

**CONSTRUCTION STANDARD**  
**FOR**  
**TRANSPORTATION PIPELINES (ONSHORE)**

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## **0. INTRODUCTION**

This Standard covers the requirements and works to be carried out for construction of gathering, flow and transportation pipeline used in liquid petroleum and natural gas designed in accordance with ANSI B 31.4 or B 31.8.

The Standard consists of 18 parts. Every part of this Standard shall be deemed supplementary and complementary to every other part and shall be read with it.

Where any circumstance arises outside the scope of this Standard, all queries shall be referred to the Engineer for decision.

## **1. REFERENCES**

Throughout this Standard the following standards and codes are referred to. The editions of these standards and codes that are in effect at the time of publication of this Standard shall, to the extent specified herein, form a part of this Standard. The applicability of changes in standards and codes that occur after the date of this Standard shall be mutually agreed upon by the Company and the Vendor.

### **ANSI/ASME (AMERICAN NATIONAL STANDARD INSTITUTE / AMERICAN SOCIETY OF MECHANICAL ENGINEERS)**

B 31.8 "Gas Transmission and Distribution Piping Systems"

### **IPS (IRANIAN PETROLEUM STANDARDS)**

IPS-E-CE-160 "Geometric Design of Roads"  
IPS-G-CE-182 "Road Surfacing and Pavements"  
IPS-C-PI-270 "Welding of Transportation Pipelines"  
IPS-C-PI-370 "Transportation Pipelines Pressure Testing"  
IPS-E-TP-100 "Paints"  
IPS-C-TP-101 "Surface Preparation"  
IPS-C-TP-102 "Painting"  
IPS-C-TP-274 "Coating"  
IPS-C-TP-820 "Electrochemical Protection"

## **2. DEFINITIONS AND TERMINOLOGY**

### **2.1 Engineer**

The Engineer referred to in this Standard is a person or a body appointed in writing by the Company project manager.

### **2.2 Executor**

The Executor is the party which carries out all or part of construction for the pipeline project.

## **3. UNITS**

This Standard is based on International System of Units (SI) except where otherwise specified.

**PART 1**  
**MATERIAL HANDLING**

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## 1. SCOPE

This part of the Standard outlines requirements for a procedure to specify responsibility of Company and Executor in handing over, loading, hauling, unloading, keeping list of inventory and storing of materials required for installation of pipeline except for explosive materials which are dealt with in part 4 of this Standard.

## 2. GENERAL

The land necessary for sites suitable as storage centers should be leased by Executor as early as possible. A procedure for hand over of materials shall be agreed upon between the Company and the Executor. The procedure, to be specified in the particular conditions of contract agreement, shall give details for handing over of pipe, valves, fittings, coating and other materials and equipment by the Company to the Executor.

The procedure shall include making a list which indicates the extent of all repairs found necessary when the pipe is received by the Executor. The list shall be made by the Executor and must be approved by the Engineer.

After taking delivery by Executor if any defect is found in materials, specified as sound in the list, it shall be made good or replaced at Executor's expense. Unless otherwise specified, site preparation of storage areas, loading, transporting of materials to storage areas and from there to installation site is the responsibility of Executor. The Executor shall provide equipment required for loading, unloading and hauling of pipes and all other materials necessary for installation of pipeline.

## 3. STORING MATERIALS

**3.1** The methods of storage and the location of storage facilities shall be approved by the Engineer prior to use.

**3.2** Materials which are liable to deterioration or damage, shall be suitably stored and protected. Any loss of material caused by inadequate storage or protection shall be removed and replaced at the Executor's expense.

**3.3** Special attention shall be paid to the storage of rolls of wrapping materials intended for protective coating system. This material shall be raised off the ground in layers to a height not exceeding 1.50 meter in a dry and protected building. The rolls shall be stored with their core being upright.

**3.4** Tools or equipment shall not be piled on top of the rolls of wrapping materials.

**3.5** The Executor shall strictly conform to the supplier's instruction regarding storage temperatures and conditions of all materials. The Executor shall provide air conditioned storage, where it is deemed necessary.

**3.6** Materials with machined faces (such as flanges, fittings, equipment, valves, etc.) shall be handled and stored in such a manner to ensure that contact of the machined faces with the ground or other materials which may damage them will be prevented. Such materials shall be stored under temporary shelters or covered with plastic or tarpaulin sheets and raised above the ground on wooden planks or other isolating devices approved by the Engineer. Both ends of valves and insulating flanges shall be temporarily sealed by wooden plugs or plastic. Machined surfaces shall be protected from shocks by maintaining their proper packaging.

**3.7** Primer barrels may be stored in stacks. However, the barrels shall be supported clear from the ground by use of timbers and the maximum number of row shall not exceed 3.

**3.8** Pipe coated with P-E (polyethylene) can be kept at ambient temperature range of -45°C to 80°C. Polyethylene is susceptible to direct sunshine. P-E coated pipes can be exposed to sun for a maximum period of 6 months provided that temperature does not exceed 60°C. Therefore, for longer storage P-E coated pipes shall be kept under roof or shed.

**3.9** All lengths and sections of coated and wrapped pipe shall be picked up clear of ground. Walking on coated pipe shall not be permitted.

**4. LOADING AND UNLOADING PIPES**

**4.1** Loading and unloading of pipes must be done carefully. Pipes shall not be dropped. Pipes larger than DN 150 (NPS 6) must be handled by crane or other suitable lifting equipment complete with proper slings, belts, or approved end hooks.

**4.2** Lifting devices to be used for handling pipe shall be so designed and used that no damage to the pipe and coating will result.

**4.3** Belts used for pipe handling shall have a minimum width equal to the diameter of the pipe being handled and should not consist of abrasive material.

**4.4** Executor shall replace any lifting equipment or apparatus considered unsafe or unsuitable by the Engineer.

**4.5** The use of non-ferrous hooks is not allowed for lifting pipe.

Lifting shoes may be made of malleable iron or other approved material and shall be faced with belting materials, brake lining, plastic or other material approved by the Engineer. Each shoe shall be properly shaped and sized to engage at least one tenth of the pipe’s inside circumference and 100 mm wide for single joint and 150 mm for double joints.

Rivets or other metallic fasteners used to hold the protective facing shall be suitably countersunk to prevent contact with the pipe.

**4.6** During hoisting, wire slings shall be of such length that the angle formed between each leg of the sling and the pipe is not less than forty five degrees.

**4.7** Yard concrete coated pipe shall be raised or lowered to or from the stock pile, ground or truck by means of end hooks engaging the ends of the pipe and shall be carried by a wire rope or chain sling with "Spreader Bar" between lifting lines.

**5. STOCKPILING OF PIPES**

**5.1** Pipes shall be placed on level graded and adequately compacted areas. Pipes shall be stockpiled at approved locations by grade of steel, diameter, thickness and also by pipe manufacturer and clearly identifiable as required by the Engineer and shall be secured against collapse or movement.

The Executor shall limit the tiers of pipe so that distorting or flattening of pipe will not occur. The maximum number of tiers is given in the table below.

PIPE	DIA	MAXIMUM NUMBER OF TIERS
NPS	DN	
6	150	12
8	200	9
10	250	7
12	300	6
16	400	5
20	500	4
24	600	4
30	750	3
36	900	3
42	1050	3
48	1200	3
52	1300	3
56	1400	3
60	1500	3
72	1800	3

**5.2** Pipes shall be stocked in such a manner that at intervals of 30 meters 2 stacks of pipe be stored leaving adequate space approximately 6 meters for passage of trucks and crane between successive stacks.

**5.3** Storage area in locations consisting of soft ground shall be compacted to the satisfaction of the Engineer using sand and gravel and roller. Compaction shall be extended with the same degree 6 meters either side of stack boundaries.

**5.4** The pipes shall be kept clear from the ground using skids or timbers approved by the Engineer.

**5.5** Every length of pre-coated pipes shall be separated from next tier by use of plastic belt.

## **6. TRANSPORTATION OF PIPES**

**6.1** During transportation, the pipe shall be wedged and protected in such a way as to prevent any distortion, flattening and damage and to have longitudinal welds located at the point of minimum possible stress and to have no contact with the adjacent pipe.

**6.2** Metal bolsters shall not be used. Approved bolsters supporting the lower tier of pipes shall be shaped to support at least thirty degrees of the circumference of the pipe. Padded bolster shall be used.

**6.3** Each load shall be tied down using cables of suitable proportions and arranged in such a manner that tie-down is achieved over the bolsters. Tie-down cables shall be covered by rubber or similar material to protect the pipe and to prevent metal to metal contact. During transportation of pipe, tie-down cables shall be inspected and retightened by the Executor during and after hauling.

**6.4** Extreme care shall be exercised for hauling pre-coated pipes using suitable and approved material for padding.

**6.5** In transportation of yard concrete coated pipes, the bolsters of truck and trailer shall have adequate bearing surface (as directed by the Engineer), to give necessary support to padding which protects the coating.

## **7. HAULING OF COATING MATERIALS**

**7.1** Hauling of coating materials to right of way shall be limited only to quantities necessary for the daily coating application. Coating materials shall be transferred directly to vehicles supplying the coat and wrap machine.

