

ECI Pricing System for Piping Works Volume 2



ECI Pricing System for Piping Works

ECI Benelux

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Foreword to first edition 2002

Why should you use this ECI Piping Pricing System when you already have your own system in place?

A perfectly sensible question. However, the Piping Workgroup feels that there are a number of good reasons for implementing this ECI Piping Pricing System, since existing systems do not offer you all of the following:

- separation of direct and indirect costs
- the possibility to separate fully piping prefabrication cost from erection cost (ie to cater for separate contracts)
- measurement corresponding to basic physical operations and related to man-hour content per operation
- fair representation of effects from quantity variations and from complexity variations (recognises piping complexity, ie weld / length ratio)
- the possibility of linking Material Take-off (MTO) and isometrics Bill of Material (BoM) data for electronic pricing
- allow basic price agreement at a very early stage, eg for pre-selection of potential partners
- allow logical links with estimating data collection systems, progress measurement data collection systems and historical data collection systems
- provide for transparent change administration

The ECI Piping Pricing System offers all of the above features. This document explains how it works.

The system includes a spreadsheet with multipliers on a CD-ROM. It is not a ready-made software package, but it is simple enough to integrate the system into any company's existing software.

This Piping Pricing System has been jointly developed by a group of professional and committed engineering and construction contractors. Such a broad basis is a guarantee of wide acceptance by others in the business.

The ECI are grateful to the Subcontracts Task Force and the Piping Pricing System Workgroup for their efforts in developing this ECI Piping Pricing System.

This document is dedicated to the memory of Michel Buidin and François Dalla Vecchia. They will be remembered for their expert contribution and good fellowship.

Cees Zwinkels and Gerard Bakker
Chairmen, ECI Benelux Subcontracts Task Force

Summary of revision 2005

Since the initial publication in 2002, a number of owners, EPC contractors and construction contractors in our industry have applied the ECI Pricing System for Piping Works successfully on different types of project at various locations. Their contribution in providing comments and suggested improvements is highly appreciated and enabled the ECI Benelux Subcontracting Task Force to prepare this 'Revision 2005' of the system.

In addition, a number of modifications were required to better support further automation of the execution work processes that interface with the system.

Summarised in essentials, the following modifications represent the majority of 'Revision 2005':

- No more differentiation between 'large bore' and 'small bore' with their separate reference diameters and Base Unit Rates but a unique reference to a 6 inch diameter and a unique Base Unit Rate per operation. This approach corresponds to the evolution of design activities resulting in 3D modelled isometrics including small bore piping and enabling prefabrication of pipe spools with diameters not only larger than 2 in. As a consequence, the diameter multiplier tables now cover the range from 1/2 in to 48 in for both prefabrication and erection activities.
- Further differentiation of the various pipe wall thicknesses. Rather than through pipe schedule groups, now formulae give a more accurate wall thickness multiplier. This also allows the use of the system for all piping specifications.
- Multipliers for different large flange ratings are now available for all piping specifications.
- Local post weld heat treatments are now separated from furnace post weld heat treatment.
- Cold pipe bending is now separated from hot pipe bending.
- Addition of pricing table for positive material identification (PMI).
- Addition of pricing table for screwed joints in prefabrication.
- Multiplier for 'tapering' is now calculated from the thickness reduction in mm, which is more appropriate and consistent than the former system based on pipe schedules.
- The operation 'weld' for modification does not automatically include 'cuts' and 'bevels'.
- The two separate operations 'flanged joint' and 'hydraulic bolt tensioning' are now combined in one operation, 'flanged joint including hydraulic bolt tensioning'.
- The CD now includes the full and complete calculations with the appropriate multipliers.

For questions and comments please contact the ECI via email: eci@lboro.ac.uk

1. Introduction

1.1 General

Developments in the petrochemical and chemical business over recent years have increased the demand for innovation, efficiency and flexibility from owners, engineering contractors and subcontractors (or construction contractors) alike.

The Benelux Regional Unit of ECI formed a Subcontracting Task Force investigating options to improve subcontract processes.

The members of this Task Force consist of people with practical day-to-day experience with (sub) contract and construction matters. Combining the knowledge, expertise and experience available within the members of the Unit has provided the platform for development of improvements for the benefit of all.

One of the Task Force's objectives is to develop a new standardised / uniform pricing system for Piping Subcontracts, which will be widely accepted in the construction industry. The numerous, very different types of system in use to date are creating significant problems for contractors in properly assessing and pricing work. This often leads to an unrealistic level of contingencies in proposals. Misunderstandings, unclear items and / or quantity variations cause disputes and claim situations after award. The new system aims to eliminate to a large extent the drawbacks experienced in current systems.

For ease of reference, we will use the term 'employer' for engineering contractor (or owner as the case may be) and 'contractor' for subcontractor or construction contractor.

Subcontracting Task Force

Taskforce objectives ...

“Improve the subcontracting process on industrial projects”

- reduce bidding time
- better identify and manage risk
- avoid claims by fair cost assessments of
 - scope of work
 - variations

The primary goals for the new system are:

- a) establish a less complex, market friendly system, representing actual costs per operation**

the cost of a single physical operation can be better defined than the combined cost of a number of diverse operations.

- b) take risk away from those parties that can't control such risks**

reduce the number of assumptions a contractor has to make in his bid by separating prices for prefabrication and erection work, recognition of complexity, and providing a transparent system which will absorb quantity variations without requiring re-negotiations.

- c) establish a method for electronic pricing of piping work**

- d) ensure transparency in measurement of progress and productivity**

1.2 Phases of development

A specification or 'shopping list' was established, listing requirements that the ECI pricing system would have to meet. The following parameters were considered as being vital:

- recognise piping complexity (weld-length ratio)
- related to man-hour content per operation and in total
- separate prefabrication from erection activities
- have a direct connection with engineering MTO data
- allow basic price agreement in very early stage (eg for selection of alliance partner)
- separate direct costs from indirects and differentiate between secondary operations (NDE, painting, etc)
- allow a logical link with progress measurement systems and planning / work preparation
- support estimating systems and provide logical collection of historical data
- allow practicable administration
- allow transparent change administration
- suitable for electronic data transfer
- suitable for global application

Various systems in use to-date were presented, commented on and evaluated. These systems were analysed in detail and tested against the above criteria.

It was observed that one recently developed system, the Raytheon 'New Pay Item System' came nearest to meeting most requirements and was suitable for further development into the envisaged ECI Piping Pricing System.

Team-members of the Piping Pricing System Workgroup involved in setting up the system were:

Gerard Bakker	Fluor (Workgroup chairman)
Michel Buidin	Fabricom
François Dalla Vecchia	Ponticelli Frères
Erwin Depaep	Fluor
Willem Graulus	Fabricom
Rob van Hoeve	Fabricom – GTI
Tony Kohlen	ABB Lummus Global
Teun Noordam	Stork ICM
Michel Sauvage	Ponticelli Frères
Dirk Somsen	Fluor
Jan Spronk	Fluor
Michel Stoelinga	Raytheon Engineers & Constructors
Cees Zwinkels	Kvaerner Process (former workgroup chairman)

Piping unit rate systems

Main system characteristics ...

- **transparent representation of operations**
 - clear description of units of work
 - separation of unrelated cost items
 - better representation of actual costs
- **reduce risks contractors can't control**
 - reducing assumptions during bidding
 - fair representation of effects from quantity variations and complexity
- **fixed multipliers reduce bidding time and final re-measurement time**

1.3 The ECI Piping Pricing System

The system is based on measurement corresponding to physical operations and defined interrelations between variables within an operation. Indirect costs are separated from direct costs.

Operations (units of work) recognised are:

- handling
- jointing
- bending
- transportation
- hydrotesting, non destructive examination (NDE), post-weld heat treatment (PWHT)
- tapering, cutting, bevelling
- painting
- supporting

In this system each **activity** or **operation** performed will be measured. It recognises separate measurement for prefabrication and erection. Interrelations between variables (size, rating, wall thickness, etc.) have been defined in tables. These interrelations are reflected in multiplier factors. For instance, a **reference pipe** has been defined: **6 inches (in), STD wall thickness, carbon steel**. The contractor will quote a **Base Unit Rate** for this 'reference' item and all other items are scaled from this Base Unit Rate by applying the relevant defined multipliers separately for each operation.

1.4 Example

The Unit Rate to perform a field butt-weld on stainless steel, diameter 4 in, wall thickness 3.05 mm (SCH. 10S), shall be calculated as follows (see table 2.2100):

Base Unit Rate Weld/each (Assumption)	Multiplier Material Type SS	Multiplier Pipe size 4 in	Multiplier Wall-thickness 3.05 mm (SCH.10S)	Multiplier: Weld type	Calculated Unit Rate
100.00	x 1.60	x 0.75	x 0.85	x 1.00	= 102.00

The apparent relation between the labour content and the cost of an operation enables expedient verification of estimated man-hour content as well as close monitoring of progress.

1.5 Application

The system as presented is intended for use on unit rate type piping contracts. In its preparation, the following activities have **not** been considered for inclusion:

- detailed engineering
- supply of piping materials
- activities such as coating and wrapping, tie-in work, jacketed pipe work and chemical cleaning
- work of other disciplines eg mechanical, scaffolding, steelwork, instrumentation and insulation

1.6 Sources used

For determination of interrelations and multiplier factors, a number of sources of information were consulted and figures compared and evaluated to establish a commonly agreed basis:


- Linde system
- Pay item system, Raytheon Engineers & Constructors
- Estimators Piping Manhour Handbook, Page & Nation, USA
- SNCT (Syndicat National de la Chaudronnerie et de la Tuyauterie) of France
- Ponticelli Frères data base
- Fabricom FEMS system

The System's "multipliers"

Basis of multipliers ...

- Statistics of participating ECI members
- Page & Nation (USA)
- SNCT (France)
- Linde (Germany)

and subject to...
and result of ...
extensive discussions!



2. Description of the system

2.1 General

2.1.1 Basis of the ECI Piping Pricing System

The heart of the New Pricing System is formed by the Multiplier Tables: one table for prefabrication activities and one for erection.

All relevant factors influencing operations in a (unit rate based) piping contract are shown in table format. For each operation, **fixed** multiplier factors are given, representing their relation to the 'reference operation'.

Only Base Unit Rates for the 'reference operations' are required; other unit rates are automatically scaled off by applying the relevant multipliers.

The multiplier factors have been established and verified as a true representation of the related complexity and shall **not** be altered. One of the main virtues of the system is that it may save considerable time in preparation of a bid due to the standardised and accepted nature. Modifications to, or discussions about, multipliers would jeopardise this.

It must be noted that some piping related activities do not appear in the multiplier tables, because they are specific and no multiplier factors apply (eg positive material identification). For each of these, relevant pricing tables can be prepared and applied.

Contractors shall take the characteristic nature of the work of the project into account on the basis of all relevant information provided in the bid package.

2.1.2 Units of work

In this system, the work scope is broken down into operations for which (unit) prices are agreed. These activities, which are all (re-)measurable operations, are referred to as *units of work*.

These units of work may also include items that will **not** be measured or separately paid for. Such items are referred to as 'non-measured items'.

The prices for the units of work are deemed to include the associated non-measured items.

2.1.3 Units of work numbering system

Each user may assign their own coding system for numbering the different units of work, suitable for intelligent coupling to the material take-off system employed, for estimating and progress control purposes.

