially, all steel pipes (to have) to be threaded together. 2. The Chinese even (to use) bamboo pipe to transmit natural gas to light their capital. 3. An important improvement of pipeline technology (to occur) in the 18th century when cast-iron pipes (to be) manufactured for use as water lines, sewers, and gas pipelines. 4. This (to be) difficult to do for large pipes, and they (to be) apt to leak under high pressure. 5. It (to be) a 6-inch-diameter, 109-mi-long steel pipeline. 6. Clay pipes (to be) used as early as 4000 B.C. for drainage purposes in Egypt and certain other countries. 7. Pipelines (to be) categorized in different ways.
Source: https://www.britannica.com/technology/pipeline-technology

TEXT 4.2 Driver Selection

1 Read and translate the text.

The component that actually provides power to the pump is referred to as the prime mover. A wide variety of primer movers are in use, including electric motors, gas turbines, and diesel internal combustion engines. In recent years, most long-distance transmission pipelines have begun using electric motors or gas turbines. Virtually any prime-mover pump design combination is possible, with decisions resting primarily on the physical properties of the fluids being pumped, the desired throughputs, operating pressures, and transport speeds for the pipeline and for logistical needs such as meeting operating parameters, availability of power or fuel for the prime mover, and compatibility with SCADA (supervisory control and data acquisition) systems in use and the sensors they rely on. Initial costs and maintenance demands can also influence selection. In terms of initial costs, electric motors are far less expensive than any other option. Operating costs (measured as $/brake horsepower/year) are generally uniform across all options; however, overall efficiencies of electric motors are substantially better than other options. When maintenance costs are considered, times between major overhauls of prime movers vary, with electric motors and industrial turbines expected to require the fewest overhauls over time.

Pipeline pigs come in a wide variety of sizes and designs. Pigs are inserted into the pipeline while it is operational and are carried along by the fluid being pumped. Because they are solid devices constructed of various materials including metal, plastics, and rubber derivatives, pigs must be removed before reaching the next pump. Typically, pig traps, launchers, and recovery facilities are collocated with pump stations. Pigs are designed to perform a wide array of functions. Their basic purpose is threefold: (1) provide a way to clean debris and scale from the inside of the pipe, (2) inspect or monitor the condition of the pipe, (3) or act as a plug or seal to separate products in multi-product commercial pipelines or to isolate a segment for repair without depressurizing the remainder of the pipeline. Pigs designed to clean the pipe can use mechanical means (often called scraper pigs) or chemicals. Pigs that monitor the condition of the pipe are categorized as in-line inspection tools. Monitoring pigs, also sometimes called “instrument pigs” or “smart pigs,” can perform a wide

variety of functions. Geometry pigs check for deformation of the pipe (which can greatly influence throughput efficiencies, but can also be an early indicator of significant problems that could compromise pipeline integrity). Pipeline curvature, temperature and pressure profiles, bend measurements, corrosion detection, crack detection, leak detection, and product sampling represent some of the other major functions performed by smart pigs. Magnetic flux leakage and ultrasonic technologies are employed for some of these inspections. Another type of pig recently developed is the gel pig. As the name implies, gel pigs consist of a series of gelled liquids that are introduced for a variety of purposes, including serving as a separator between products in a multi-product pipeline, collecting debris (especially after initial construction or repairs that involved opening the pipeline, and dewatering the pipeline. Figure 2 provides examples of the various types of pigs.

Source: Devold, H. (2013) Oil and Gas Production Handbook: An Introduction to Oil and Gas Production, Transport, Refining. – p. 69

Figure 2 Examples of the types of pigs

2 Answer the fallowing questions.

- What have been used in most long-distance transmission pipelines, in recent years?
- Why is it necessary to remove the pigs before reaching the next pump?
- How are the pigs that monitor the condition of the pipe categorized?

3 Translate into Russian. Find Participle.

1. Construction was carried out by dividing the length of the pipeline into different sections. 2. The original project proposed to build a pipeline from Angarsk, Russia to Daqing in northern China. 3. The project was completed in three sections. 4. It had transported more than 30 mt of crude oil since the commissioning of the first section in 2006. 5. The second phase was completed in July 2009. 6. This section became operational towards the end of 2003. 7. The project received approval from the National Energy Board (NEB) of Canada in March 2010.
Source: https://www.hydrocarbons-technology.com/features/featureworlds-longest-oil-gas-pipelines-imports/