**7.2** During unloading, transport and application of wrapping materials, any contact with water, mud, earth, dust, crushed stone and foreign materials shall be avoided.

## **8. DAMAGED PIPES**

Pipes which have been found damaged specially those showing ovality, dents, flattening or other permanent deformation, shall be stored and stockpiled separately. These pipes can be taken to site for incorporation in the works only when defects have been repaired or eliminated by cutting and beveling provided that such repairs have been approved by the Engineer.

## **9. FINAL STORAGE**

In line with completion of construction activities all excess company supplied materials (e.g., pipe, valve, fitting, usable crop ends) shall be collected, transported and stored by the Executor and kept under his care. Location for storing such materials shall be approved by the Engineer and materials shall be classified according to their characteristics (dia, thickness, grade, type etc.). This operation must be finished at the date of "work completion".

**PART 2**  
**RIGHT OF WAY**

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## 1. SCOPE

This part of the Standard describes requirements and responsibilities of Executor in connection with verification of the staked route with that shown in the working drawings and setting out the right of way in width shown in approved working drawing.

## 2. GENERAL

The pipeline route shall be in accordance with the relevant working drawings and the route as staked on the site which also indicate the working width. In the event of any discrepancy between the route as staked on site and the route on the working drawings, the route on the drawings shall prevail.

## 3. ROUTE

**3.1** The Executor shall re-stake any alterations necessary to comply with the route shown in the working drawings. The Executor is responsible for the accuracy of survey line established by him and shall incur expenses to perform survey work.

**3.2** The Executor may suggest changes in the original route in some sections resulting from observation to avoid presence of water wells, qanats, rocks, inaccessible locations and other conditions which may affect the construction, maintenance and safe operation of pipeline. In such cases the following procedure shall be adhered to:

- a)** The Executor shall prepare the relevant drawings and submit them to the Engineer for his review and written approval.
- b)** The Executor shall mark the proposed route for the Engineer to inspect.
- c)** The Executor shall give in writing the reasons for route alteration and explain advantages.
- d)** All relevant information shall be provided to the Engineer by the Executor sufficiently in advance of construction to enable the Engineer to examine the Executor proposals.

The Executor shall never deviate from the original route before obtaining written approval of the Engineer. The Engineer's approval does not relieve the Executor from any of his responsibilities or obligations in respect of timely and orderly completion of the project.

**3.3** The Engineer may instruct the Executor to make any deviations from the original route which may deem necessary.

**3.4** Where surface features or any foreign underground installations are indicated on the working drawings, the Executor shall verify that the locations so indicated are correct.

The Executor shall be held responsible for any claim arising from incomplete verifications. The Executor shall locate all installations that are to be crossed particularly underground installations.

The Executor shall explore and precisely locate existing pipelines and all other installations which are parallel or adjacent to the pipeline being constructed, specially when the clearing between the pipelines is less than required by the working drawings.

The Engineer shall be informed by the Executor of any foreign installations encountered which have not been indicated on the working drawings and he will advise the Executor of action to be taken.

## 4. DRAINAGE AND TEMPORARY STAKING

Drainage channel shall be made along the route in hilly terrains and also any other place where there are the possibility of erosion of right of way by surface water. The channel shall be properly sloped.

## 5. CLEARING AND GRADING

The right of way may be adjacent to an existing pipeline or the Company may have existing line on the right of way of the pipeline under construction. In such cases, the clearing and grading operations shall be carried out in a manner that:

- a) The cover of existing buried pipelines shall be strictly maintained.
- b) The passage of the Executor's vehicles or equipment along or across existing pipelines is forbidden excepts at crossings located and approved by the Engineer. The number of such crossings shall be kept to a minimum and they shall be constructed and maintained so that the cover high to the existing pipeline is sufficient to prevent damage to the existing pipeline and is a minimum of 2.5 meters over a width of at least 8.5 meters on either side of the center line of the pipeline, or as instructed by the Engineer.

### 5.1 Clearing

**5.1.1** Before commencing work in any new section of right of way the Executor shall get a clearance certificate from the Engineer for that section.

**5.1.2** The Executor shall clear the entire width of right of way.

**5.1.3** The Executor shall observe the forest protection law of Islamic Republic of Iran and obtain necessary permits before cutting the trees. The Engineer shall provide Executor with such permits if requested by the Executor. The ecological nature of the terrain that the right of way traverses must be preserved as far as possible. When trees have to be removed, any resulting saleable timber will remain the property of the Company.

**5.1.4** All cleared trees removed from the right of way shall be cut into 2.5 meter lengths and neatly piled along the edge of the right of way.

**5.1.5** Existing fences shall not be removed without giving previous notice to owners and/or users through the Engineer, where it is necessary to remove permanent fences, walls or gates.

Before cutting any fence, Executor, shall furnish material and shall adequately brace the existing fence to prevent damage and, if the fence is in the vicinity of a power transmission line, shall adequately earth the fence on both sides of the cut.

Where a fence paralleling the right of way must be removed for construction purposes, Executor shall install a temporary fence or, with Engineer's and landowner's approval, temporarily relocate the existing fence.

Access points through fences which cross the right of way shall be securely locked and kept closed by the Executor and to be opened only for the passage of vehicles and authorised personnel.

The Executor shall not dump any kind of material resulting from clearing and grading on roads, railroads, streams, ditches, drains and any other place where it might obstruct the flow of water or passage of traffic.

### 5.2 Grading

After clearing has been carried out the right of way must be reasonably leveled and sharp changes in contour along the right of way shall be graded down. The maximum gradient shall be 12 and if it is continuous, a 15 meters stretch of level track shall be provided at 150 meter intervals.

Should any damage occurs to any existing installation in clearing and grading operation, the Executor is responsible for repair to owner(s) satisfaction.

**5.3** The Executor is responsible to maintain right of way until completion of construction of the project.

## 6. ACCESS/SERVICE ROADS

6.1 Access/service roads (on temporary bases-during construction).

6.1.1 Access roads shall be provided by the Executor to connect existing roads to the following locations:

- a) Right of way
- b) Valve sites
- c) Site for water source
- d) Either side of rail road and river crossings
- e) Cathodic protection and telecommunication stations
- f) Camp site
- g) Any other locations as instructed by the Engineer.

6.1.2 Service roads along the right of way to make passage of vehicles and construction plants possible.

6.1.3 The temporary access and service roads during construction period shall have condition satisfactory to the Engineer and shall be suitable for driving four-wheel drive vehicles along them.

### 6.2 Access and Service Roads (Permanent)

6.2.1 The Executor shall upgrade the temporary roads and also construct permanent roads at the following locations:

- a) On either side of marshy lands.
- b) At locations where the slope of right of way is more than 16°.
- c) At any other locations where it is deemed necessary and instructed by the Engineer.

6.2.2 Requirements for construction of the above mentioned permanent roads (e.g., compaction of subgrade, fill and back fill, finish grading, base course, road crossings, drainage and culverts, surface conditions etc.) shall comply with specification set fourth in IPS-E-CE-160 and IPS-G-CE-182.

## 7. PERMITS AND AUTHORIZATION

The Company shall undertake the acquisition of land for permanent access service roads, and will secure at his own expense the necessary permits for roads, railways, stream/river crossing and also crossing of existing structures. The Executor shall comply with all conditions required in the permits. Prints of drawings showing details of such crossing, shall be provided to the Engineer sufficiently in advance of construction to enable the Engineer obtain the necessary permits in time to comply with the construction schedule.

The Executor shall obtain necessary easement and permit through the Engineer for construction of the above mentioned access/service roads.

7.1 When transit of the vehicles and construction equipment or in particular the construction of R.O.W. interferes or requires the relocation of the electric poles, telephone lines, electric cables, underground structure and/or installation, the Executor shall notify the Engineer in advance of his requirements. The Engineer will obtain the necessary approval and/or permits for the Executor within a reasonable time after notification. The Executor shall not commence the work in that section of R.O.W without the Engineer written approval.

7.2 The Executor shall give the Engineer advance notice of his needs for authorization to use public and private roads for access to the work by all vehicles, equipment and personnel. The Engineer will obtain the necessary authorization for the Executor.

## 8. BLASTING OPERATIONS

Reference shall be made to Part 4 of this Standard.

## **9. CARE OF SERVICES AND PROPERTIES**

**9.1** The Executor shall promptly repair any damage caused by his operation to bridges, private roads, fences, buildings or other property on or off right-of-way to the satisfaction of the Engineer. All relevant costs shall be borne by the Executor.

**9.2** Where right of way operations run parallel to or crossing installations such as pipelines, cables etc. the Executor shall take care to prevent any damage to these installations and shall conform to the requirements of the relevant authorities.

When telephone or utility lines are damaged due to the ingress and egress of the Executor's tools and equipment for the construction of the pipeline, the Executor shall, at his cost, undertake the necessary repairs of such telephone and utility lines to the satisfaction of the Engineer. The Executor shall pay for such repairs if the repairs are accomplished by the concerned authority.