2.1.4 Measurement

During the bid phase, the employer will provide a Form of Tender which includes the various applicable pricing tables. Units of work quantities in these pricing tables are usually provided from estimated material take-offs. During the execution phase, actual units of work quantities are best calculated and measured on the basis of released for construction drawings. The method of measurement (referred to as measurement) indicates how the unit of work quantities may be measured.

For progress measurement, a contractor shall usually submit its determination of units of work performed in accordance with the provisions of the contract.

2.1.5 Description of work breakdown structure

The following breakdown structure has been used for reference:

2.1.5.1 Prefabrication

- a) *Transportation of piping materials* - agree suitable means of compensation.
(see sample set-up)

- b) *Shop prefabrication and painting activities*, as included in units of work:
 - handling
 - joints
 - bending
 - testing and heat treatment
 - supports
 - painting
 - modification work

- c) *Labour and equipment rates*

2.1.5.2 Erection

'Indirect costs' shall be clearly separated from 'direct costs'.

'Indirect costs' cover those items of expense which do not vary proportionally with the quantities of work.

'Direct costs' cover those items of expense which vary with the quantities of work.

- a) *Indirect costs* - compensation for the following items of expense shall be excluded from the Unit Rates and shall be priced separately as 'indirect costs'.
- *Site and / or camp facilities*: mobilisation, demobilisation, operation and maintenance costs including man-hours spent in relation to these items and all running costs such as electricity, phone, fax, stationary, computers etc.
 - *Site staff, management and supervision*: management, supervision above level of working foreman, administration, drawing and design, planning, preparation and follow-up of work including Quality Assurance / Quality Control (QA / QC), Safety, etc. and relative costs for mobilisation / demobilisation according to a list of functions and expected agreed assignment periods.
 - *Major construction equipment*: limited to cranes, rigging equipment, on-site transportation equipment for personnel and material, power generators, air compressors including their operators if applicable and all relative costs for mobilisation / demobilisation, consumables, maintenance, etc, according to a list of items and agreed expected assignment periods.
 - *General services*: cost of personnel assigned to tools and equipment warehousing and maintenance except for those relative to the above major construction equipment.
 - *Overheads and profits*: limited to the part in relation to items of expense that form part of the 'indirect costs'.

Prices and / or rates covering 'indirect costs' remain only valid insofar as 'quantities', 'schedule' and the like do not change beyond a mutually agreed percentage or period.

- b) '*Direct costs*' to cover *pipng erection and painting activities* - items of expense which are not covered in the 'indirect costs' shall be covered by the unit rates to be established for:
- handling
 - joints
 - bending
 - testing and heat treatment
 - supports
 - painting
 - modification work

- c) *Labour and equipment rates*

2.1.6 Guidelines / recommendations

- Detailed scope description: split of work between employer and contractor may vary from project to project - this should have no effect on application of the system.
- Project-specific extensions to the system are possible: eg for piping material types not covered, a multiplier may be added as the need arises - however, any extensions shall be clearly identified as such.
- Wall thickness multipliers are calculated by means of a formula which covers all wall thicknesses up to 50 mm.

2.1.7 Exceptions

- multiplier tables do not cover wall thicknesses > 50 mm
- multiplier tables do not cover pipe > 48" (DN1200)
- multiplier tables do not cover flange ratings > 2500lbs
- multiplier tables do not cover hot bending of pipe
- multiplier tables do not cover the cold bending of pipe over and above 6 inches
- although steam tracing is not covered by the system, supply and return lines can be regarded as piping
- demolition and tie-in work are not covered in this system
- furnace PWHT

It is recommended that handling of these excepted items is agreed as required.

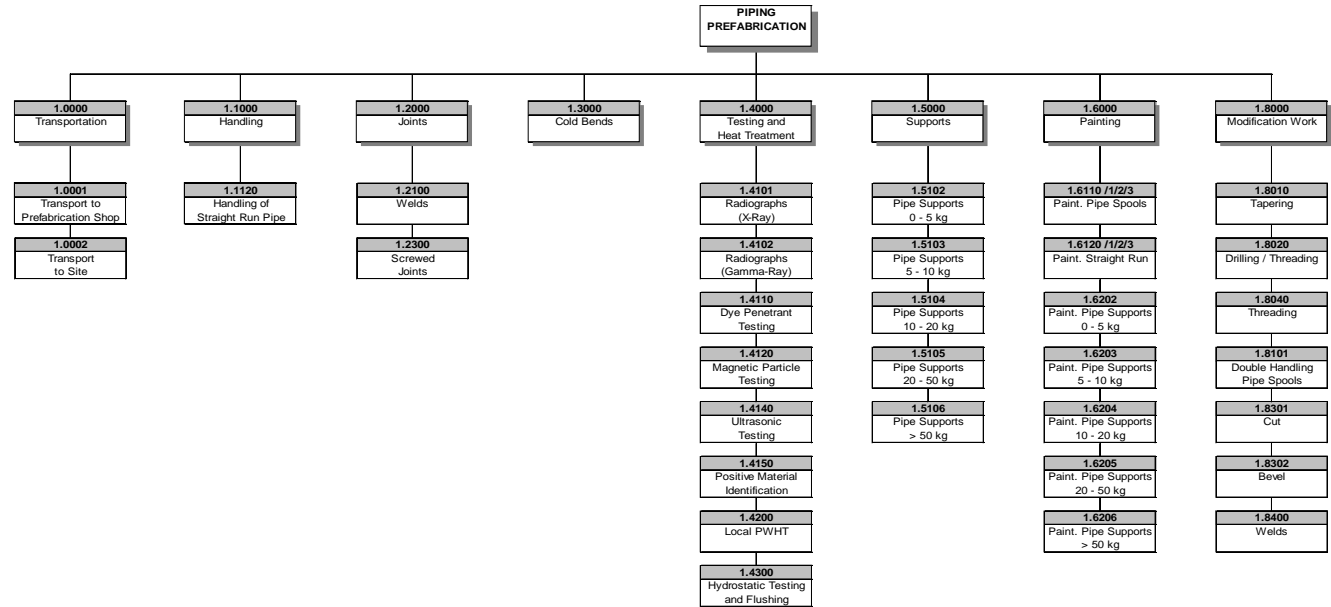
2.1.8 Configuration of the system

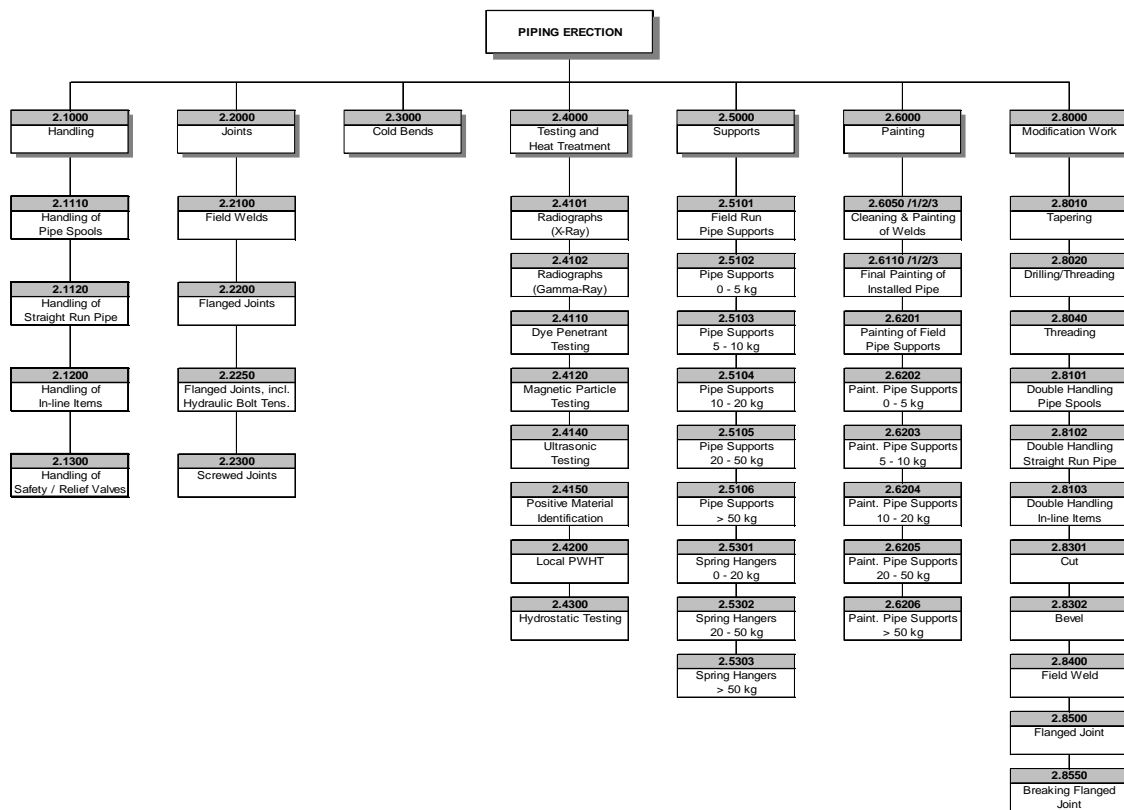
Besides a spreadsheet which calculates the interrelations between the multiplier table and the relevant pricing table, this handbook does **not** provide a ready-made software package to load and implement into the system of any organisation. There are simply too many different hardware and software options in use on the market to restrict this system to any particular configuration. It is however simple enough for each user to start from what is available and standardise within his or her own organisation and develop the software requirements for the system to suit his particular situation. The system can be set up to run on any commercially available database, spreadsheet or similar type of application.

A parts-library will have to be set up to link MTO (materials take off) data, generated by computer plant design tools such as PDS, PDMS or similar, with the pricing tables and related multipliers therein. As soon as isometrics are produced, the isometric material lists can be linked to the relevant pricing data to generate cost per isometric.

2.2 Pricing structure diagrams

The pricing structures for the piping work is split into **prefabrication** and **erection**, thus providing the possibility to have two separate contracts.





2.3 Multiplier reference points

Unit rates are calculated from Base Unit Rates which are multiplied with the applicable factors for material type, diameter, wall thickness, flange rating and special items / weld type as set in multiplier tables MT-1 and MT-2.

The multipliers are fixed and firm, and shall not be changed for changes in scope, quantity, complexity or for any other reason.

The reference points (base multiplier = 1.0) for the Base Unit Rates are as follows:

Material type	carbon steel
Pipe / fitting size	diameter 6 in. (or DN150)
Wall thickness	standard
Flange rating	150 lbs.

2.4 Description for piping prefabrication multipliers

(multiplier table MT-1)

2.4.1 Multipliers for material type

The Base Unit Rates for handling, welds, screwed joint, cold bend, post weld heat treatment (PWHT), tapering, cuts and bevels are based on:

carbon steel

(for which the multiplier is set as 1.0)

The multipliers for all other material types as listed in multiplier table MT-1, shall be applied to above-mentioned Base Unit Rates to cover variations to the extent of the work involved with the applicable material types.

2.4.2 Multipliers for pipe / fitting size

The Base Unit Rates for handling, welds, screwed joint, cold bends, NDE, PWHT hydrotesting, tapering, cuts and bevels, and for painting, are based on:

diameter 6 in (or DN150)

(for which the multiplier is set as 1.0)

The multipliers for pipe / fitting size for all other outside diameters, as listed in multiplier table MT-1, shall be applied to the above mentioned Base Unit Rates to cover variations to the extent of the work involved with the applicable outside diameters.