4 Translate into English using Participle.

1. Ранее насосные станции использовали накопительный бак для контроля работы системы. 2. Компания транспортировала около 90% добываемой нефти и около 25% производимых нефтепродуктов. 3. Оставшаяся часть нефтепровода между Саудовской Аравией и Иорданией транспортировала небольшие объёмы нефти. 4. Технически мы имели всю необходимую инфраструктуру для того, чтобы перекать нефть через Балтимор в Кентуки и обратно. 5. В прошлом году этот трубопровод был демонтирован, а его трубы использовали для перекачки нефти по маршлруту Владимир - Ростов. 6. На насосной станции были установлены 5 насосных агрегатов фирмы Эрхард-Земмер. 7. Перед пуском газа по трубам его необходимо было подготовить, так как вместе с природным газом из скважины выходили различные примеси. 8. За всю свою историю человечество выкачало из земных недр 1,248 трлн. баррелей нефти.

UNIT 5 PIPELINE CONSTRUCTION

TEXT 5.1 Movement and Staging of Pipeline Components

1 Read and translate the following terms.

Access roads, staging areas, the construction spread, soil conditions, magnifying the impact, the laydown yard, the forested terrain, silt fences, paved transitions, to incorporate measures, pipe segments, the pipe stacking method, the double joining.

2 Read and translate the text.

Pipe segments are normally delivered from their point of manufacture by rail to a rail off-loading yard conveniently located to the construction ROW (right of way). From there, pipe segments are loaded onto flatbed trucks and taken to a material laydown yard that is temporarily maintained in an area close to the construction site. Numerous laydown yards may be constructed to support individual pipe construction spreads. A truck typically carries a maximum of 20 pipe segments at a time; however, this varies by pipeline diameter, wall thickness, weight, and pipe stacking method. Trucks will make round-trips all day between rail off-loading areas and material laydown areas until all of the materials assigned to the laydown areas have been delivered. In areas with less road infrastructure, consolidation of crews and materials going to different spreads using the same public access roads is more likely, thereby potentially magnifying the impact. In addition to the laydown areas adjacent to the ROW, off-site staging areas used to collect equipment and workers could occupy several acres, but the amount of space would be highly dependent on the size and terrain of the project. Although their primary purpose is temporary storage of pipeline materials, laydown yards are also sometimes used for “double joining” two pipe segments before their delivery to the ROW. Laydown and staging areas could be in use from 3 to 12 weeks.

The survey crew will carefully survey and stake the construction ROW to ensure that only the preapproved construction workspace is cleared. The clearing and grading crew leads the construction spread. This crew is responsible for removing trees, boulders, and debris from the construction ROW and preparing a level working surface for the heavy

construction equipment that follows. Depending on existing soil conditions, this may require bringing in additional materials such as stone and sand to create a temporary work road adjacent to the pipeline. The clearing and grading crew is also responsible for installation of silt fences along the edges of streams and wetlands as necessary to prevent erosion of disturbed soil. Trees inside the ROW are cut down, roots are excavated; and timber is stacked along the side of the ROW for later removal. Brush is commonly shredded or burned. The amount of clearing required varies widely. Sometimes only one pass down the ROW with a bulldozer is required. Where the route passes through rough or forested terrain, however, clearing operations can be much more extensive. The purpose is to make it possible to move construction equipment along the ROW as needed. The clearing and grading crew is also responsible for clearing and grading ROW access roads. As with the ROW, access roads from public roadways may also need to incorporate measures such as silt fences and stone or paved transitions.

Source: Pharris, T. C., Kolpa, R. L. (2008) Overview of the Design, Construction, and Operation of Interstate Liquid Petroleum Pipelines. - p. 51

3 Answer the fallowing questions.

- What may be constructed to support individual pipe construction spreads?
- What period of time could laydown and staging areas be in use?
- Under what conditions can clearing operations be much more extensive?
- How many passes are required down the ROW with a bulldozer?

4 Decide whether the statements are TRUE (T) or FALSE (F).

1) Laydown yards are also sometimes used for “double joining” four pipe segments before their delivery to the ROW.
2) Numerous laydown yards may be constructed to support individual pipe construction spreads.
3) Pipe segments are normally delivered from their point of manufacture by air to air off-loading yard.
4) Crew is responsible for removing trees, boulders, and debris from the construction ROW.