**9.3** The Executor shall where possible avoid causing damage to irrigation canals, qanats, ditches or other irrigation installation and shall also avoid interruption in flow of water.

**9.4** During the progress of right of way operations the Executor shall endeavor to minimize disruption to any existing cultivated areas. The Executor may be requested by the Engineer to amend his right of way operation program from time to time, particularly during harvesting, to ensure such disruption is minimized by the Executor.

**9.5** The Executor shall perform the works in such a way so as to minimize the disruption of activities to authorities, owners, users of adjacent roads, bridges and the owner of building or lands. The Executor shall use his best endeavor to avoid unnecessary damage to crops, trees and properties adjacent to the right of way.

**9.6** The Executor shall make every endeavor to keep traditional right of way of tribes open during their migratory periods.

**PART 3**  
**DITCHING**

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## 1. SCOPE

This part of the Standard covers requirements for trenching operations for buried pipeline.

It explains conditions of trench before pipe is laid, conditions under which blasting can be performed, staking and marking and use of excavated materials.

## 2. GENERAL

**2.1** Trench shall be located in the cut/graded section (working side of right of way).

**2.2** The bottom of the trench shall be uniformly graded and free from loose rock, large gravel and other objects which may damage pipe's coating. Wherever additional depth of ditch is required such as for roads, railways, canal, underground pipelines or utility crossings, it shall be provided at no additional expense to the Company.

**2.3** When the excavated material does not meet the specified requirements for backfilling, in the opinion of the Engineer, the Executor shall remove such material from the site as the digging of the trench progresses and shall supply suitable material approved by the Engineer.

## 3. METHOD OF DITCHING AND PADDING OF TRENCH BED

**3.1** The Executor shall use such system of trenching, equipment and methods as may be required to excavate the ditch to satisfaction of the Engineer, regardless of type of soil or rock encountered.

**3.2** The Executor shall familiarize himself with the location of pipe line route in relation to the existing roads, bridges, railways, houses etc., and shall be deemed to have made provisions for excavating by hand or machine (but not explosive) in such locations where the use of explosive would result in damage, injury or disturbance.

When blasting is permitted the Executor shall strictly observe and adhere to all requirements specified in part 4 of this Standard.

**3.3** The sides of the trench shall be free of rock, loose stones, blasted debris or other spoil likely to fall or blown around or on top of the pipe.

**3.4** To prevent the excavated material from falling into the trench, a strip of 40 cm minimum width shall be left clear between the edge of the trench and the edge of the pile of excavated earth. In steep areas of hillside, before starting the work and where required, the Executor shall provide suitable barricades or other similar protection in order to prevent the material from falling down the hill particularly when lines of communication, houses, services, water courses and cultivations are found on the down slope side of the ditch.

**3.5** The pipe shall be laid in the water free trench bottom on a soft layer (padding). Padding material shall be stone free dry sand or soft and sieved earth. Minimum depth of padding for trench bed shall be 20 cm.

**3.6** In steep rocky areas where padding can not be laid and contained due to steep slope, prior to lowering in, it is necessary to put sacks filled with soft material at the bottom of the trench.

## 4. SETTING STAKES

The Executor shall supply and set temporary stakes along the right of way as follows:

- a)** Stakes shall be placed on each extremity of the entire length of the right of way at intervals not exceeding 100 meters and close enough to be visible one from the other. Stakes shall be of such heights as to be visible above any growing crops.

- b) Along the working side of the right of way 1.80 meter high stakes shall be set to indicate each pipeline change in horizontal direction.
- c) At each kilometer a post 1.80 meter high shall be set with an indicating plate.
- d) Auxiliary markers with 1.80 meter high stakes (with indicating plates) shall be placed at the following locations:
  - At each point where the pipes to be laid changes its characteristics in wall thickness, diameter, pipe manufacturer, type of coating as required by the Engineer.
  - At each intersection with underground installations such as water, electricity, telephone, etc.
  - The Executor shall avoid causing damage to drainage, irrigation and waterway systems. The exact location of such installations shall be staked out in an easy and visible manner immediately next to the trench to be dug.
- e) The Executor shall indicate on the stakes the trench depth within the zone.

## 5. CARE OF SERVICES

**5.1** Prior to performing any machine excavation closer than 5 meters to such underground installations, the Executor shall expose the existing installation by hand excavation. Spoil shall be placed so that no heavy equipment operates over the existing installations.

**5.2** Any structure which may be threatened during the trench excavation such as electric poles, foundations etc., shall be braced and adequately supported.

Bracing shall not be removed until the backfilling progress allows its removal without any risk of damage to structure or injury to personnel. All excavated material shall be placed in such a way as to avoid any inconvenience to property owners, or interference with the access of pedestrians or vehicles as well as to operation of adjacent installations.

**5.3** The excavated material shall, when crossing cultivated areas, be placed so that the top soil can be replaced on the surface after backfilling. General backfilling material shall be stored separately from the top soil and care shall be taken to ensure that these materials are not intermixed.

**5.4** Wherever it is deemed necessary by the Engineer for access to houses, building etc., or where live stock is confined and passage way across the trench is desired, the Executor shall provide safe temporary bridges or suitable plate cover for crossing the trench or temporary fencing to prevent animals from falling in the trench.

## 6. ROCK TRENCH AND PADDING

Rock trench shall be defined as a trench which can not be excavated by use of normal hand excavation or machine excavation techniques. Such trenches would require drilling or blasting to enable formation of the trench. In such rocky areas blasting operations shall be carried out as specified in Part 4 of this Standard.

**7. DITCH DIMENSIONS**

For pipeline to be laid without damage to protective coating, trench dimensions shall not be less than the following:

	<b>TRENCH IN ROCKY TERRAIN</b>	<b>TRENCH IN UNCULTIVATED TERRAIN OTHER THAN ROCKY</b>	<b>TRENCH IN CULTIVATED TERRAIN</b>
Minimum depth of cover	600 mm	900 mm	1200 mm
Width of trench in excess of pipe dia	400 mm	400 mm	400 mm

**Notes:**

**1 - The minimum depth of cover is the vertical distance measured from the graded ground level (excluding crown) to the top of the pipe. In swampy areas, the minimum depth is the distance from the grade level to the top of the weighting. In rocky areas, to the top of rockshield over the pipe. In case of transverse slope the depth of cover shall be measured from the level of the down-slope side of the trench.**

**2 - Minimum depth of cover, when crossing with roads, rivers and seismic faults shall be as indicated in alignment and working drawings.**

**3 - Width of trench, when crossing seismic faults shall be as per related working drawings.**

**8. BELL HOLES FOR TIE-INS**

The Executor shall dig bell holes where tie-in welds are to be performed. The dimensions of bell holes shall be as follow to permit ease of maneuvering for welding and coating of pipe:

- Length: 3 pipe O.D as minimum
- Depth: Such that the minimum clearance under the pipe shall be one meter.

**9. DAMAGES AND CLAIMS**

**9.1** The Executor shall be fully responsible for any claims resulting from his interference with surface and subterranean water flow (Qanats) and for any accident resulting therefrom.

**9.2** Any damage to drainage or irrigation system shall be temporarily repaired by the Executor in order to allow its proper usage during construction works. Permanent repair shall be made by the Executor prior to backfilling the trench. In such final repair, the Executor shall restore the former gradient alignment of the damaged system, and shall use materials of a quality and size at least equal to that of the materials to be replaced.

**PART 4**

**SUPPLY, STORING, HANDLING**

**AND**

**USE OF EXPLOSIVE MATERIALS**

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## 1. SCOPE

This part of the Standard covers requirements to be observed by the Executor in clearing right-of-way and trenching operation in terrains containing natural rock, large boulders or other materials which have to be removed by blasting operation.

## 2. SUPPLY, HANDLING AND STORAGE OF EXPLOSIVE MATERIALS

**2.1** The use of explosive materials may be permitted provided the approval is obtained from the authorities concerned. Taking delivery of explosive materials and its use shall be the responsibility of the Executor.

**2.2** The Executor shall notify the Engineer in writing, four months in advance of its need for explosives. This notification shall include all necessary documentation to satisfy the relevant authorities with the type and amount of explosives requested by the Executor. The notification shall also include a consumption schedule for explosive materials throughout execution of the project. The authorities concerned may supply the explosives or grant permit for importing explosive materials by the Executor.

The Engineer assists the Executor to obtain explosives or permit for its importation if it is found necessary.

**2.3** For delivery, transportation, storage, handling and use of explosives, the Executor shall strictly conform to the Iranian laws and regulations.

**2.4** The Executor shall deliver to the blasting sites all necessary explosives, detonators and all materials associated with blasting operations.

## 3. ENGINEER'S APPROVAL PRIOR TO THE USE OF EXPLOSIVES

**3.1** The Executor shall obtain the Engineer's written approval prior to the use of explosives. Each approval shall be limited to a specific length of the line. The Engineer will refuse his approval in a particular case if, in his opinion, blasting can not be carried out with complete safety. The Engineer's approval does not obligate him for any of the Executor's responsibilities concerning the use of explosives.