2.4.3 Multipliers for pipe wall thickness

The Base Unit Rates for handling, welds, screwed joint, cold bends, NDE (X+Gamma Ray+US), PWHT, cuts and bevels are based on:

standard wall thickness (STD)

(for which the multiplier is set as 1.0)

The multipliers for pipe wall thickness for all other wall thicknesses as calculated with the formulae shown in multiplier table MT-1, shall be applied to above-mentioned Base Unit Rates to cover variations to the extent of the work involved with the applicable wall thicknesses.

2.4.4 Multipliers for flange rating

The Base Unit Rate for hydrotesting is based on:

flange rating ANSI 150 lbs

(for which the multiplier is set as 1.0)

The multiplier for flange rating for all other flange ratings, as listed in multiplier table MT-1, shall be applied to the above-mentioned Base Unit Rate to cover variations to the extent of the work involved with the applicable flange ratings.

2.4.5 Multipliers for weld types

The Base Unit Rates for welds are based on:

butt weld

(for which the multiplier is set as 1.0)

The multipliers for all other weld types, as listed in multiplier table MT-1, shall be applied to the above mentioned Base Unit Rate to cover variations to the extent of the work involved with the applicable weld types. Note that for welds on slip-on flanges, multiplier **1.0** shall also be used.

2.4.5.1 Multiplier for welded valves

The multiplier for welded valves applies to the Base Unit Rate for each weld and covers the extra work involved in the dismantling, handling and mounting of valve internals.

2.4.5.2 Multiplier for socket welds

The multiplier for welding socket welds applies to the Base Unit Rate for welds and covers the reduced work involved with welding a socket weld versus a butt weld. This multiplier also applies to the Base Unit Rates for cuts and bevels (modification work).

2.4.5.3 Multiplier for seal welds

The multiplier for welding seal welds applies to the Base Unit Rate for welds and covers the reduced work involved with welding a seal weld against a butt weld. This multiplier also applies to the Base Unit Rates for cuts and bevels (modification work).

2.4.5.4 Multiplier for mitre welds / dummy legs

The multiplier for welding angle welds and / or dummy legs applies to the Base Unit Rate for welds and covers the extra work involved with welding a mitre weld for a mitre-bend, or for welding a dummy leg to a pipe or elbow. This multiplier also applies to the Base Unit Rates for cuts and bevels (modification work).

2.4.5.5 Multiplier for branch welds (90°)

The multiplier for branch welds (including nipples, half-couplings and bosses) applies to the Base Unit Rate for welds of the branch size and covers the extra work involved with drilling / cutting a hole in, and welding a branch to, the main pipe under a straight angle of 90°. This multiplier also applies to the Base Unit Rates for cuts and bevels (modification work).

2.4.5.6 Multiplier for branch welds (angle not 90°)

The multiplier for branch welds applies to the Base Unit Rate for welds of the branch size and covers the extra work involved with drilling / cutting a hole in, and welding a branch to, the main pipe under an angle that is not 90°. This multiplier also applies to the Base Unit Rates for cuts and bevels (modification work).

2.4.5.7 Multiplier for reinforced branch welds (90°)

The multiplier for reinforced branch welds applies to the Base Unit Rate for welds of the branch size. It covers the extra work involved with drilling / cutting a hole in, and welding of a branch to, the main pipe under a straight angle of 90°, as well as fabrication from pipe material, and handling and welding a branch reinforcement pad. This multiplier also applies to the Base Unit Rates for cuts and bevels (modification work).

2.4.5.8 Multiplier for reinforced branch welds (angle not 90°)

The multiplier for reinforced branch welds applies to the Base Unit Rate for welds of the branch size. It covers the extra work involved with drilling / cutting a hole in, and welding a branch to, the main pipe under an angle which is not 90°, as well as fabrication from pipe material, and handling and welding a branch reinforcement pad. This multiplier also applies to the Base Unit Rates for cuts and bevels (modification work).

2.4.5.9 Multiplier for welding outlets (90°)

The multiplier for welding outlets (weldolets, flangolets, sockolets, nippolets, threadolets) applies to the Base Unit Rate for welds of the outlet size. It covers the extra work involved with drilling / cutting a hole in, and welding an outlet to, the main pipe under a straight angle that is 90°. This multiplier also applies to the Base Unit Rates for cuts and bevels (modification work).

2.4.5.10 Multiplier for welding outlets (angle not 90°)

The multiplier for welding outlets (latrolets, elbolets) applies to the Base Unit Rate for welds of the outlet size. It covers the extra work involved with drilling / cutting a hole in, and welding an outlet to, the main pipe under an angle that is not 90°. This multiplier also applies to the Base Unit Rates for cuts and bevels (modification work).

2.4.6 Multiplier for tapering steps

The Base Unit Rate for tapering is based on:

reduction of wall thickness between 1.6 mm and 3.6 mm

(for which the multiplier is set as 1.0)

The multiplier for tapering applies to the Base Unit Rate for tapering when the reduction of wall thickness is >3.6 mm.

2.4.7 Prefabrication multiplier table MT-1

ECI Multiplier Table MT-1:

PIPING PREFABRICATION UNIT RATE MULTIPLIER TABLE

		HANDLING R.L.+MODS	WELD JOINT	SCREWED JOINT	COLD BEND	NDE, X + GAMMA RAY	NDE, DP/MP/US	LOCAL PWHT	HYDRO TEST	PAINTING	TAPERING THREADING	CUT / BEVEL	
MATERIAL TYPE	CS	1.00	1.00	1.00	1.00	-	-	1.00	-	-	-	1.00	
	KCS	1.00	1.00	1.00	1.00	-	-	1.00	-	-	-	1.00	
	SS	1.10	1.40	1.20	1.30	-	-	-	-	-	-	1.20	
	AS	1.00	1.40	1.20	1.30	-	-	1.20	-	-	-	1.20	
PIPE/FITTING SIZE	0.5"	DN15	0.32	0.33	0.33	0.33	0.80	0.80	1.00	0.32	0.30	0.33	
	0.75"	DN20	0.34	0.34	0.34	0.34	0.80	0.80	1.00	0.34	0.30	0.34	
	1"	DN25	0.37	0.35	0.35	0.35	0.80	0.80	1.00	0.37	0.30	0.35	
	1.5"	DN40	0.44	0.39	0.39	0.39	0.80	0.80	1.00	0.44	0.30	0.39	
	2"	DN50	0.57	0.46	0.46	0.46	0.80	0.80	1.00	0.57	0.40	0.46	
	3"	DN80	0.70	0.59	0.59	0.59	0.85	0.85	1.00	0.70	0.55	0.59	
	4"	DN100	0.85	0.75	0.75	0.75	0.90	0.90	1.00	0.85	0.70	0.75	
	6"	DN150	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
	8"	DN200	1.10	1.40	-	-	1.10	1.20	1.00	1.10	1.30	1.40	
	10"	DN250	1.30	1.80	-	-	1.20	1.40	1.00	1.30	1.60	1.80	
	12"	DN300	1.50	2.10	-	-	1.30	1.60	2.00	1.50	1.90	2.10	
	14"	DN350	1.75	2.30	-	-	1.40	1.80	2.00	1.75	2.10	2.30	
	16"	DN400	2.00	2.60	-	-	1.50	2.00	2.00	2.00	2.40	2.60	
	18"	DN450	2.25	3.00	-	-	1.60	2.20	2.00	2.25	2.70	3.00	
	20"	DN500	2.50	3.30	-	-	1.70	2.40	2.00	2.50	3.00	3.30	
	22"	DN550	2.75	3.60	-	-	1.80	2.60	3.00	2.75	3.15	3.60	
	24"	DN600	3.00	3.90	-	-	1.90	2.80	3.00	3.00	3.30	3.90	
	26"	DN650	3.20	4.20	-	-	2.00	3.00	3.00	3.20	3.60	4.20	
	28"	DN700	3.40	4.60	-	-	2.10	3.20	3.00	3.40	4.20	4.60	
	30"	DN750	3.60	4.90	-	-	2.20	3.50	3.00	3.60	4.50	4.90	
	32"	DN800	3.80	5.30	-	-	2.30	3.70	3.00	3.80	4.80	5.30	
	34"	DN850	4.00	5.70	-	-	2.40	3.90	3.00	4.00	5.10	5.70	
	36"	DN900	4.20	6.10	-	-	2.50	4.10	3.00	4.20	5.40	6.10	
	38"	DN950	4.40	6.50	-	-	2.60	4.30	4.50	4.40	5.70	6.50	
	40"	DN1000	4.60	6.90	-	-	2.70	4.50	4.50	4.60	6.00	6.90	
	42"	DN1050	4.80	7.30	-	-	2.80	4.70	4.50	4.80	6.30	7.30	
	44"	DN1100	5.00	7.70	-	-	2.90	4.90	4.50	5.00	6.60	7.70	
	46"	DN1150	5.20	8.10	-	-	3.00	5.10	4.50	5.20	6.90	8.10	
	48"	DN1200	5.40	8.60	-	-	3.10	5.30	4.50	5.40	7.20	8.60	
	FLANGE RATING	ANSI	ISO PN and DN	-	-	-	-	-	-	-	-	-	-
		150 lbs.	up to PN 20	-	-	-	-	-	-	1.00	-	-	-
		300 lbs.	> PN 20 to PN 50	-	-	-	-	-	-	1.00	-	-	-
600 lbs.		> PN 50 to PN 100	-	-	-	-	-	-	1.30	-	-	-	
900 lbs.		> PN 100 to PN 160	-	-	-	-	-	-	1.50	-	-	-	
1500-2500 lbs.	> PN 160 to PN 420	-	-	-	-	-	-	2.00	-	-	-		
WELD TYPE	BUTT WELD / SLIP-ON	-	1.00	-	-	-	-	-	-	-	-	1.00	
	WELDED VALVE	-	1.50	-	-	-	-	-	-	-	-	-	
	SOCKET WELD	-	0.60	-	-	-	-	-	-	-	-	0.60	
	SEAL WELD	-	0.40	-	-	-	-	-	-	-	-	0.40	
	MITRE WELD / DUMMY LEG	-	1.40	-	-	-	-	-	-	-	-	1.40	
	BRANCH WELD (90°)	-	2.50	-	-	-	-	-	-	-	-	2.50	
	BRANCH WELD (angle non 90°)	-	3.80	-	-	-	-	-	-	-	-	3.80	
	REINF. BRANCH WELD (90°)	-	3.30	-	-	-	-	-	-	-	-	3.30	
	REINF. BRANCH WELD (non 90°)	-	4.90	-	-	-	-	-	-	-	-	4.90	
	WELDING OUTLET (90°)	-	4.00	-	-	-	-	-	-	-	-	4.00	
	WELDING OUTLET (non 90°)	-	6.00	-	-	-	-	-	-	-	-	6.00	
	WALL THICKNESS	OPERATION	Wall thickness MULTIPLIER to be calculated by means of the following formulae in which: wt1 is the considered wall thickness wt2 is the Std wall thickness for the considered diameter										
HANDLING SCREWED JOINT COLD BEND / CUT / BEVEL		$M = 0.6 + 0.4 wt_1 / wt_2$											
WELD JOINT NDE (X + GAMMA RAY + US) LOCAL PWHT		Wall thickness THINNER than Standard wall thickness $M = 0.7 + 0.3 wt_1 / wt_2$					Wall thickness THICKER than Standard wall thickness $M = 0.3 + 0.7 wt_1 / wt_2$						
HYDRO TEST / NDE (DP+MP) / PAINTING THREADING		No Wall Thickness MULTIPLIER											
		TAPERING											
		TAPERING STEP	MULTIPLIER										
		0 to 1.6 mm	0.00										
		> 1.6 to 3.6 mm	1.00										
		> 3.6 to 5.6 mm	1.50										
		> 5.6 to 7.6 mm	2.00										
		> 7.6 to 9.6 mm	2.50										
		> 9.6 to 11.6 mm	3.00										
		> 11.6 to 13.6 mm	3.50										
		> 13.6 mm	special pricing										

2.5 Transportation of piping materials

The descriptions given below provide a sample of how the unit rates for transportation of piping materials could be handled, depending on locations and subject to prior agreement.