5 Scan the text above and complete the sentences.

1) Trees inside the ROW are cut down, roots are excavated; and.…
2) The purpose is to make it possible to move construction equipment.…
3) As with the ROW, access roads from public roadways may also need to.…
4) Depending on existing soil conditions, this may require bringing in additional materials such as.…
5) A truck typically carries a maximum of 20 pipe segments at a time; however, this varies.…

6 Translate into Russian noticing Modal Verbs.

1. Gazprom's Nord Stream 2 pipeline **may** get Chinese financing if European companies are forced out of the project by the latest round of US sanctions. 2. Liquids and gases are transported in pipelines, and any chemically stable substance **can be** sent through a pipeline. 3. Releases of products carried through pipelines **can** impact the environment and may result in injuries or fatalities as well as property damage 4. You **should** avoid configuration like this, and only use branch pipelines or merge request pipelines, when possible. 5. The purpose of the pipeline **is to** assemble several steps that can be cross-validated together while setting different parameters. 6. It is likely that some possible future projects in the pipeline **may be** dropped or withdrawn. 7. The value of the pipeline **must be** an array, slice, map, or channel. 8. In other words, your user account **might** not have access to a certain resource, but scripts and tasks that run in your pipeline might have access to that resource. 9. Russian President says his country **should be able to** complete a gas-export pipeline to Germany that has been placed under sanctions by the United States by the first quarter of 2021, slightly later than previously announced. 10. In many cases, critics argue, pipeline accidents **could** have been prevented with proper regulation from the government and increased safety measures by the industry. 11 The fixing of the rough pipeline route is an optimization task, whereas beside the technical and economical, also other aspects **have to be** taken into consideration.

TEXT 5.2 Excavation and Filling

1 Read and translate the following terms.

A vicinity, the loose rock, the accelerated corrosion, a backhoe, topsoils and subsoils, an operating life, cover requirements, the river bed, to be directionally bored, highway borrow ditches, bedding materials, auspices, stockpiled adjacent to smth., to be composed of heavy clays, a clamshell bucket.

2 Read and translate the text.

Construction access roads are removed and reclaimed after the construction phase; however, some will remain in place throughout the operating life of the pipeline for access to the ROW (right of way) by maintenance and inspection personnel. In virtually all circumstances, topsoils and subsoils are separately stockpiled adjacent to the trench. In most instances, the subsoil can be used to backfill the trench once appropriate bedding materials have been placed at the bottom of the trench and the pipe has been installed. An exception to this general procedure occurs when the subsoils contain rocks of varying sizes that could damage the pipe if they were used as backfill or when the subsoils are composed of heavy clays that would retain water in the vicinity of the pipe, thereby promoting accelerated corrosion. In those instances, appropriate backfill materials are brought to the site from the nearest practical source, and the original soils are disposed of elsewhere, typically under the auspices of a soil disposal permit or approved soil management plan.

The ditch, or trench, in which the pipeline will be installed is usually made to one side of the center of the ROW rather than in the center, to provide adequate room for construction equipment and operations alongside the pipe as well as room for future installations. Ditching in relatively soft soil is done by a machine with a large wheel on which cutting teeth are mounted. The wheel rotates continuously as the machine moves along the pipeline route, and excavated material is continuously deposited alongside the ditch. In loose rock or hard soil, it may be necessary to use other equipment for trenching — for example, a backhoe or clamshell bucket. Blasting or special rock-cutting equipment may be required when the ditch must pass through solid rock.

The depth of the ditch is based on minimum cover specifications or the distance from the top of the buried pipe to the ground surface. For the same minimum cover requirements, a larger diameter pipe requires a deeper ditch. The minimum cover varies according to requirements of regulatory agencies, standard industry practice guidance, the type of area through which the pipeline passes, and features along the pipeline route. A minimum of 3 feet of cover is typical, but it may be less in open, unpopulated areas and more when the pipe passes under roads, rivers, and highway borrow ditches. Minimum cover for river crossings (the distance between the top of the river bed and the top of the pipeline) is set at 4 feet; however, additional cover may be necessary where scouring of river bed materials by moving water is possible. Most river crossings are directionally bored. The width of the pipeline ditch varies according to the size of the pipeline. Typically, this width ranges from 14 to 28 inches for intermediate pipeline diameters.

Source: Pharris, T. C., Kolpa, R. L. (2008) Overview of the Design, Construction, and Operation of Interstate Liquid Petroleum Pipelines. - p. 55

3 Work with a partner. Discuss the questions below.

- What types of soils can be used to backfill the trench once appropriate bedding materials have been placed at the bottom of the trench?
- How do you do ditching in relatively soft soil?
- What is required when the ditch must pass through solid rock?