**3.2** The Executor shall obtain all necessary local permits.

## 4. BLASTING OPERATIONS

**4.1** Blasting operation will be permitted upon approval of the Engineer.

**4.2** The Executor shall use only experienced workmen to supervise, handle, haul, load and shoot explosives.

**4.3** The Engineer or his representative (nominated in writing) shall be present at all times during the use of any explosive, unless the Engineer has provided written notice that blasting may proceed without his attendance.

**4.4** The Executor shall provide all necessary warnings and control procedures required for blasting operations.

## 5. CARE OF LIFE, SERVICES AND PROPERTY

**5.1** The Executor shall exercise extreme care to safeguard against loss of life, live stock, injury and accident and damage to other installations, springs, irrigation facilities or water courses.

**5.2** Where the pipeline runs parallel to an existing pipeline or adjacent to any petroleum installations or under-ground structures and in those areas, where the Engineer deems necessary to take particular safety measures, the Executor shall, prior to blasting operations, present to the Engineer for his approval a detailed blasting procedure and plan. The procedure and plan should indicate the type of explosives, exact location and size of each charge in addition to blasting schedule. The procedure shall include, but not limited to minimum distance to existing installations.

Blasting operations will be restricted near the existing installations. The minimum distance where blasting will be permitted is subject to agreement of the Engineer. The agreement shall be obtained prior to proceeding with any blasting, taking into account the blasting procedure proposed by the Executor and approved by the Engineer.

**5.3** The Executor is fully responsible for damages affected to any person, animal, adjacent property, springs, irrigation facilities or water courses as result of blasting operations. The Engineer's approval does not relieve the Executor of his responsibility for correctness in blasting.

**5.4** When telephone or utility lines are damaged by or require relocation due to the blasting operations, the Executor shall repair or relocate such services to the satisfaction of the Engineer at the Executors expense.

**5.5** Any damage caused to existing installations shall be immediately repaired to the full satisfaction of the Engineer and the owner. All direct or indirect losses and costs shall be borne by the Executor.

## **6. CARE FOR LOSS OF EXPLOSIVE AND ITS DISPOSITIONS**

**6.1** Proper disposition must be made of any and all refuse from explosive containers and cartridges, and in no case shall they be disposed of in the backfill of the trench.

**6.2** If loose rock is scattered over cultivated fields, the Executor shall pick up such rock and dispose of it to the satisfaction of the Engineer.

**6.3** The loss or partial loss of explosives or detonators during the blasting operations will render the spoil material from that area unacceptable for backfilling. Such materials shall be removed from the Right-of-way.

**PART 5**  
**STRINGING**

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## **1. SCOPE**

This part of the Standard deals with manners to be considered in taking pipes from stockpile and stringing along right of way for subsequent welding, coating, lowering and backfilling.

## **2. GENERAL**

- 2.1** Pipes shall be transferred from stockpile to the installation site. Care must be taken to ensure that pipes are taken from right stock.
- 2.2** The Executor shall submit his stringing plan for approval of the Engineer at least 15 (fifteen) kilometers in advance of stringing operations. The Engineer retains the right to review such distance during progress of works.
- 2.3** In order to keep and maintain the work within reasonable lengths, the pipe stringing shall precede welding operation by a distance of not greater than 5 (five) km. The Engineer reserves the right to review such distance during the progress of the works and, if necessary, to instruct the Executor to limit the daily pipestringing activity accordingly.
- 2.4** In stringing operation, the Executor shall observe characteristics of pipes as indicated in working drawings and auxiliary stakes placed in the ground along right of way (see Clause 4 of Part 3 of this Standard).
- 2.5** In that part of the right of way directly subject to flood, swamps and in close vicinity of corrosive soil, no pipe shall be strung until the time of assembly.
- 2.6** Pipe shall not be in direct contact with ground. The Executor shall provide appropriate wooden skids in such cases.
- 2.7** Stringing shall be made after completion of explosion operations.

## **3. DIMENSIONS TO BE OBSERVED**

The minimum distance between the pipe and the edge of the trench shall be one meter.

## **4. PERCENTAGE OF PIPE ALLOWED FOR REJECTION**

The total maximum tolerated length for the non-usable crop-ends and for the pipes rejected for reasons attributable to the Executor activities including pipes used to qualify the welding procedures and the welders, is fixed at 1% maximum of the total length of the Company supplied pipes. The lengths exceeding this amount shall be charged to the Executor.

## **5. CARE FOR SERVICES**

During pipe stringing care shall be taken to ensure that, water courses, water supplies, electricity and telecommunication services are not interrupted or affected in any way by the operation.

**PART 6****PREPARATION OF PIPES AND CAPPING OPEN ENDS**

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## 1. SCOPE

This part of the Standard covers checking to be made in respect of cleaning of pipe ends and interior of pipes as well as pipe condition. It also emphasizes necessity of repair before lining up pipe and weld it into a string.

## 2. CARE OF LINE PIPE

During loading, transportation, unloading and stringing, the Executor shall take all necessary precautions to keep the inside of the pipe free from dirt, waste and other foreign matter. When lifting pipe care must be taken to prevent buckling and any damage.

## 3. CHECKING PIPE CONDITION

The Executor shall inspect all line pipe to ensure that no pipe with buckles, gouges, grooves, nicks, notches or other defects is incorporated in the finished pipeline. Bevels on the ends of pipe are to be checked immediately before lining up and production welding.

## 4. SWABBING OF PIPES

**4.1** The interior of each length of pipe or fitting shall be visually and thoroughly examined to make sure that it is clean and empty.

**4.2** Each single length of pipe which is contaminated in any way and if necessary, as determined by the Engineer, shall be thoroughly swabbed before lining up and being welded into a string. Swabbing shall be made to remove all dirt or foreign matter from the inside of the pipe. Any solvent, if required to be used, shall be approved by the Engineer.

**4.3** The swab shall be constructed of two separate discs of 1 cm thick rubber or similar material sized to fit the inside diameter of the pipe and rigid back-up plate. The type of SWAB, used by the Executor, shall be approved by the Engineer.

## 5. CLEANING PIPE ENDS

The ends of the pipe including bevel and root face shall be thoroughly cleaned of rust, scale, dirt, grease, protective coating, burrs or other foreign matter on both the inside and outside edges which may adversely affect the weldability of the bevelled ends.

## 6. CAPPING PIPE ENDS

**6.1** At the end of each day's work, the Executor shall cap all open ends of welded sections of pipe with a night cap.

**6.2** Failure to cap ends of sections which can not be swabbed shall be cause for requiring the Executor to run a scraper through that section before tie it in pipeline.

**6.3** Night caps shall be placed using suitable technique to prevent damage to the bevels at the ends.

**6.4** Unattended sections of the pipeline and strings with open ends shall be effectively capped when work is discontinued for any reason to prevent entrance of animals or foreign matter into the pipeline. These night caps shall remain in position where work is interrupted at crossings, under railways, roads, rivers etc.

**6.5** The Executor shall be responsible for any obstruction inside the pipeline.

## 7. CUTTING AND BEVELLING

If necessary, as determined by the Engineer, bevels on the ends of pipe shall be made in the field with a bevelling machine. Normally these bevels shall be made to an angle of 30 degrees plus 5 degrees minus zero degree ( $30^\circ, +5^\circ, -0^\circ$ ), measured from a line drawn perpendicular to the axis of the pipe, and with a root face  $\frac{1}{16}$  in  $\pm \frac{1}{32}$  in. (1.6 0.8 mm). Manual oxygen cutting shall not be used for bevelling the ends of pipe for welding unless it is impracticable, to the Engineer's judgement, to use machining or machine flame cutting equipment. In such cases permission shall be obtained from the Engineer, and the cut face ground back to clean metal before welding.

## 8. REPAIR WORK ON LINE PIPE

**8.1** Defective longitudinal welds shall be repaired by cutting out as a cylinder the section of pipe containing the defective weld and re-welding new section with normal circumferential welds. Patching is prohibited and minimum length of the new section shall be according to IPS-C-PI-270.

**8.2** A list indicating the extent of all repairs found necessary, when the pipe is received, is to be made by the Executor and approved by the Engineer before repair work commences.

**PART 7**  
**CHANGE OF DIRECTION**

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## 1. SCOPE

This part of the Standard covers requirements for cold field bending. It describes limits to be observed in field bending in terms of minimum bend radius as well as maximum stretching or thinning of the pipe wall thickness.

## 2. GENERAL

**2.1** Performed bends shall be used when changes of slope or direction are required.

**2.2** No bends will be permitted on pipe which has been or is to be concrete coated. For river crossings the pipe may only be laid in natural curves which can not over stress the pipe or the reinforced concrete sheath.

**2.3** Maximum permissible angle of cold field bending shall conform to ANSI/ASME B 31.8.

**2.4** No bend shall be made within two (2) meters of a circumferential butt weld or bevelled end of pipe unless the pipe is double jointed, in which case this dimension may be reduced to a minimum of one meter.