The non-measured items include all equipment and consumables required to execute this work.

1.0001 TRANSPORTATION OF PIPING MATERIALS TO PREFABRICATION SHOP(S)	
Included	The loading at employer's site warehouse or other warehouse location, transportation to contractor's prefabrication shop(s) of 'free issue' prefabrication piping materials
Excluded	Loading onto truck (by employer)
Measurement	Number of truckloads (loaded to capacity). <i>Note: subject to specific project execution philosophy</i>
Unit	Each (ea)
Multipliers	None

1.0002 TRANSPORTATION OF PIPING MATERIALS TO SITE	
Included	The loading at contractor's prefabrication shop(s), transportation to site of piping materials
Excluded	
Measurement	Number of truckloads (loaded to capacity). <i>Note: subject to specific project execution philosophy</i>
Unit	Each (ea)
Multipliers	None

2.6 Description units of work / method of measurement prefabrication

The descriptions given below describe the units of work included in pricing table 1. Any supply of materials 'by contractor' are to be specified in the scope description. The 'non-measured' items include the following:

- consumable materials
- equipment and tools
- prefabrication facilities
- engineering and coordination / administration, required for prefabrication
- quality assurance / quality control

1.1000 HANDLING

1.1120 HANDLING OF STRAIGHT RUN PIPE

Included	<p>Offloading, warehousing, shop handling, cleaning and capping of straight run pipe</p> <p>Straight run pipe shall be pipe with no in-line fittings welded to it, such as elbows, tees, reducers, flanges, stubends, etc</p> <p>When only o'lets, any other branches, welded shoes / guides, cradles, reinforcement pads etc. are welded on pipe in prefabrication, it is still considered to be a straight run pipe</p> <p>Also when random length (RL) pipe is cut to length and / or bevelled in prefabrication, it is still considered being straight run pipe</p>
Excluded	Making of joints, such as welds
Measurement	Length of pipe from end to end
Unit	Linear metre (m ¹)
Multipliers	Material type, pipe size, wall thickness

1.2000 JOINTS

1.2100 WELDS

Included	<p>Cutting, necessary bevelling, pre-heating where required and welding of pipe and / or fittings</p> <p>Handling of pipe materials: Offloading, warehousing, shop handling, cleaning and capping of pipe spools including pipe, fittings and other welded in-line items which form part of pipe spools</p>
Excluded	Non-destructive examination, hydrostatic testing, post weld heat treatment
Measurement	Number of welds
Unit	Each (ea)
Multipliers	Material type, pipe / fitting size, wall thickness, weld type

1.2300 SCREWED JOINTS	
Included	The cutting and threading of pipe and the making of a screwed joint Handling of pipe materials: Offloading, warehousing, shop handling, cleaning and capping of pipe spools including pipe, fittings and all in-line items which form part of pipe spools
Excluded	Hydrostatic testing
Measurement	Number of screwed joints
Unit	Each (ea)
Multipliers	Material type, pipe size, wall thickness

1.3000 COLD BENDS	
Included	The cold bending of pipe
Excluded	Handling of pipe
Measurement	Number of bends
Unit	Each (ea)
Multipliers	Material type, pipe size, wall thickness

1.4000 TESTING AND HEAT TREATMENT

1.4101/2 RADIOGRAPHS (X-RAY / GAMMA-RAY)	
Included	All work involved with the taking and developing of radiographs, the evaluation, administration and reporting. Included is additional handling of pipe spools to / from the radiographic bunker
Excluded	
Measurement	Number of welds for which radiographs have been approved
Unit	Each (ea)
Multipliers	Pipe size, wall thickness

1.4110 DYE PENETRANT TESTING (DP)	
Included	All work involved with the making of a dye penetrant test, the evaluation, administration and reporting Included is additional handling of pipe spools
Excluded	
Measurement	Number of welds for which a dye penetrant test have been approved
Unit	Each (ea)
Multipliers	Pipe size

1.4120 MAGNETIC PARTICLE TESTING (MP)	
Included	The taking of magnetic particle tests (if required), the evaluation, administration and reporting Included is additional handling of pipe spools
Excluded	
Measurement	Number of welds for which a magnetic particle test have been approved
Unit	Each (ea)
Multipliers	Pipe size

1.4140 ULTRASONIC TESTING (US)	
Included	The taking of ultrasonic tests (if required), the evaluation, administration and reporting Included is additional handling of pipe spools
Excluded	
Measurement	Number of welds for which an ultrasonic test has been approved
Unit	Each (ea)
Multipliers	Pipe size, wall thickness

1.4150 POSITIVE MATERIAL IDENTIFICATION (PMI)	
Included	Renting of PMI equipment. Taking of alloy verifications, the evaluation and reporting
Excluded	
Measurement	Number of tests
Unit	Each (ea)
Multipliers	None

1.4200 LOCAL POST WELD HEAT TREATMENT (PWHT)	
Included	All work involved with the electrical local post weld heat treatment of one weld. Included is additional handling of pipe spools, hardness testing and related documentation
Excluded	
Measurement	Number of treated welds
Unit	Each (ea)
Multipliers	Material type, pipe size, wall thickness

1.4300 HYDROSTATIC TESTING AND FLUSHING	
Included	<p>All supply of temporary materials and all work involved with the pre-flushing, hydrostatic testing and flushing of a piping system</p> <p>Included are the following activities:</p> <ul style="list-style-type: none"> • opening and closing of valves • handling and welding / bolt-up of test blinds • drain and dry by means of oil-free air of ambient temperature after testing • cutting off of welded test blinds and beveling of pipe ends
Excluded	
Measurement	Length of tested lines, centerline to centerline (through all fittings)
Unit	Linear metre (m')
Multipliers	Pipe size, flange rating

1.5000 SUPPORTS	
1.5102/3/4/5/6 SUPPLY AND FABRICATION OF PIPE SUPPORTS	
Included	<p>The material supply and fabrication of carbon steel pipe supports, guides, hangers, dummy leg base plates and cradles. Included are all shim-plates required for pipe support base-plates and all bolting materials</p> <p>Included are all attachment welds to pipe, eg the welding of shoes to pipe where required</p>
Excluded	<p>Dummy leg piping materials and reinforcement plates for cradles, for which handling and welds are measured as part of pipe spools</p> <p>Field run supports shall be priced and quantified as part of the erection pricing table</p>
Measurement	Weight of supports per weight range, net as fabricated, excluding weight of bolts, nuts, washers and shim-plates
Unit	Kilogram (kg)
Multipliers	None

1.6000 PAINTING	
Note:	For materials, number of coats and MDFT (minimum dry film thickness), reference is made to the applicable specification. Included is taping and marking A Base Unit Rate shall be given for each paint system

1.6110/1/2/3 PAINTING OF PIPE SPOOLS (INCLUDING FITTINGS)	
Included	Shop treatment (blasting / painting) of prefabricated pipe spools and the transportation between the prefabrication shop(s) and the paint shop
Excluded	
Measurement	Length of Pipe plus equivalent length of all fittings, flanges, valves <i>(Note: method of determining equivalent length to be specified by employer)</i>
Unit	Equivalent linear metre (m')
Multipliers	Pipe / fitting size

1.6120/1/2/3 PAINTING OF STRAIGHT RUN PIPE	
Included	Shop treatment (blasting / painting) of straight run pipe and the transportation between the prefabrication shop(s) and the paint shop
Excluded	
Measurement	Length of pipe from end to end
Unit	Linear metre (m')
Multipliers	Pipe size

1.6202/3/4/5/6 PAINTING OF PIPE SUPPORTS	
Included	Shop treatment of pipe supports and the transportation between the prefabrication shop(s) and the paint shop
Excluded	
Measurement	Weight of supports per weight range, net as fabricated, excluding weight of bolts, nuts, washers and shim-plates
Unit	Kilogram (kg)
Multipliers	None

1.8000 MODIFICATION WORK

1.8010 TAPERING

Included	The tapering (ie by means of inside machining 1:4) of any type of pipe or fitting from existing wall thickness (as per drawing and / or actual supply) to more than 1.6 mm and after that in steps of 2 mm up, including the handling and transportation of pipe, flanges or fittings
Excluded	
Measurement	Number of tapered ends
Unit	Each (ea) step
Multipliers	Material type, pipe / fitting / flange size, tapering step

1.8020 DRILLING / THREADING

Included	The drilling of a hole and threading in blinds, etc. Included is the handling of the blind
Excluded	
Measurement	Number of threaded holes
Unit	Each (ea)
Multipliers	None

1.8040 THREADING

Included	The cutting of pipe and the threading of the pipe end
Excluded	
Measurement	Number of threaded ends per pipe size
Unit	Each (ea)
Multipliers	Material type, pipe size

1.8101 DOUBLE HANDLING OF PIPE SPOOLS (FOR MODIFICATION WORK)

Included	The handling of an already fabricated pipe spool necessary for modifications thereof due to drawing revisions
Excluded	Making of joints, such as welds
Measurement	Length of pipe spools from centreline to centreline through all fittings
Unit	Linear metre (m')
Multipliers	Material type, pipe / fitting size, wall thickness

1.8301 CUT (FOR MODIFICATION WORK)	
Included	The cutting of already fabricated pipe spools necessary for modifications thereof due to drawing revisions
Excluded	
Measurement	Number of cuts for modifications to already fabricated pipe spools
Unit	Each (ea)
Multipliers	Material type, pipe size, wall thickness, weld type

1.8302 BEVEL (FOR MODIFICATION WORK)	
Included	The beveling after cutting of already fabricated pipe spools necessary for modifications thereof due to drawing revisions
Excluded	
Measurement	Number of bevelled ends for modifications to already fabricated pipe spools
Unit	Each (ea)
Multipliers	Material type, pipe size, wall thickness, weld type

1.8400 WELDS (FOR MODIFICATION WORK)	
Included	The welding after beveling of already fabricated pipespools necessary for modifications thereof due to drawing revisions
Excluded	Non-destructive testing, hydrostatic testing or heat treatment
Measurement	Number of welds
Unit	Each (ea)
Multipliers	Material type, pipe / fitting size, wall thickness, weld type

2.7 Description for piping erection multipliers

(Multiplier table MT-2)

2.7.1 Multipliers for material type

The Base Unit Rates for handling, welds, screwed joints, cold bends, post weld heat treatment (PWHT), tapering, cuts and bevels are based on:

carbon steel

(for which the multiplier is set as 1.0)

The multipliers for all other material types as listed in multiplier table MT-2, shall be applied to the above-mentioned Base Unit Rates to cover variations to the extent of the work involved with the applicable material types.