4 Fill in the gaps using the words in the box. There is one extra word.

A. subsoil	**B.** larger	**C.** blasting	**D.** ditching	**E.** width

- 1. The _____ of the pipeline ditch varies according to the size of the pipeline.
- 2. _____ may be required when the ditch must pass through solid rock.
- 3. A _____ diameter pipe requires a deeper ditch.
- 4. _____ in relatively soft soil is done by a machine with a large wheel on which cutting teeth are mounted.

5 Translate into Russian noticing Modal Verbs.

1. Repair work to the pipeline **could** involve excavation, which **would** create conditions similar to initial construction for a limited period of time over an area limited by the extent of the repair. 2. For pipelines not using Dataflow Shuffle, Dataflow **might not be able to** scale down the workers effectively because the workers **may** have shuffled data stored in local disks. 3. Building a pipeline and connecting it to the existing transport systems in the Norwegian Sea **could be** done either by developing a traditional processing plant in connection with the Melkøya LNG plant or develop a simpler processing plant. 4. Pipeline **should not be** more than 2.13 m (7 ft) above the cow platform. 5. For this purpose the hydraulic characteristics of the pump and pipeline **have to be** known for forward as well as for reverse flow. 6. Releases of products carried through pipelines **can** impact the environment and **may** result in injuries or fatalities as well as property damage. 7 When a permit is granted, or at any time thereafter, the Board may determine a date by which construction of the pipeline **is to be** commenced or completed. 8. When draining compressed air or gases, the pipeline **has to be** connected to the taphole in the housing cover or to the threaded bushing at the housing upper section by an additional compensation pipe. 9. Cconstructing a facility across, on, along or under a pipeline you **must** contact the pipeline company to obtain written consent.

6 Give the Russian equivalents of the following word combinations.

to be composed of; to backfill the trench; to be mounted; to be stockpiled; room for construction equipment; to be under the auspices; to be removed and reclaimed; cover specifications; the pipeline route; to be directionally bored.

7 Translate into English.

Должны быть засыпаны грунтом; трубы малого диаметра можно укладывать в траншеи; что бы не повредить трубы, грунт не должен содержать камни, валуны; при прокладке труб в водонасыщенных грунтах; толщина слоя должна быть 10 - 15 см.; расстояние между стенкой траншеи и стенкой трубы составляет 35 см.

ANSWER KEY

Unit 1

TEXT 1.1: Flowlines

Ex. 2: 1 operate; 2 maintain; 3 variate; 4 differ; 5 introduce; 6 segregate; 7 reduce.

TEXT 1.2: Pumping Stations

Ex. 2: 1 E; 2 G; 3 I; 4 H; 5 B; 6 A;7 D; 8 C; 9 F.

Ex. 5: 1 F; 2 F; 3 T; 4 F; 5 T; 6 F; 7 T.

Unit 2

TEXT 2.1: Ifluencing Factors

Ex. 6: 1 installed; 2 serves; 3 stabilization; 4 bedding; 5 tamped; 6 ensure.

TEXT 2.2: Bedding and Sizing

Ex. 3: 1 primarily pumps and pressure management devices, are properly sized and positioned; 2 on linesize, the number of pump stations, and the like; 3 prior to backfilling to check for faults not observable by visual examination; 4 ranging from 31.75 lb/foot to 196.91 lb/foot.

Ex. 4: 1 H; 2 D; 3 I; 4 E; 5 F; 6 C;7 B; 8 G; 9 A.

Unit 3

TEXT 3.1: Product Qualities

Ex. 5: 1 I; 2 L; 3 B; 4 H; 5 K; 6 J;7 D; 8 C; 9 A; 10 F; 11 G; 12 E.

TEXT 3.2: Pour Point

Ex. 1: 1 - 760 mm Hg; 2 - 2 psia; 3 - 2 psia; 4 - 212°F; 5 - 15 psia.

Ex. 3: 1 T; 2 F; 3 F; 4 F.

Unit 4

TEXT 4.1: Pumping facilities

Ex. 4: 1 F; 2 H; 3 J; 4 G; 5 I; 6 D;7 A; 8 B; 9 E; 10 C.

Unit 5

TEXT 5.1: Movement and Staging of Pipeline Components

Ex. 4: 1 F; 2 T; 3 F; 4 T.

TEXT 5.2: Excavation and Filling

Ex. 4: 1 E; 2 C; 3 B; 4 D.

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CONTENTS

ДЕЛОВОЙ ИНОСТРАННЫЙ ЯЗЫК
ТРУБОПРОВОДНЫЙ ТРАНСПОРТ УГЛЕВОДОРОДОВ
BUSINESS FOREIGN LANGUAGE
PIPELINE TRANSPORTATION OF HYDROCARBONS

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