**2.5** No wrinkle bends or hot bends are permissible.

**2.6** If bend is made from pipe lengths containing longitudinal seam, the seam shall be positioned on the neutral axis of the bend and length shall be arranged so that successive lengths have the seam properly staggered as per IPS-C-PI-270.

**2.7** All bends shall be made cold and uniform by the use of an approved bending machine with bending shoes of proper size and skilled operator.

## 3. MINIMUM BEND RADIUS TO BE OBSERVED

**3.1** Radius of field bends shall be based on  $1.5^\circ$  per length of pipe equal to nominal diameter.

**3.2** Where physical requirements, obstructions, etc., dictate that a bend be made of tighter radius than the limits given in 3.1, this shall be done with the Engineer's prior approval.

## 4. LIMIT OF THINNING AND DEFORMATION

**4.1** Stretching or thinning of the pipe wall thickness shall not exceed 1.5% at any point along a performed bend.

**4.2** The pipe diameter shall not be reduced by more than 2% of nominal pipe diameter. Care must be taken to avoid wrinkling and not to exceed this limit of deformation. Wrinkled pipe or pipe exceeding the said deformation shall be rejected.

**PART 8****WELDING AND LAYING OF PIPE**

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## 1. SCOPE

This part of the Standard covers technical requirements for welding of pipe over the ditch and double jointing yard as well as laying pipe in trench, exposed and casing sections. The requirements include complementary trenching works, considerations to be given in laying pipe when trench contains water or mud and test of pipe coating just before laying.

## 2. WELDING WORK

### 2.1 Welding of Pipe Over the Ditch

Reference shall be made to IPS-C-PI-270.

### 2.2 Welding of Pipe at Double Jointing Yard

**2.2.1** For expediency efficiency, line pipe may be double jointed by the Executor before transportation to site for stringing.

**2.2.2** When double jointing of line pipe is agreed upon between the Company and the Executor, the Executor shall weld single joints of pipe into double joints at pipe storage site, wherever the double jointing is considered efficient, practical and suitable, prior to transportation and stringing the pipe along the right of way.

**2.2.3** Prior to commencement of the work, the Executor shall submit his proposal regarding the welding process in addition to welding procedure for the Engineers review and approval.

**2.2.4** All welding work, welding materials, qualification tests for welding procedure and welders, inspection and testing, acceptance standard to be applied to production weld, repair or removal of defects shall conform to requirements cited in IPS-C-PI-270.

Non-destructive testing shall be carried out at frequency of one hundred percent by radiographic or ultrasonic method as agreed by the Engineer.

Destructive test, when instructed by the Engineer, shall be carried out as per requirements of IPS-C-PI-270.

## 3. LAYING OPERATION

### 3.1 Verification of Trench Conditions Before Laying Pipe

**3.1.1** The Executor shall verify the trench conditions and dimensions prior to lowering-in. The trench shall also be visually examined for proper finishing of its walls, bottom and padding material.

**3.1.2** When necessary complementary trenching works shall be carried out in order to ensure that the pipeline rests uniformly on the bottom of the trench. In such cases, padding operation should be completed before lowering-in is done to the satisfaction of the Engineer.

**3.1.3** All hard objects, rocks, large clods, sticks shall be removed from the bottom of the trench into which the coated and wrapped pipe-line is to be lowered so that the protective coating shall not be punctured or abraded.

### 3.2 Laying Pipe Into Trench

**3.2.1** The Executor shall, when the trench contains water or mud, dry and clean out the trench before lowering-in the pipe. For certain locations of limited length, the Executor may propose for the approval of the Engineer a process which, without drying out of the trench, enables the pipeline to be laid as normal in the bottom of the trench.

**3.2.2** Pipe shall normally be lowered into the trench immediately after the coating and wrapping test has been passed by the Engineer.

**3.2.3** The Executor shall test the pipeline for coating integrity with a holiday detector just prior to lowering-in. The testing method and instruments shall be approved by the Engineer.

**3.2.4** The line shall be lowered into the ditch in such a manner as to obtain required amount of slack. The Executor may employ any acceptable means of lowering for laying, provided that such means secure the necessary amount of slack uniformly in the bottom of the ditch and does not injure the pipe or its protective coatings.

**3.2.5** Where coated and wrapped pipe is supported on padded skids their number shall be sufficient to ensure that no damage will be caused to the coating and wrapping. Wide non-abrasive belts or canvas padded sling shall be used at all time in handling the pipeline.

**3.2.6** Protective shields, plywood (or equivalent material) shall be placed along the side walls of trench containing rock or hard objects if Engineer deems necessary. The shields should be taken out when pipe is not subject to further movement.

**3.2.7** If during the laying operation the coating is unreasonably damaged by equipment or rough handling or rough trench, the Engineer may require the equipment be replaced or that the procedure be altered to eliminate the defect. Damaged coating shall be repaired and tested with holiday detector before lowering pipe into trench. It is most important to ensure that pipe coating is sound and undamaged before pipe reaches the bottom of trench.

**3.2.8** If after inspection and repair of coating the pipeline has to be again placed on skids, the skids shall be suitably padded. Upon removal of skids, the Executor shall check the coating with a holiday detector and make repair as required.

**3.2.9** Walking on coated pipe is absolutely prohibited.

**3.2.10** Except for water crossings, sections of coated pipe being tied into the line shall not be dragged or pulled into position and the length of such sections shall be regulated to allow handling without damaging the protective coating.

At crossings or locations where it may be necessary to pull or drag sections of pipe into place, the coated pipe shall be properly protected and handled in a manner to prevent damage to the coating or to the pipe.

### **3.3 Laying Pipe in Exposed Sections**

**3.3.1** Assembling and laying pipe in exposed sections, e.g., in scrapper traps or line break valve stations, shall be performed only after the construction of pipe supporting structures are completed. The Executor shall erect suitable support structures ensuring their correct alignment in plan and elevation.

**3.3.2** Care shall be taken to ensure that the pipe shall have an additional protection, when this comes into contact with the support structure; such methods of protection must be approved by the Engineer.

**3.3.3** The methods and techniques employed for lifting and moving and laying of exposed pipe work and the control procedures to be followed shall be the same as specified for buried pipeline.

**3.3.4** The pipeline shall under no circumstances rest directly on the ground and at no point shall the clearance between the bottom of the pipe and the ground be less than 40 cm.

**3.3.5** When the supports consist of steel structures, the Executor shall avoid setting the supports coinciding with the pipe field welds.

### **3.4 Laying Pipe in Casing Sections**

Pipe laying in casings shall be in compliance with the following requirements.

**3.4.1** Sections of carrier pipe to be installed in casing shall be totally straight sections. The pipe shall be assembled near one end of the casing by welding a section longer than the relevant casing installed, by at least two meters on each side.

**3.4.2** The welded joints of the carrier pipe shall be 100% radiographed and then the carrier pipe shall be externally coated as specified in part 9 of this Standard. After completion of coating, the insulators shall be fitted on the coated pipe as per working drawings.

**3.4.3** All debris must be removed from inside surface of casing before the carrier pipe is pulled into it.

**3.4.4** The pipe shall then be pulled into place in such a manner that the pipe is centered in the casing, the pipe insulation is undamaged and the rate of travel within the casing is uniform.

**3.4.5** Centering cradles and end seals shall be installed immediately after the pipe is in place. After installation of pipe section in the casing, the end seals shall be fitted and secured in position by stainless steel straps.

**3.4.6** Before tie-in the pipeline cased section into the remainder of the pipeline on both sides of the crossing, the Executor shall verify the electrical insulation between the casing and the pipeline cased section using an ohmmeter. During the resistance measurement, the pipeline cased section shall have no contact with the earth or water.

Under no circumstance the measurement value shall be less than 100 ohms. If this minimum value is not obtained, the Executor shall locate and remove the cause of improper insulation to the satisfaction of the Engineer.

### **3.5 Lowering Bend Sections**

**3.5.1** The length of pipe between bends shall be adjusted if required, by the Executor, to obtain an adequate amount of slack.

**3.5.2** All bends shall generally fit the trench in the following manner.

**3.5.2.1** Sag-bends shall fit to the bottom of the trench. They shall be lowered-in such that the legs of the bends are firmly supported.

**3.5.2.2** Over-bends shall clear the high point of the bottom of the ditch. They shall be lowered-in such that the crutch of the bend is firmly supported so that backfill will tend to close rather than open the bend.

**3.5.2.3** Side-bends shall be laid such that the crutch of the bend is at a minimum of two hundred (200) millimeters distance from the side of the trench.

**PART 9**

**CORROSION PROTECTION COATING**

**FOR**

**BURIED PIPELINES**

Reference shall be made to IPS-C-TP-274.

**PART 10**  
**BACKFILLING**

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## 1. SCOPE

This part of the Standard covers the requirements for backfilling of buried lines which shall be carried out immediately after lowering operation and before hydrostatic testing. It explains checking of some important features before performing backfilling operation, the quality of backfill material and considerations to be given at crossings with waterways, roads and irrigated lands.

## 2. GENERAL

**2.1** Backfilling shall be carried out immediately after the pipeline is lowered into the trench, but the Executor shall first obtain approval of the Engineer prior to backfilling any section of the trench.