2.7.2 Multipliers for pipe / fitting size

The Base Unit Rates for handling, welds, flanged joints, screwed joints, cold bends, NDE, PWHT, hydrotesting, tapering, cuts and bevels, and for painting, are based on:

diameter 6 in (or DN150)

(for which the multiplier is set as 1.0)

The multipliers for pipe / fitting size for all other outside diameters, as listed in multiplier table MT-2, shall be applied to the above-mentioned Base Unit Rates, to cover variations to the extent of the work involved with the applicable outside diameters.

2.7.3 Multipliers for pipe wall thickness

The Base Unit Rates for handling, welds, cold bends, screwed joints, NDE (X+gamma ray+US), PWHT, cuts and bevels, are based on:

standard wall thickness (STD)

(for which the multiplier is set as 1.0)

The multipliers for pipe wall thickness for all other wall thicknesses as calculated with the formulae shown in multiplier table MT-2 shall be applied to the above-mentioned Base Unit Rates to cover variations to the extent of the work involved with the applicable wall thicknesses.

2.7.4 Multipliers for flange rating

The Base Unit Rate for handling of in-line items, flanged joints and hydrotesting is based on:

flange rating ANSI 150 lbs

(for which the multiplier is set as 1.0)

The multipliers for flange rating for all other flange ratings, as listed in multiplier table MT-2, shall be applied to the above-mentioned Base Unit Rate to cover variations to the extent of the work involved with the applicable flange ratings.

2.7.5. Multipliers for weld types or special items

The Base Unit Rates for welds are based on:

butt weld

(for which the multiplier is set as 1.0)

The multipliers for all other weld types, as listed in multiplier table MT-2, shall be applied to the above-mentioned Base Unit Rate to cover variations to the extent of the work involved with the applicable weld types.

Note that for welds on slip-on flanges, multiplier 1.0 shall be used.

2.7.5.1 Multiplier for handling of welded valves

The multiplier for handling welded valves applies to the Base Unit Rate for handling in-line items and covers the extra work involved with dismantling, handling and mounting of valve internals and / or special handling of spools containing welded-in valves.

2.7.5.2 Multiplier for socket welds

The multiplier for welding socket welds applies to the Base Unit Rate for welds and covers the reduced work involved with welding a socket weld against a butt weld. This multiplier also applies to the Base Unit Rates for cuts and bevels (modification work).

2.7.5.3 Multiplier for seal welds

The multiplier for welding seal welds applies to the Base Unit Rate for welds and covers the reduced work involved with welding a seal weld against a butt weld. This multiplier also applies to the Base Unit Rates for cuts and bevels (modification work).

2.7.5.4 Multiplier for mitre welds / dummy legs

The multiplier for welding mitre welds and / or dummy legs applies to the Base Unit Rate for welds and covers the extra work involved with welding a mitre weld for a mitre-bend, or for welding a dummy leg to a pipe or elbow. This multiplier also applies to the Base Unit Rates for cuts and bevels (modification work).

2.7.5.5 Multiplier for branch welds (90°)

The multiplier for branch welds (including nipples, half-couplings and bosses) applies to the Base Unit Rate for welds of the branch size and covers the extra work involved with drilling / cutting a hole in, and welding a branch to, the main pipe under a straight angle of 90°. This multiplier also applies to the Base Unit Rates for cuts and bevels (modification work).

2.7.5.6 Multiplier for branch welds (angle, not 90°)

The multiplier for branch welds applies to the Base Unit Rate for welds of the branch size and covers the extra work involved with drilling / cutting a hole in, and welding a branch to, the main pipe under an angle that is not 90°. This multiplier also applies to the Base Unit Rates for cuts and bevels (modification work).

2.7.5.7 Multiplier for reinforced branch welds (90°)

The multiplier for reinforced branch welds applies to the Base Unit Rate for welds of the branch size. It covers the extra work involved with drilling / cutting a hole in, and welding of a branch to, the main pipe under a straight angle of 90° as well as fabrication from pipe, handling and welding a branch reinforcement pad. This multiplier also applies to the Base Unit Rates for cuts and bevels (modification work).

2.7.5.8 Multiplier for reinforced branch welds (angle not 90°)

The multiplier for reinforced branch welds applies to the Base Unit Rate for welds of the branch size. It covers the extra work involved with drilling / cutting a hole in, and welding a branch to, the main pipe under an angle that is not 90°, as well as fabrication from pipe, handling and welding a branch reinforcement pad. This multiplier also applies to the Base Unit Rates for cuts and bevels (modification work).

2.7.5.9 Multiplier for welding outlets (90°)

The multiplier for welding outlets (weldolets, flangolets, sockolets, nippolets, threadolets) applies to the Base Unit Rate for welds of the outlet size. It covers the extra work involved with drilling / cutting a hole in, and welding an outlet to, the main pipe under a straight angle that is 90°. This multiplier also applies to the Base Unit Rates for cuts and bevels (modification work).

2.7.5.10 Multiplier for welding outlets (angle not 90°)

The multiplier for welding outlets (latrolets, elbolets) applies to the Base Unit Rate for welds of the outlet size. It covers the extra work involved with drilling / cutting a hole in, and welding an outlet to, the main pipe under an angle that is not 90°. This multiplier also applies to the Base Unit Rates for cuts and bevels (modification work).

2.7.5.11 Multiplier for control, safety valves

The multiplier for control / safety valves applies to the Base Unit Rate for handling flanged in-line items and covers the extra work involved with dismantling, checking, handling and mounting of valve internals.

2.7.6 Multiplier for tapering steps

The Base Unit Rate for tapering is based on:

Reduction of wall thickness between 1.6 mm and 3.6 mm

(for which the multiplier is set as 1.0)

The multiplier for tapering applies to the Base Unit Rate for tapering when the reduction of wall thickness is >3.6 mm.

2.7.7 Erection multiplier table MT-2

ECI Multiplier Table MT-2:

PIPING ERECTION UNIT RATE MULTIPLIER TABLE

		HANDLING	HANDLING INLINE ITEMS	WELD JOINT	FLANGED JOINT	SCREWED JOINT	COLD BEND	NDE, X + GAMMA RAY	NDE, DPM/PLUS	LOCAL PWHT	HYDRO TEST	PAINTING	TAPERING / THREADING	CUT / BEVEL			
MATERIAL TYPE	CS	CARBON STEEL	1.00	-	1.00	-	1.00	1.00	-	-	1.00	-	-	1.00	1.00		
	KCS	KILLED CARBON STEEL	1.00	-	1.00	-	1.00	1.00	-	1.00	-	-	-	1.00	1.00		
	SS	STAINLESS STEEL	1.10	-	1.60	-	1.20	1.30	-	-	-	-	-	1.20	1.20		
	AS	ALLOY STEEL	1.00	-	2.00	-	1.20	1.30	-	-	1.20	-	-	1.20	1.20		
PIPE / FITTING SIZE	0.5"	DN15	0.32	0.20	0.33	0.42	0.33	0.33	0.80	0.80	1.00	0.32	0.30	0.33	0.33		
	0.75"	DN20	0.34	0.20	0.34	0.46	0.34	0.34	0.80	0.80	1.00	0.34	0.30	0.34	0.34		
	1"	DN25	0.37	0.24	0.35	0.52	0.35	0.35	0.80	0.80	1.00	0.37	0.30	0.35	0.35		
	1.5"	DN40	0.44	0.34	0.39	0.57	0.39	0.39	0.80	0.80	1.00	0.44	0.30	0.39	0.39		
	2"	DN50	0.57	0.50	0.46	0.65	0.46	0.46	0.80	0.80	1.00	0.57	0.40	0.46	0.46		
	3"	DN80	0.70	0.63	0.59	0.70	0.59	0.59	0.85	0.85	1.00	0.70	0.55	0.59	0.59		
	4"	DN100	0.85	0.80	0.75	0.80	0.75	0.75	0.90	0.90	1.00	0.85	0.70	0.75	0.75		
	6"	DN150	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
	8"	DN200	1.10	1.25	1.40	1.25	-	-	1.15	1.15	1.00	1.10	1.30	1.40	1.40		
	10"	DN250	1.30	1.50	1.80	1.50	-	-	1.30	1.30	1.00	1.30	1.60	1.80	1.80		
	12"	DN300	1.50	1.75	2.10	1.75	-	-	1.45	1.45	2.00	1.50	1.90	2.10	2.10		
	14"	DN350	1.75	2.00	2.30	2.00	-	-	1.60	1.60	2.00	1.75	2.10	2.30	2.30		
	16"	DN400	2.00	2.25	2.60	2.25	-	-	1.75	1.75	2.00	2.00	2.40	2.60	2.60		
	18"	DN450	2.25	2.50	3.00	2.50	-	-	1.90	1.90	2.00	2.25	2.70	3.00	3.00		
	20"	DN500	2.50	2.75	3.30	2.75	-	-	2.05	2.05	2.00	2.50	3.00	3.30	3.30		
	22"	DN550	2.75	3.00	3.60	3.00	-	-	2.20	2.20	3.00	2.75	3.15	3.60	3.60		
	24"	DN600	3.00	3.25	3.90	3.25	-	-	2.35	2.35	3.00	3.00	3.30	3.90	3.90		
	26"	DN650	3.20	3.50	4.20	3.50	-	-	2.50	2.50	3.00	3.20	3.60	4.20	4.20		
	28"	DN700	3.40	3.75	4.60	3.75	-	-	2.65	2.65	3.00	3.40	4.20	4.60	4.60		
	30"	DN750	3.60	4.00	4.90	4.00	-	-	2.80	2.80	3.00	3.60	4.50	4.90	4.90		
	32"	DN800	3.80	4.30	5.30	4.25	-	-	2.95	2.95	3.00	3.80	4.80	5.30	5.30		
	34"	DN850	4.00	4.60	5.70	4.50	-	-	3.10	3.10	3.00	4.00	5.10	5.70	5.70		
	36"	DN900	4.20	5.00	6.10	4.75	-	-	3.25	3.25	3.00	4.20	5.40	6.10	6.10		
	38"	DN950	4.40	5.40	6.50	5.00	-	-	3.40	3.40	4.50	4.40	5.70	6.50	6.50		
	40"	DN1000	4.60	5.80	6.90	5.25	-	-	3.55	3.55	4.50	4.60	6.00	6.90	6.90		
	42"	DN1050	4.80	6.20	7.30	5.50	-	-	3.70	3.70	4.50	4.80	6.30	7.30	7.30		
	44"	DN1100	5.00	6.60	7.70	5.75	-	-	3.85	3.85	4.50	5.00	6.60	7.70	7.70		
	46"	DN1150	5.20	7.00	8.10	6.00	-	-	4.00	4.00	4.50	5.20	6.90	8.10	8.10		
	48"	DN1200	5.40	7.40	8.60	6.25	-	-	4.15	4.15	4.50	5.40	7.20	8.60	8.60		
	FLANGE RATING	ANSI	ISO PN and DIN	-	-	-	-	-	-	-	-	-	-	-	-	-	
		150 lbs.	up to PN 20	-	1.00	-	1.00	-	-	-	-	1.00	-	-	-	-	
		300 lbs.	> PN 20 to PN 50	-	1.15	-	1.15	-	-	-	-	1.00	-	-	-	-	
600 lbs.		> PN 50 to PN 100	-	1.30	-	1.30	-	-	-	-	1.30	-	-	-	-		
900 lbs.		> PN 100 to PN 160	-	1.50	-	1.50	-	-	-	-	1.50	-	-	-	-		
1500-2500 lbs.		> PN 160 to PN 420	-	2.00	-	2.00	-	-	-	-	2.00	-	-	-	-		
SPECIAL ITEMS WELD TYPE	BUTT WELD / SLIP-ON	-	-	1.00	-	-	-	-	-	-	-	-	-	-	1.00		
	WELDED VALVE	-	2.00	-	-	-	-	-	-	-	-	-	-	-	-		
	SOCKET WELD	-	-	0.60	-	-	-	-	-	-	-	-	-	-	0.60		
	SEAL WELD	-	-	0.40	-	-	-	-	-	-	-	-	-	-	0.40		
	MITRE WELD / DUMMY LEG	-	-	1.40	-	-	-	-	-	-	-	-	-	-	1.40		
	BRANCH WELD (90°)	-	-	2.50	-	-	-	-	-	-	-	-	-	-	2.50		
	BRANCH WELD (angle non 90°)	-	-	3.80	-	-	-	-	-	-	-	-	-	-	3.80		
	REINF. BRANCH WELD (90°)	-	-	3.30	-	-	-	-	-	-	-	-	-	-	3.30		
	REINF. BRANCH WELD (non 90°)	-	-	4.90	-	-	-	-	-	-	-	-	-	-	4.90		
	WELDING OUTLET (90°)	-	-	4.00	-	-	-	-	-	-	-	-	-	-	4.00		
	WELDING OUTLET (non 90°)	-	-	6.00	-	-	-	-	-	-	-	-	-	-	6.00		
	CONTROL VALVE	-	2.00	-	-	-	-	-	-	-	-	-	-	-	-		
	SAFETY VALVE	-	1.50	-	-	-	-	-	-	-	-	-	-	-	-		
	STANDARD ITEM	-	1.00	-	-	-	-	-	-	-	-	-	-	-	-		
WALL THICKNESS	OPERATION	Wall thickness MULTIPLIER to be calculated by means of the following formulae in which: wt is the considered wall thickness wt is the Standard wall thickness for the considered diameter											TAPERING				
	HANDLING SCREWED JOINT COLD BEND / CUT / BEVEL	$M = 0.6 + 0.4 \text{ wt} / \text{wt}_s$											TAPERING STEP	MULTIPLIER			
	WELD JOINT NDE (X + GAMMA RAY + US) LOCAL PWHT	Wall thickness THINNER than Standard wall thickness					Wall thickness THICKER than Standard wall thickness						> 0 to 1.6 mm	0.00			
	HANDLING INLINE ITEMS FLANGED JOINT / HYDRO TEST NDE (DP-MP) / PAINTING / THREADING	No Wall Thickness MULTIPLIER											> 1.6 to 3.6 mm	1.00			
																> 3.6 to 5.6 mm	1.50
																> 5.6 to 7.6 mm	2.00
																> 7.6 to 9.6 mm	2.50
																> 9.6 to 11.6 mm	3.00
																> 11.6 to 13.6 mm	3.50
																> 13.6 mm	special pricing