**2.2** If any backfilling is carried out without approval of the Engineer, he will have the right to require the Executor to remove the backfill for examination of coat and wrap.

**2.3** Before any backfilling operation is undertaken, some important features of the work shall be checked by the Executor which include the following:

- a) The pipe is laid in the trench bottom on a soft layer with minimum thickness of 20 cm.
- b) The quality of backfill materials conforms to the requirements and meets satisfaction of the Engineer.
- c) Correct positioning of accessories such as weights, anchors, etc.
- d) Removal of loose rocks or debris from trench.
- e) Any repair to coating is made.

## 3. INITIAL BACKFILLING (WITH SOFT MATERIALS)

**3.1** The lowered-in pipe shall be surrounded with soft materials around the sides and the top. Minimum thickness of soft material on top of pipe shall be 20 cm.

**3.2** The soft material shall be rock and stone free sand or soft and sieved spoil or earth. The Engineer shall approve the source and quality of the sand or soft earth.

**3.3** For this soft layer the Executor may use, with the approval of the Engineer, the softest material from sieved spoil earth cleaned of all debris.

**3.4** If the softest material cleared of all debris is unavailable from the excavated spoil earth, the Executor may use sieved earth containing some loose gravel provided that in the opinion of the Engineer no damage to the pipe coating would result from the inclusion of such gravel.

**3.5** The soft material shall be immediately furnished and placed around and at top of the pipe by the Executor to protect pipe coating from excessive temperatures or inclement weather.

**3.6** Where rockshield wrap is used, the initial backfill may contain loose gravel and small size rock fragments provided that in the opinion of the Engineer no damage to the coating would result from the inclusion of such materials.

## 4. NORMAL BACKFILLING

**4.1** After covering coated pipe with at least 20 cm, soft materials, the backfill shall be placed in the ditch in the same order of soil structure as removed provided the Executor has obtained approval of the Engineer.

**4.2** The first 50 centimeter of the normal backfill may contain 30 (thirty) percent by volume the rocky debris with a maximum size of ten centimeter provided that they are thoroughly mixed with 70 (seventy) percent loose earth. Other layers of backfill shall not contain rocks with size of more than 30 (thirty) centimeter.

- 4.3** The backfill material shall be free from non earthy debris. Large clods of dirt or clays, stumps or foreign material that could cause voids in the backfill shall not be allowed in the trench.
- 4.4** The use of highly alkaline, acid or sulphurous material is strictly prohibited for backfilling.
- 4.5** The Engineer shall reject backfilling material at his own discretion.
- 4.6** The backfill shall normally be extended and crowned to a height of not less than 20 cm, and not more than 30 cm, above the adjacent ground level or as otherwise directed by the Engineer.
- 4.7** Backfilling shall be such that to allow natural surface drainage. Surplus spoil shall be removed from the premises and disposed of by the Executor to the satisfaction of the Engineer.
- 4.8** Backfilling operation shall never be carried out when trench contains ice, water or when earth or backfill material is frozen.

## **5. BACKFILLING IN SPECIAL LOCATIONS**

### **5.1 Backfilling in Areas Subject to Erosion**

At water crossing and similar areas which are subject to erosion (as directed by the Engineer) protection measures shall be taken by executor against the same. In such locations the Executor shall reinforce backfill with earth filled bags or sand mixed with cement bags after the trench has been filled and the backfill has been solidly compacted to the surrounding ground level.

**5.2** Backfilling of trench through roads shall be carried out immediately after the pipe has been laid. The backfill shall be compacted and finished level with road surface. Degree of tamping and compaction shall be to the satisfaction of the Engineer.

Such sections shall be maintained by the Executor until the works are completed. The road surface shall be finally restored by the Executor to the original condition.

### **5.3 Use of Stoppage and Drainage Ditch**

On steep slopes or similar areas which are subject to severe erosion and in the opinion of the Engineer there is danger of trench backfill being washed out, the Executor shall take following preventive measures:

The Executor shall furnish and place bag breakers filled with sand, soil or sand mixed with cement, as directed by the Engineer. In addition shallow ditches shall be dug as necessary to channel water diverted by breakers away from the pipe trench.

### **5.4 Backfilling in Irrigated Areas**

In irrigated areas where water packing of the backfill is necessary, the following procedure shall be adopted:

- a)** Soil shall be placed in the ditch to a level not exceeding one half the depth from top of pipe to ground surface and then saturated with water.
- b)** Soil filling shall be made in 50 centimeters maximum increments and water packing shall continue as above until trench is full.
- c)** Trench shall be windrowed approximately 15 centimeters high and then compacted to the satisfaction of the Engineer.

Such reinstatement of the backfilling in irrigated areas shall be carried out in a way to ensure that there is no disruption or disturbance to the overall irrigation system.

**PART 11**  
**CROSSINGS**

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## 1. SCOPE

This part of the Standard outlines specific considerations to be given by the Executor in construction of pipeline at crossings. It deals with surveys required to be carried out by Executor before giving schedules and timing for work execution at crossings.

## 2. GENERAL

**2.1** Construction shall be organized so that traffic interruption and interference with activities of adjacent property and utility owners are kept at minimum.

**2.2** In addition to information given in route and profile drawing the Executor shall endeavor to determine locations of buried lines, utilities and other underground structures which may exist across the proposed route of pipeline and have to be crossed.

**2.3** Owners of any possible affected structures shall be given notice well in advance of construction work so that they may make necessary preparation and assign a representative to witness the construction activities at the crossing concerned. To submit the notice, the Executor is required to perform following.

**2.3.1** Before starting crossing work the Executor shall carry out an adequate geological, hydrographic and meteorological survey in order to determine the necessary precautions and the period most favorable for the execution of the works.

The survey results and detailed work schedule on crossings shall be submitted to the Engineer for approval. Work shall not be started without this approval.

- Regardless of the method of crossing the Executor elects to use, he shall submit to the Engineer for approval details of the method and equipment to be used together with timing of operation.

## 3. OVER-HEAD STRUCTURES CROSSINGS

**3.1** Pipeline route may cross existing over-head structure, e.g., Power or telecommunication lines. In such case distance of ditch from poles must be observed as shown in drawing.

**3.2** If blasting is required for ditching the Executor shall take necessary precautions to avoid any damage to poles and overhead line.

## 4. ROAD CROSSINGS WITHOUT CASINGS

Road crossings shall be performed in accordance with relevant drawings taking the followings into considerations.

**4.1** Crossings without casing shall be made by trenching. The Executor shall open the trench/only after the pipeline section relevant to the crossing is prepared. Before opening the trench, the Executor shall have welded the crossing pipeline section to be laid.

**4.2** The crossing section shall have a minimum length extending about 1.5 meters on either side overall width of the road.

**4.3** The radiographic test shall be 100% of all welded joints along crossing section.

**4.4** All backfilling shall be accomplished by placing suitable and compactable material (in accordance with relevant standard) in layers of 15 cm, in thickness.

Each layer shall be mechanically tamped with a pneumatic tamping device (or equal) until the degree of compaction is equal to or more than the density of the road. Whenever the material removed from the open trench is not suitable for backfilling and tamping the Executor shall obtain and use suitable material from other sources.

**4.5** After backfilling the surface of the road shall be replaced with material having at least equal quality with the surrounding surface and in a manner satisfactory to both the Engineer and the concerned authority.

## **5. MAJOR RIVER AND LAKE CROSSINGS**

**5.1** In major river crossings & lakes continuity of operation and the safety of the general public shall be controlling factor in construction.

**5.2** Depending on the crossing width, depth and velocity of flow the crossing may be laid either by launching and pulling the pipe across or by laying pipe by conventional land method.

**5.3** When major river crossings are long and require particular laying methods, the Executor shall prepare and submit for the Engineer's approval a detailed method and work plan.

**5.4** If under water pipeline is pulled into place the Executor shall follow the following procedures.

**5.4.1** The pulling line shall be attached to a pulling head welded to the pipeline such that no bending stresses of any magnitude are introduced into the pipe as a result of the pulling operation.

**5.4.2** The trench shall be graded to give the maximum amount of support to the pipeline when being lowered or pulled into place immediately after the pipeline is in the trench. The Executor shall take the necessary measurements to determine the location and length of under water spans. Any spans found to be in excess of two meters (2 m) shall be remedied in a manner acceptable to the Engineer.

**5.4.3** For crossings to be pulled, no cold bends or fabricated bends shall be permitted in that section of the crossing between the sag bends at each bank.

**5.5** Pipe for under water crossing shall be cleaned coated and wrapped as for underground sections in accordance with the specification and drawings unless otherwise specified.

**5.6** Precautions shall be taken during construction to limit stress below the level that would produce buckling or collapse due to out of roundness of the completed pipeline.

**5.7** All circumferential welds in river crossings shall be tested 100% by radiography. All river crossings shall be pre-tested hydrostatically prior to being tied into the line.

**5.8** All water & river crossings shall be constructed to provide adequate cover throughout the flood plain to prevent exposure of the pipe due to bottom scour or erosion of the banks.