2.8 Description units of work / method of measurement erection

The descriptions given below describe the units of work included in pricing table 2. Any supply of materials 'by contractor' are to be specified in the scope description. The 'non-measured' items include the following:

- the supply, installation and removal of temporary erection bolts, nuts, gaskets, flanges, blinds, spades, plates, etc
- the supply, installation / use including maintenance / calibration and removal of testing materials and / or equipment
- the supply, installation and removal of temporary supporting measures

2.1000 HANDLING

2.1100 HANDLING OF PIPE

2.1110 HANDLING OF PIPE SPOOLS	
Included	Offloading, temporary storage, on-site transportation, handling and erection, level and alignment of pipe spools Only when in-line fittings such as elbows, tees, reducers, weld-neck flanges etc, are included, shall piping be considered to be a pipe spool
Excluded	Making of joints, such as welds, screwed joints and bolt-up of flanges, hydrostatic testing. For branch connections, except for tees, the measurement shall start at the outside diameter of the header
Measurement	Length of pipe spools from centreline to centreline through all fittings, branches, dummy legs etc
Unit	Linear metre (m ¹)
Multipliers	Material type, pipe / fitting size, wall thickness

Note: This item covers prefabricated and field run pipe spools

2.1120 HANDLING OF STRAIGHT RUN PIPE	
Included	<p>Offloading, temporary storage, on-site transportation, handling and erection, level and alignment of straight run pipe</p> <p>Straight run pipe shall be pipe with no in-line fittings welded to it, such as elbows, tees, reducers, flanges, stubends, etc. When only o'lets, any other branches, welded shoes / guides, cradles, reinforcement pads etc. are welded on pipe in prefabrication, it is still considered to be a straight run pipe</p> <p>Also, when random length pipe is cut to length and / or bevelled in prefabrication, it is still considered to be a straight run pipe</p>
Excluded	Making of joints, such as welds, screwed joints and bolt-up of flanges, hydrostatic testing
Measurement	Length of pipe from end to end
Unit	Linear metre (m ¹)
Multipliers	Material type, pipe size, wall thickness

2.1200 HANDLING OF IN-LINE ITEMS	
Included	Loading at warehouse, on-site transportation, temporary storage, handling and erection, level and alignment of in-line items: flanged valves, socket weld valves, screwed valves, strainers, silencers, bellows, gauges, thermowells
Excluded	Bolt-up of flanges, making of screwed connections, welding, hydrostatic testing
Measurement	Number of in-line items
Unit	Each (ea)
Multipliers	Inlet pipe size, inlet rating, special items

2.1300 HANDLING (for certification) OF SAFETY / RELIEF VALVES	
Included	Dismantling, handling, transportation, (testing, verification, certification by an approved and authorised party) and reinstatement of safety / relief valves
Excluded	Bolt-up of flanges
Measurement	Number of safety / relief valves certified
Unit	Each (ea)
Multipliers	Inlet pipe size, inlet rating <i>Note: MT-2 column Handling Inline Items applies</i>

2.2000 JOINTS**2.2100 FIELD WELDS**

Included	Cutting, necessary beveling, pre-heating where required, welding of pipe and / or fittings Included is the protection of surrounding surfaces to avoid damages caused by grinding and welding
Excluded	Non-destructive examination, hydrostatic testing, PWHT
Measurement	Number welds
Unit	Each (ea)
Multipliers	Material type, pipe size, wall thickness, special items / weld type

2.2200 FLANGED JOINTS

Included	The bolt-up of a flanged joint, including the handling of bolts, nuts, washers, gaskets, rings, spades, spectacle blinds and blind flanges Included are bolt tensioning (torque-wrenching) and the administration thereof, if required
Excluded	Handling of pipe and fittings, hydrostatic testing
Measurement	Number of flanged joints. When rings, spades, wafer or lugtype valves are inserted between two flanges, one flanged joint shall be measured
Unit	Each (ea)
Multipliers	Pipe size, flange rating

2.2250 FLANGED JOINTS INCLUDING HYDRAULIC BOLT TENSIONING

Included	The bolt-up of a flanged joint, including the handling of bolts, nuts, washers, gaskets, rings, spades, spectacle blinds and blind flanges The hydraulic tensioning of a flanged joint, including the administration thereof, all in accordance with the applicable specifications
Excluded	Handling of pipe and fittings, hydrostatic testing
Measurement	Number of hydraulically tensioned flanged joints. When rings or spades or wafer or lugtype valves are inserted between two flanges, one flanged joint shall be measured
Unit	Each (ea)
Multipliers	Pipe size, flange rating

2.2300 SCREWED JOINTS	
Included	The cutting and threading of pipe and the making of a screwed joint
Excluded	Handling of pipe and fittings, hydrostatic testing
Measurement	Number of screwed joints.
Unit	Each (ea)
Multipliers	Material type, pipe size, wall thickness

2.3000 COLD BENDS	
Included	The cold bending of a pipe
Excluded	Handling of pipe
Measurement	Number of bends
Unit	Each (ea)
Multipliers	Material type, pipe size, wall thickness

2.4000 TESTING AND TREATMENT

2.4101/2 RADIOGRAPHS (X-RAY / GAMMA-RAY)	
Included	All work involved with the taking and developing of radiographs, the evaluation, administration and reporting
Excluded	
Measurement	Number of welds for which radiographs has been approved
Unit	Each (ea)
Multipliers	Pipe size, wall thickness

2.4110 DYE PENETRANT TESTING (DP)	
Included	All work involved with the making of a dye penetrant test, the evaluation, administration and reporting
Excluded	
Measurement	Number of welds for which a dye penetrant test has been approved
Unit	Each (ea)
Multipliers	Pipe size

2.4120 MAGNETIC PARTICLE TESTING (MP)	
Included	The taking of magnetic particle tests, the evaluation, administration and reporting
Excluded	
Measurement	Number of welds for which magnetic particle test has been approved
Unit	Each (ea)
Multipliers	Pipe size

2.4140 ULTRASONIC TESTING (US)	
Included	The taking of ultrasonic tests, the evaluation, administration and reporting
Excluded	
Measurement	Number of welds for which ultrasonic test has been approved
Unit	Each (ea)
Multipliers	Pipe size, wall thickness

2.4150 POSITIVE MATERIAL IDENTIFICATION (PMI)	
Included	Renting of PMI equipment. Taking of alloy verifications, evaluations and reporting
Excluded	
Measurement	Number of tests
Unit	Each (ea)
Multipliers	None

2.4200 LOCAL POST WELD HEAT TREATMENT (PWHT)	
Included	All work involved with the electrical local post weld heat treatment of one weld. Included is additional handling of pipe spools, hardness testing and related documentation
Excluded	
Measurement	Number of treated welds
Unit	Each (ea)
Multipliers	Pipe size, wall thickness, material type

2.4300 HYDROSTATIC TESTING, FLUSHING AND REINSTATEMENT	
Included	<p>All supply of temporary materials and all work involved with the cleaning, pre-flushing, hydrostatic testing, flushing, draining, drying and reinstatement of piping system</p> <p>Included are the following activities:</p> <ul style="list-style-type: none"> • spading, de-spading • breaking of flanged joints • opening and closing of valves • blocking and unblocking of spring type supports / hangers • handling and welding / bolt-up of test blinds • drain and dry by means of oil-free air of ambient temperatures after testing • cutting off of welded test blinds and beveling of pipe ends • bolt-up and torque-wrenching (if required) of flanged joints
Excluded	Supply of test and flush water and disposal thereof (if off-site)
Measurement	Length of tested lines centreline to centreline (through all fittings and in-line items). For branch connections, except tees, the measurement shall start at the outside diameter of the header
Unit	Linear metre (m ¹)
Multipliers	Pipe size, flange rating

Note: For service testing a reduction factor against the hydrotesting Base Unit Rate may be agreed upon by employer and contractor.

2.5000 SUPPORTS**2.5101 PREFABRICATION AND INSTALLATION OF FIELD RUN PIPE SUPPORTS**

Included	<p>Included is the design, if required</p> <p>The material supply and fabrication of carbon steel pipe supports, guides, hangers, dummy leg base plates. Included are all shim-plates required for pipe support base-plates and all bolting materials</p> <p>Included are all attachment welds to pipe eg the welding of shoes to a pipe where required</p> <p>Offloading, temporary storage, on-site transportation, handling and erection of pipe supports, drilling, guides, hangers, dummy leg base plates; included are all shim-plates required for pipe support base-plates and all bolting materials</p>
Excluded	Dummy leg piping materials, for which handling and welds are measured as part of pipe spools. Grouting of supports
Measurement	Weight of supports per weight range, net as fabricated, excluding weight of bolts, nuts, washers and shim-plates
Unit	Kilogram (kg)
Multipliers	None

2.5102/3/4/5/6 INSTALLATION OF PREFABRICATED PIPE SUPPORTS

Included	Offloading, temporary storage, on-site transportation, handling and erection of pipe supports, drilling, guides, hangers, dummy leg base plates, cradles. Included are all shim-plates required for pipe support base-plates and all bolting materials
Excluded	Dummy leg piping materials, reinforcement plate for cradle for which handling and welds are measured as part of pipe spools. Grouting of supports
Measurement	Weight of supports per weight range, net as fabricated, excluding weight of bolts, nuts, washers and shim-plates
Unit	Kilogram (kg)
Multipliers	None

2.5301/2/3 SPRING HANGERS

Included	Offloading, site transportation, warehousing, handling and erection of spring hanger assemblies and spring type supports
Excluded	
Measurement	Number of spring hangers per weight range
Unit	Each (ea)
Multipliers	None

2.6000 FIELD PAINTING	
Note:	For materials, number of coats and minimum dry film thickness (MDFT), reference is made to the applicable specification. Included is taping and marking. Base Unit Rate shall be given for each paint system

2.6050/1/2/3 CLEANING AND PAINTING OF WELDS	
Included	All work involved with the surface preparation, priming and finish painting of including the area adjacent to the weld Included are required protection of all surrounding surfaces to avoid contamination and all required weather protection to ensure correct humidity and temperature environment for painting
Excluded	
Measurement	number of painted welds
Unit	Each (ea)
Multipliers	Pipe / fitting size

2.6110/1/2/3 FINAL PAINTING OF INSTALLED PIPE	
Included	Field treatment of installed pipe including all fittings, valves etc.
Excluded	
Measurement	Length of pipe plus equivalent length of all fittings, flanges, valves <i>(Note: method of determining equivalent length to be specified by employer)</i>
Unit	Equivalent linear metre (m ¹)
Multipliers	Pipe / fitting size

2.6201/2/3/4/5/6 FIELD PAINTING OF PIPE SUPPORTS	
Included	Field treatment of pipe supports, including all handling
Excluded	
Measurement	Weight of supports per weight range, net as fabricated, excluding weight of bolts, nuts, washers and shim-plates
Unit	Kilogram (kg)
Multipliers	None

2.8000 MODIFICATION WORK**2.8010 TAPERING**

Included	The tapering (ie by means of inside machining 1:4) of any type of pipe or fitting from existing wall thickness (as per drawing and / or actual supply) to more than 1.6 mm and after that in steps of 2 mm up, including the handling and transportation of pipe, flanges or fittings
Excluded	
Measurement	Number of tapered ends
Unit	Each (ea) step
Multipliers	Material type, pipe / fitting / flange size, tapering step

2.8020 DRILLING / THREADING

Included	The drilling of a hole and threading in blinds, etc. Included is the handling of the blind
Excluded	
Measurement	Number of threaded holes
Unit	Each (ea)
Multipliers	None

2.8040 THREADING

Included	The cutting of pipe and the threading of the pipe end
Excluded	
Measurement	Number of threaded ends per pipe size
Unit	Each (ea)
Multipliers	Material type, pipe size

2.8101 DOUBLE HANDLING OF PIPE SPOOLS (FOR MODIFICATION WORK)

Included	The dismantling, handling and reinstatement of already-erected pipe spools necessary for modification thereof due to drawing and / or field revisions Included is the removal of any redundant piping materials
Excluded	The making of joints, such as welds and bolt-up of flanges
Measurement	Length of pipe spools from centreline to centreline through all fittings. For branch connections, except tees, the measurement shall start at the outside diameter of the header
Unit	Linear metre (m ¹)
Multipliers	Pipe / fitting size, wall thickness

2.8102 DOUBLE HANDLING OF STRAIGHT RUN PIPE (FOR MODIFICATION WORK)	
Included	The dismantling, handling and reinstatement of already erected straight run pipe necessary for modifications thereof due to drawing and / or field revisions Included is the removal of any redundant piping materials.
Excluded	The making of joints, such as welds and bolt-up of flanges
Measurement	Length of pipe from end to end
Unit	Linear metre (m ¹)
Multipliers	Pipe size, wall thickness

2.8103 DOUBLE HANDLING OF IN-LINE ITEMS (FOR MODIFICATION WORK)	
Included	The handling of already erected in-line items necessary for modifications thereof due to drawing and / or field revisions, eg turning of already installed flanged valves
Excluded	The making of joints, such as bolt-up of flanges
Measurement	Number of items handled
Unit	Each (ea)
Multipliers	Pipe size, flange rating, special items

2.8301 CUT (FOR MODIFICATION WORK)	
Included	Cutting of already fabricated and / or installed pipe spools necessary for modifications thereof due to drawing and / or field revisions
Excluded	
Measurement	Number of cuts for modifications to already fabricated pipe spools
Unit	Each (ea)
Multipliers	Material type, pipe size, wall thickness, weld type

2.8302 BEVEL (FOR MODIFICATION WORK)	
Included	The beveling after cutting of already fabricated and / or installed pipe spools necessary for modifications thereof due to drawing and / or field revisions
Excluded	
Measurement	Number of beveled ends for modifications to already fabricated pipe spools
Unit	Each (ea)
Multipliers	Material type, pipe size, wall thickness, weld type

2.8400 FIELD WELDS (FOR MODIFICATION WORK)	
Included	The welding after beveling of already fabricated and / or installed pipespools necessary for modification thereof due to drawing and / or field revision
Excluded	Non-destructive examination, hydrostatic testing, PWHT
Measurement	Number of welds
Unit	Each (ea)
Multipliers	Material type, pipe size, wall thickness, weld type

2.8500 FLANGED JOINTS (FOR MODIFICATION WORK)	
Included	The bolt-up of a flanged joint, including the handling of bolts, nuts, washers, gaskets, rings, spades and blinds necessary for modifications to piping due to drawing and / or field revisions Included is bolt tensioning (torque-wrenching) and the administration thereof, if required
Excluded	
Measurement	Number of flanged joints. When rings, spades, wafer or lug-type valves are inserted between two flanges, one flanged joint shall be measured
Unit	Each (ea)
Multipliers	Pipe size, flange rating

2.8550 BREAKING FLANGED JOINTS (FOR MODIFICATION WORK)	
Included	The breaking (loosening) of a flanged joint, including the handling of bolts, nuts ,washers, gaskets, rings and spades, necessary for modifications to piping due to drawing and / or field revisions
Excluded	
Measurement	Number of flanged joints dismantled. When rings, spades, wafer or lug type valves are inserted between two flanges, one flanged joint shall be measured
Unit	Each (ea)
Multipliers	Pipe size, flange rating

3. Pricing tables: Prefabrication (PT-1)

Pricing table 1: Piping prefabrication
Summary of Base Unit Rates

Unit no.	Description:			Grand total
	Piping prefabrication	Currency	<Curr>	

1.0000	Transportation	Unit	Base Unit Rate	Subtotal
1.0001	Transportation of piping materials to prefabrication shop(s)	ea		
1.0002	Transportation of piping materials to site	ea		

1.1000	Handling	Unit	Base Unit Rate	Subtotal
1.1120	Handling of straight run pipe	m ¹		

1.2000	Joints	Unit	Base Unit Rate	Subtotal
1.2100	Welds	ea		
1.2300	Screwed joints	ea		

1.3000	Cold bends	Unit	Base Unit Rate	Subtotal
1.3000	Cold bends	ea		

Pricing table 1: Piping prefabrication
Summary of Base Unit Rates

Unit no.	Description:			Grand Total
	Piping prefabrication	Currency	<Curr>	
1.4000	Testing and heat treatment	Unit	Base Unit Rate	Subtotal
1.4101	Radiographs (X-ray)	ea		
1.4102	Radiographs (Gamma-ray)	ea		
1.4110	Dye penetrant testing (DP)	ea		
1.4120	Magnetic particle testing (MP)	ea		
1.4140	Ultrasonic testing (US)	ea		
1.4150	Positive material identification (PMI)	ea	See pricing table	
1.4200	Local post weld heat treatment (PWHT)	ea		
1.4300	Hydrostatic testing and flushing	m ¹		
1.5000	Supply and fabrication of pipe supports	Unit	Base Unit Rate	Subtotal
1.5102	Pipe supports (0-5kg)	kg		
1.5103	Pipe supports (5-10kg)	kg		
1.5104	Pipe supports (10-20kg)	kg		
1.5105	Pipe supports (20-50kg)	kg		
1.5106	Pipe supports (>50kg)	kg		

Pricing table 1: Piping prefabrication
Summary of Base Unit Rates

Unit no.	Description:			Grand Total
	Piping prefabrication	Currency	<Curr>	
1.6000	Painting	Unit	Base Unit Rate	Subtotal
1.6110	Painting of pipe spools (incl. Fittings) - paint system a	m ¹		
1.6111	Painting of pipe spools (incl. Fittings) - paint system b	m ¹		
1.6112	Painting of pipe spools (incl. Fittings) - paint system c	m ¹		
1.6113	Painting of pipe spools (incl. Fittings) - paint system d	m ¹		
1.6120	Painting of straight run pipe - paint system a	m ¹		
1.6121	Painting of straight run pipe - paint system b	m ¹		
1.6122	Painting of straight run pipe - paint system c	m ¹		
1.6123	Painting of straight run pipe - paint system d	m ¹		
1.6202	Painting of pipe supports (0-5kg)	kg		
1.6203	Painting of pipe supports (5-10kg)	kg		
1.6204	Painting of pipe supports (10-20kg)	kg		
1.6205	Painting of pipe supports (20-50kg)	kg		
1.6206	Painting of pipe supports (>50kg)	kg		
1.8000	Modification work	Unit	Base Unit Rate	Subtotal
1.8010	Tapering	ea		
1.8020	Drilling / threading	ea	See pricing table	
1.8040	Threading	ea		
1.8101	Double handling of pipe spools (modification work)	m ¹		
1.8301	Cut (modification work)	ea		
1.8302	Bevels (modification work)	ea		
1.8400	Welds (modification work)	ea		

Pricing table 1: Transportation of piping materials

Unit no.	Description: Transportation of piping materials	<i><Curr></i>
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		Quantity	Base Unit Rate	Total amount
1.0001	Transportation of piping materials to prefabrication shop(s)			
Provisional Total transportation of piping materials to prefabrication shop(s)				

Unit no.	Description: Transportation to site	<i><Curr></i>
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		Quantity	Base Unit Rate	Total amount
1.0002	Transportation of piping materials to site			
Provisional total transportation of piping materials to site				

Pricing table 1: Handling of straight run pipe

Material type	Size	Wall thickness (mm)	Pipe length (m)	<Curr>	Multipliers			Total amounts
				Base Unit Rate	Material type	Size	Wall thick-ness	
1.1120	Totals							

Pricing table 1: Welds

Material type	Size	Wall thickness (mm)	Weld type	No. of welds	<Curr> Multipliers					Total amounts
					Base Unit Rate	Mat'l type	Size	Wall thick-ness	Weld type	
1.2100			Totals							

Pricing table 1: Radiographs (Gamma-Ray)

			<Curr>	Multipliers		
Size	Wall thickness (mm)	No. of gamma rays	Base Unit Rate	Size	Wall thickness	Total amounts
1.4102	Totals					