**5.9** The river bed shall be restored as near as possible to its former elevations and obstructions resulting from construction of the pipeline shall be removed and disposed of by the Executor to the satisfaction of the Engineer.

**5.10** On completion of the lowering-in of the pipe the trench shall be backfilled such that the level of the water course is restored to its original level. Banks shall be restored to their original lines and levels. Bank protection works shall be provided in accordance with the working drawings and to the satisfaction of the Engineer.

## **6. WATERWAY CROSSINGS**

**6.1** Water ways with a minimum rate of flow or small water way where a peak seasonal flow occurs shall be treated as normal pipe laying except that the top cover shall in no case be less than 1.2 meters.

**6.2** All the water way crossings shall be carried out in accordance with the Standard or working drawings.

**6.3** Welded joints shall be inspected by radiography at the rate agreed by the Engineer.

**6.4** Pretesting before tie-in is not required for water way crossing.

## 7. QANAT CROSSINGS

The Executor shall establish from local information the size and depth of these water carriers at the actual point of crossing and construct the crossing in accordance with the drawings. Should the construction of the qanat be disturbed the Executor shall make repairs at his own cost to the satisfaction of the controlling authority. The Executor shall prepare all drawings where not provided by the company or required modifications.

## 8. LAND DRAINS

**8.1** The pipeline shall be laid underneath all land drains exposed during trenching unless the Engineer directs otherwise.

**8.2** The course of any land drain cut by the trench shall be clearly marked and it shall be permanently reinstated after the pipe laying is completed.

**8.3** If so directed by the Engineer land drains shall be temporarily reinstated during construction to minimize inconvenience to land owners and occupiers or to prevent water from gaining access to the trench.

## 9. CROSSING OF EXISTING BURIED INSTALLATIONS

**9.1** Crossing of existing buried installations such as pipes and cables shall be carried out in compliance with working drawing.

**9.2** The uncovering of the buried installations shall be carried out by hand excavation.

**9.3** As long as the buried installations remain uncovered the executor shall install and maintain any necessary and/or required protection in order to avoid damage or breakage occurring to existing installations.

**9.4** At all crossing of buried steel installation a reinforced concrete slab shall be applied to the pipeline under construction for a distance of 5 meters on each side of the crossed installation.

**9.5** The Executor shall be responsible for any damage which occurs to the buried installations during the works.

**9.6** Should the Executor for his own convenience request the concerned authority to move or put out of service an electrical or telephone cable, all such requests shall be arranged with the knowledge of the Engineer.

## 10. BRIDGE ATTACHMENTS

Special requirements are involved in this type of crossing. The use of higher strength light weight steel pipe, proper design and installation of hangers, and special protection to prevent damage by the elements of bridge and approach traffic shall be considered.

## 11. OTHER CROSSINGS

**11.1** The over head crossings shall be carried out in compliance with specific working drawings and the laying of the pipeline shall be carried out as per specification. All welded joints shall be 100% radiographed. For all such over head crossings, the pipe shall be externally protected by painting.

**11.2** At the points where the pipe enters the ground, the external coating of buried pipe shall be extended for a minimum of 1 meter on the riser above ground level or for a distance equal to 1 time pipe diameter, whichever is greater.

**11.3** The overhead portion of the buried pipe coating overlapping the overhead section shall be adequately secured and reinforced to avoid possible water infiltrations beneath the coating joint.

**PART 12**  
**CASING INSTALLATIONS**

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## 1. SCOPE

This part of the Standard covers requirements for installation of casings for correct insertion of carrier pipe where pipeline crosses major public roads, freeways, and railways. The Standard also explains boring methods for installation of casings in order to obviate interruption of traffic. Insertion of carrier pipe into casing is dealt with in Clause 3.4 of Part 8 of this Standard.

## 2. GENERAL

Crossing of major public roads, freeways, railways and such other facilities shown on working drawings shall be made by laying pipeline in steel casings. Crossing of railways and freeways shall be made without any interruption of railway traffic.

## 3. PERMITS AND AUTHORIZATIONS

**3.1** Vehicles traffic shall not be interrupted unless prior permission has been obtained by the Engineer from concerned authority.

**3.2** The Executor is required to advise the Engineer of the time work will commence on any crossing at least one month in advance. In addition to that at least one week before commencement of work at a specific crossing, the Executor shall notify the Engineer in writing the need to obtain permit from the relevant authorities.

**3.3** Upon receipt of the written notification from the Executor, the Engineer shall obtain necessary permits from the relevant authorities and the Executor shall comply with all requirements of the concerned authorities, as instructed by the Engineer.

## 4. METHODS OF CASING INSTALLATION

**4.1** The Executor shall install steel casing by thrust boring. If this method is not practicable because of the nature of the ground, with permission of the concerned authority and the approval of the Engineer, casings may be laid by other approved methods. Where conventional boring methods become impracticable because of rock formation, the Executor shall complete the crossing using tunneling method and employing suitable means for this purpose.

**4.2** In order to obviate settlement of pipe the pipe shall have firm bearing on the bottom for a distance of not less than 8 meters from each end of the casing. This shall be accomplished by placing sand filled bags under the pipe at one meter intervals. The Executor may suggest alternative means for firm bearing for bottom, where pipe rests, which shall be approved by the Engineer.

**4.3** The Executor shall install vent and drain pipes as per working drawings.

**4.4** The Executor shall install insulators and cradles onto carrier pipe at intervals given in the working drawing.

**4.5** The Executor shall install end seal at either end of the casing.

## 5. INSPECTION OF CASING PIPE

**5.1** Prior to welding, each length of casing pipe shall be thoroughly checked by the Executor to ensure that no out-of-roundness or dents are existing. These defects, if found, shall be repaired before lining up the casing pipes. The pipe length containing such defects shall be rejected if the defects can not be repaired.

**5.2** Welding of casing pipes shall be in accordance with IPS-C-PI-270 without needing destructive or non-destructive tests.

**5.3** The casing shall be considered ready for insertion of the carrier pipe after inspection and removal of earth, mud and other foreign matters to the Engineer's satisfaction and all internal welds on the bottom 90 (ninety) degrees have been ground smooth. The casing and the trench on either side of the casing ends shall be free of water.

## **6. PAINTING AND COATING**

Vent pipes shall be coated externally up to an elevation of 30 cm above the ground level.

## **7. BACKFILLING AND TAMPTING**

When permission is obtained to cross road bed by open trenching, backfilling and tampting shall be performed in accordance with requirements given in clauses 4.4 and 4.5 of part 11 of this Standard. The Executor should plan and organize trenching, welding, laying and backfill works so as to minimize delay and traffic interruption.

## **8. SAFETY OF TRAFFIC AND PIPELINE**

During the entire period of the casing installation, the Executor shall furnish and install, to the satisfaction of the Engineer, adequate and proper traffic aids such as warning signs, guards and other safeguards necessary for the safety of the public at all crossings. The traffic aids shall be in accordance with the regulations in force concerning traffic safety. Suitable protection shall be provided on both sides of the road to prevent damage to the pipeline by vehicles leaving the road. Where any ditch during the casing operation remains open across public or private roads, the Executor shall construct by-pass roads, temporarily backfill the ditch or install substantial temporary bridgework of adequate strength and width to ensure safety of traffic.

**PART 13****PREFABRICATED ASSEMBLIES**

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## 1. SCOPE

This part of the Standard covers test and installation of fabricated assemblies such as pig launcher and receiver, line break valves, isolated valves, vent and drain valves.

## 2. CHECKS

The Executor shall carry out pre-installation checks on all block valves, isolated valves and scraper trap assembly to ascertain they are operational. The checks shall be made in presence of the Engineer at storage sites and prior to transportation of the assemblies to the right of way. If the Executor feels needs of assistance or service from supplier or manufacturer he can ask the Engineer for this.

## 3. INSTALLATIONS

**3.1** The fabricated assemblies shall be installed at the positions indicated on the working drawings.

**3.2** The Executor shall submit his method of installation to the Engineer for his approval and shall exercise every care to ensure that damage does not occur to valves and assemblies as a result of his method of installation.

**3.3** Piping, pipe fittings and special components connected to the valves or to scraper traps shall be assembled by the Executor in the ditch or at field workshop, if possible for some parts of assembly. Such parts of assembly which might be fabricated in workshop shall receive corrosion protective coating as per IPS-E-TP-100 and IPS-C-TP-101 before transportation to installation site.

**3.4** Maximum torque used for stud bolts in flanged end valves shall be agreed by the Engineer.

**3.5** All valves shall be fitted over an insulated pad on the surface of their concrete support, where concrete valve support is shown on working drawing.

**3.6** Actuators for valves shall be installed by the Executor. All tubing and wiring shall be installed by the Executor in accordance with the working drawings or the valve manufacturer's instruction as directed by the Engineer.

## 4. COATING AND PAINTING

**4.1** Surface of all buried parts of fabricated assemblies shall be cleaned, coated and inspected as specified in IPS-C-TP-101 and IPS-C-TP-102.

**4.2** Wherever buried parts or apparatus exit from the ground, they shall be coated with the same specification as applied to buried parts for a distance corresponding to at least one pipe diameter above finished ground level. This distance shall never be less than 1000 mm.

**4.3** All above ground parts of fabricated assemblies shall be cleaned and painted as specified in IPS-E-TP-100.

**PART 14**  
**PRESSURE TESTING**

Reference shall be made to IPS-C-PI-370.

**PART 15**  
**CLEAN-UP OPERATION**

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## **1. SCOPE**

This part of the Standard covers clean up and restoration activities which shall be performed immediately after the pipe is backfield. The activities are aimed at leaving right of way to its original conditions.

## **2. GENERAL**

**2.1** As soon as possible after the pipe is laid and backfield, the Executor shall perform such work as required to leave the right of way as nearly like its original condition as possible. The work shall include removing surplus and defective materials, disposing waste materials, removing temporary bridges, restoring the land traversed, restoring any neighboring land and utilities affected by the Executor operations to their original condition.

**2.2** The Executor shall use a special "clean-up crew" to work systematically down the line behind the pipelaying and backfilling operations until the work is complete to satisfaction of the Engineer. At any time during progress of the works, completed clean-up shall not lag more than 5 kilometers behind completed backfilling unless written approval of the Engineer is obtained.

## **3. STAGES OF CLEAN-UP AND RESTORATION ACTIVITIES**

**3.1** Major clean-up and restoration activities shall get started immediately after the pipe is backfield. Remaining clean-up and restoration activities shall be carried out upon completion of the final tie-in corresponding to hydrostatic test section.

**3.2** Final clean-up shall be carried out after the completion of final dewatering and before commissioning.

## **4. SURPLUS, DEFECTIVE AND WASTE MATERIALS**

All surplus or defective construction materials, which are the property of the company, shall be transported and delivered by the Executor to the company's storage depot as directed by the Engineer.

Waste materials such as damaged coat and wrap, damaged drums of primer etc., shall be disposed of by the Executor. Outside of built-up areas it is permissible, subject to approval by the Engineer, to bury such waste outside of the right of way to a depth giving a minimum of 500 mm. of backfill cover.

## **5. RESTORATIONS OF PUBLIC AND PRIVATE FACILITIES**

**5.1** The Executor may use public and private roads, bridges and other structures and utilities for access or haulage. Assessment of any damage to these facilities caused by his operation is the sole judgment of the Engineer and the concerned authorities. Repair of damage shall be made as cited in clause 10 of part 2 of this Standard.

**5.2** In carrying out the restorations and repairs, the Executor shall comply with all the clauses or regulations issued by the relevant authorities for the purpose.

**5.3** All drainage and irrigation systems, masonry works and other items listed in the reports on site conditions, prepared before opening the right of way, shall be brought back to a Standard equal to that existing before the start of the works and accepted by the Engineer.

**5.4** The Executor shall ensure that any water which was collected, as a result of the work, is evacuated by constructing, at his own cost, drainage system without causing any environmental damage.

**5.5** All creeks, water courses, wells, qanats and ditches shall be restored to their original condition and their banks shall be pitched with stone to prevent from washing out or erosion.

**6. ACTIVITIES IN CLEAN-UP OPERATIONS**

**6.1** The service road section of right of way and also the edge of backfill crown shall be cleaned and graded smoothly.

**6.2** Temporary roadways provided for construction shall be removed unless required by the company for future operational use.

**6.3** The right of way shall be continually maintained by the Executor against wash-outs or erosion until final acceptance of the work. Therefore if the Executor attempts to perform clean-up operations during adverse weather or wet ground condition, he shall assume full risk of acceptance and the Executor may be required to perform again such clean-up activities.

**PART 16**  
**CATHODIC PROTECTION**

Reference shall be made to IPS-C-TP-820.

**PART 17****RECORDS AND AS-BUILT SURVEY**

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## 1. SCOPE

This part of the Standard describes the Executor responsibility in maintaining record books and locating repairs. It also covers requirements and information in respect of the as-built surveys.

## 2. RECORDS

**2.1** Upon completion of final clean-up and restoration operation a complete record of the condition of the right of way and access ways shall be submitted to the Engineer by the Executor.

**2.2** The Executor shall maintain during the works record books describing and locating repairs, of whatever nature, to the pipe and pipeline and shall make 3 copies of them available to the Engineer.

The Executor shall provide and submit to the Engineer all reports, documentations cited in individual parts of this Standard, as well as result of inspection and tests performed in accordance with Standards IPS-C-PI-270 and IPS-C-PI-370.

Together with the final survey drawings the Executor shall submit a technical report on the as built survey which follows construction work as well as copies of all field books used on the survey and copies of all computations made during the survey.

The report on the survey and its computations shall give full details of all basic data used, methods employed, instruments used, adjustments made, Standards of accuracy observed, reference and bench marks established, special problems or difficulties experienced, index of all drawings and data used and associated with the survey. The Executor shall submit final survey drawings in 5 copies.

**2.3** Unless otherwise agreed upon with the Engineer, as-built data to be prepared by the Executor shall be in accordance with those shown on route and profile drawings.

## 3. AS-BUILT SURVEY

### 3.1 General Information

On completion of the pipeline construction, or of a section as approved by the Engineer, the Executor shall carry out the "as built" survey in accordance with the procedures approved by the Engineer. The survey report and drawing shall provide the primary information given below:

- a)** The total length of the pipeline.
- b)** The continuous contour line, profile of the pipeline along the route in relation to existing topographical features and Company or other development.
- c)** The positions and relevant lengths of above ground sections of the pipeline and facilities.
- d)** Accurate connections to existing control points (NCC) to enable the new works to be shown on Company maps and drawings.
- e)** Data for showing the relation of the new works in relation to properties and land boundaries and rights-of-way of other properties and as a basis for assessing any claims for compensation from other parties arising from the construction of the works.

### 3.2 Detail Information

The as-built survey and final survey drawings shall include the following information:

**3.2.1** The elevations in meters, above mean sea level, of the ground level and at the top of the pipe at intervals not exceeding 150 meters and also at all changes in grade, river stream and road crossings, above ground sections along the pipeline and its terminal and crossing with other pipelines. Elevations at all kilometer posts, bench marks shall be given.

**3.2.2** The horizontal positions, in metric co-ordinates, of the pipeline and all topography features specified in Paragraph 3.1e and 3.1b above within the following distance on each side of the pipeline.

150 meters on each side of liquid pipeline.

250 meters on each side of gas pipeline.

**3.2.3** The slope changes in meters at intervals not exceeding 150 meters for the complete length of the pipeline. Changes shall also be shown at river-stream crossings, major road crossings, changes in pipe diameters, pipe type, grade and wall thickness, valves, scraper traps, start and end of all above ground sections of the pipeline and reference markings; adjacent building, survey control points, reference marks, bench marks and other identifiable features.

#### 3.2.4 Precise bench mark leveling

#### 3.2.5 Topographical feature survey

**3.2.6** Other information cited in route and profile drawings, given to the Executor as part of tender documents, shall also be reflected and relevant spaces shall be filled in. The survey report and survey drawings shall be accepted and approved in writing by the Engineer before final certificate is issued.

### 3.3 Survey Procedure

The Executor shall submit details of his proposed survey personnel for approval of the Engineer. The Executor shall replace any of his survey staff who are considered by the Engineer to be incompetent, inexperienced, negligent or incapable of their duties.

**3.3.1** The survey is to be carried out using theodolite and chain (steel survey tape), and any other apparatus necessary for purpose, to an accuracy of not less than  $\frac{1}{7500}$ . Electronic distance measuring equipment, if approved by the Engineer, may be used instead of steel tape.

**3.3.2** Horizontal angles shall be observed to ten seconds of arc and individual chain measurements measured to 0.025 meter.

**3.3.3** Elevation of the ground surface at the top of pipe shall be observed and recorded to 0.025 meters.

**3.3.4** The slope change is to be used to show the actual distance along the pipeline of any point from the start of the line. The Executor shall make the measurement over pipeline entire length by a continuous change commencing with chain at the start of the line and continuing to the end of same.

On completion of the survey, or before any drafting commences, the Executor shall produce all field books and computations for examination by the Engineer. The Executor may be required to clarify such field notes or computations as required by, and to the satisfaction of the Engineer. If the survey drawings and survey report are not acceptable in part or whole, the final certificate will only be issued after the Executor has carried out such additional survey work or prepared revised drawings or survey report that are acceptable to the Engineer.

**PART 18****ABOVE-GROUND PIPELINES**

Requirements specified for buried lines in preceding parts of this Standard shall be observed in construction of above-ground pipelines where applicable.

Considerations which apply specifically to above-ground pipelines include the following which shall be taken into account during construction.

- 1.** The pipe shall be laid to follow the ground contours of the cleared right-of-way surface on sleepers and supports.
- 2.** In grading operation, the gradients shall be uniform between changes in vertical direction.
- 3.** Crash barriers shall be provided to protect the pipeline from traffic accidents, if found necessary, using suitable barriers to prevent the pipeline from becoming an unauthorized footpath.