Pricing table 1: Ultrasonic testing (US)

Size	Wall thickness (mm)	No. of US test	<Curr>	Multipliers		Total amounts
			Base Unit Rate	Size	Wall thickness	
1.4140	Totals					

Pricing table 1: Positive material identification (PMI)

			<Curr>	
Unit no.	Description	Quantity	Base Unit Rate	Total amounts
1.4150	Totals			

Pricing table 1: Local post weld heat treatment (PWHT)

Material type	Size	Wall thickness (mm)	No. of welds for treatment	<Curr>	Multipliers			Total amounts
				Base Unit Rate	Mat'l type	Size	Wall thick-ness	
1.4200	Totals							

Pricing table 1: Hydrostatic testing and flushing

Size	Flange rating	Line length (thru all fittings) (m)	<Curr>	Multipliers		Total amounts
			Base Unit Rate	Size	Flange rating	
1.4300	Totals					

Pricing table 1: Supply and fabrication of pipe supports

Unit no.	Description		<Curr>	
1.5000	Supports	Weight (kg)	Base Unit Rate	Total amounts
1.5102	Pipe supports (0-5kg)			
1.5103	Pipe supports (5-10kg)			
1.5104	Pipe supports (10-20kg)			
1.5105	Pipe supports (20-50kg)			
1.5106	Pipe supports (>50kg)			
1.5000	Totals			

**Pricing table 1: Painting of pipe spools (incl. fittings)
- paint system B**

Size	Spool length (m)	Base Unit Rate	<Curr>	
			Multiplier	Size
		Total amounts		
1.6111 Totals				

**Pricing table 1: Painting of straight run pipe
- paint system A**

Size	Pipe length (m)	<Curr>	Multiplier	Total amounts
		Base Unit Rate	Size	
1.6120 Totals				

Pricing table 1: Painting of straight run pipe - paint system C

Size	Pipe length (m)	<Curr>		Total amounts
		Base Unit Rate	Multiplier	
1.6122 Totals				

**Pricing table 1: Painting of straight run pipe
- paint system D**

			Multiplier		
		<Curr>			
Size	Pipe length (m)	Base Unit Rate	Size	Total amounts	
1.6123 Totals					

Pricing table 1: Painting of pipe supports

Unit no.	Description		<Curr>	
1.6200	Painting of pipe supports	Weight (kg)	Base Unit Rate	Total amounts
1.6202	Painting of pipe supports (0-5kg)			
1.6203	Painting of pipe supports (5-10kg)			
1.6204	Painting of pipe supports (10-20kg)			
1.6205	Painting of pipe supports (20-50kg)			
1.6206	Painting of pipe supports (>50kg)			
1.6200	Totals			

Pricing table 1: Drilling / Threading

			<Curr>	
Unit no.	Description	Quantity	Base Unit Rate	Total amounts
1.8020	Totals			

**Pricing table 1: Double handling of pipe spools
(modification work)**

Material type	Size	Wall thickness (mm)	Pipe length	<Curr> Base Unit Rate	Multipliers			Total amounts
					Mat'l type	Size	Wall thick-ness	
1.8101		Totals						

Pricing table 1: Cuts (modification work)

Mat'l type	Size	Wall thickness (mm)	Weld type	No. of cuts	Multipliers				Total amounts
					Base Unit Rate	Mat'l type	Size	Wall thickness	
1.8301	Totals								

Pricing table 1: Bevels (modification work)

Mat'l type	Size	Wall thickness (mm)	Weld type	No. of bevels	<Curr>	Multipliers				Total amounts
						Base Unit Rate	Mat'l type	Size	Wall thickness	
				Totals						

Pricing table 1: Welds (modification work)

Mat'l type	Size	Wall thickness (mm)	Weld type	No. of welds	<Curr>	Multipliers				Total amounts
					Base Unit Rate	Mat'l type	Size	Wall thickness	Weld type	
1.8400			Totals							

4. Pricing tables: Erection (PT-2)

Pricing table 2: Piping erection

Summary of Base Unit Rates

Unit no.	Description:			Grand Total
	Piping erection	Currency	<Curr>	
2.1000	Handling	Unit	Base Unit Rate	Subtotal
2.1110	Handling of pipe spools	m ¹		
2.1120	Handling of straight run pipe	m ¹		
2.1200	Handling of in-line items	ea		
2.1300	Handling (for certification) of safety / relief valves	ea		
2.2000	Joints	Unit	Base Unit Rate	Subtotal
2.2100	Field welds	ea		
2.2200	Flanged joints	ea		
2.2250	Flanged joints including hydraulic bolt tensioning	ea		
2.2300	Screwed joints	ea		
2.3000	Cold bends	Unit	Base Unit Rate	Subtotal
2.3000	Cold bends	ea		

Pricing table 2: Piping erection

Summary of Base Unit Rates

Unit no.	Description: Piping erection			Grand Total
		Currency	<Curr>	

2.4000	Testing and heat treatment	Unit	Base Unit Rate	Subtotal
2.4101	Radiographs (X-ray)	ea		
2.4102	Radiographs (Gamma ray)	ea		
2.4110	Dye penetrant testing (DP)	ea		
2.4120	Magnetic particle testing (MP)	ea		
2.4140	Ultrasonic testing (US)	ea		
2.4150	Positive material identification (PMI)	ea	See pricing table	
2.4200	Local post weld heat treatment (PWHT)	ea		
2.4300	Hydrostatic testing, flushing and reinstatement.	m ¹		

2.5000	Supports	Unit	Base Unit Rate	Subtotal
2.5101	Prefabrication & installation of field run pipe supports	kg		
2.5102	Installation of prefabricated pipe supports (0-5kg)	kg		
2.5103	Installation of prefabricated pipe supports (5-10kg)	kg		
2.5104	Installation of prefabricated pipe supports (10-20kg)	kg		
2.5105	Installation of prefabricated pipe supports (20-50kg)	kg		
2.5106	Installation of prefabricated pipe supports (>50kg)	kg		
2.5301	Spring hangers (0 - 20kg)	ea		
2.5302	Spring hangers (20 - 50kg)	ea		
2.5303	Spring hangers (> 50kg)	ea		

Pricing table 2: Piping erection**Summary of Base Unit Rates**

Unit no.	Description: Piping Erection			Grand Total
		Currency	<Curr>	
2.6000	Painting	Unit	Base Unit Rate	Subtotal
2.6050	Cleaning & painting of welds - paint system a	ea		
2.6051	Cleaning & painting of welds - paint system b	ea		
2.6052	Cleaning & painting of welds - paint system c	ea		
2.6053	Cleaning & painting of welds - paint system d	ea		
2.6110	Final painting of installed pipe - paint system a	m ¹		
2.6111	Final painting of installed pipe - paint system b	m ¹		
2.6112	Final painting of installed pipe - paint system c	m ¹		
2.6113	Final painting of installed pipe - paint system d	m ¹		
2.6201	Field painting of field pipe supports	kg		
2.6202	Field painting of pipe supports (0-5kg)	kg		
2.6203	Field painting of pipe supports (5-10kg)	kg		
2.6204	Field painting of pipe supports (10-20kg)	kg		
2.6205	Field painting of pipe supports (20-50kg)	kg		
2.6206	Field painting of pipe supports (>50kg)	kg		

Pricing table 2: Piping erection

Summary of Base Unit Rates

Unit no.	Description: Piping erection			Grand Total
		Currency	<Curr>	
2.8000	Modification Work	Unit	Base Unit Rate	Subtotal
2.8010	Tapering	ea		
2.8020	Drilling / threading	ea	See pricing table	
2.8040	Threading	ea		
2.8101	Double handling of pipe spools (modification work)	m ¹		
2.8102	Double handling of straight run pipe (modification work)	m ¹		
2.8103	Double handling of in-line items (modification work)	ea		
2.8301	Cut (modification work)	ea		
2.8302	Bevel (modification work)	ea		
2.8400	Field welds (modification work)	ea		
2.8500	Flanged joints (modification work)	ea		
2.8550	Breaking flanged joints (modification work)	ea		

Pricing table 2: Handling (for certification) of safety / relief valves

Inlet size	Inlet rating	No of items	<Curr>	Multipliers		Total amounts
			Base Unit Rate	Size	Flange rating	
2.1300	Totals					

Pricing table 2: Flanged joints

Size	Flange rating	No of flanged joints	<Curr>	Multipliers		Total amounts
			Base Unit Rate	Size	Flange rating	
2.2200	Totals					

Pricing table 2: Screwed joints

Material type	Size	Wall thickness (mm)	No. of screwed joints	<Curr>	Multipliers			Total amounts
				Base Unit Rate	Mat'l type	Size	Wall thickness	
2.2300								
		Totals						

Pricing table 2: Cold bends

Material Type	Size	Wall thickness (mm)	No. of Bends	<Curr>	Multipliers			Total amounts
				Base Unit Rate	Mat'l Type	Size	Wall thickness	
2.3000	Totals							

Pricing table 2: Magnetic particle testing (MP)

Size	No. of MP Tests	<Curr>		Total amounts
		Base Unit Rate	Multiplier Size	
2.4120 Totals				

Pricing table 2: Ultrasonic testing (US)

Size	Wall thickness (mm)	No. of US test	<Curr>			
			Base Unit Rate	Multipliers		Total amounts
				Size	Wall thickness	
2.4140		Totals				

Pricing table 2: Positive material identification (PMI)

				<Curr>
Unit no.	Description	Quantity	Base Unit Rate	Total amounts
2.4150	Totals			

Pricing table 2: Hydrostatic testing, flushing and reinstatement

Size	Flange rating	Line length (thru all fittings) (m)	<Curr>			
			Base Unit Rate	Multipliers		Total amounts
				Size	Flange rating	
2.4300	Totals					

Pricing table 2: Pipe supports

Unit no	Description		<Curr>	
2.5100	Supports	Weight (kg)	Base Unit Rate	Total amounts
2.5101	Prefabrication & installation of field run pipe supports			
2.5102	Installation of prefabricated pipe supports (0-5kg)			
2.5103	Installation of prefabricated pipe supports (5-10kg)			
2.5104	Installation of prefabricated pipe supports (10-20kg)			
2.5105	Installation of prefabricated pipe supports (20-50kg)			
2.5106	Installation of prefabricated pipe supports (>50kg)			
2.5000	Totals			

Unit no.	Description		<Curr>	
2.5300	Supports	Quantity (ea)	Base Unit Rate	Total amounts
2.5301	Spring hangers (0-20kg)			
2.5302	Spring hangers (20-50kg)			
2.5303	Spring hangers (>50kg)			
2.5300	Totals			

**Pricing table 2: Cleaning and painting of welds
- paint system A**

Size	No. of welds	<Curr>		Total amounts
		Base Unit Rate	Multiplier	
2.6050 Totals				

**Pricing table 2: Cleaning and painting of welds
- paint System B**

Size	No. of welds	<Curr>	Multiplier	Total amounts
		Base Unit Rate	Size	
2.6051 Totals				

**Pricing table 2: Cleaning and painting of welds
- paint system D**

Size	No. of welds	<Curr>		Total amounts
		Base Unit Rate	Multiplier	
2.6053 Totals				

**Pricing table 2: Final painting of installed pipe
- paint system A**

		<i><Curr></i>	Multiplier	
Size	Equivalent pipe length (m)	Base Unit Rate	Size	Total amounts
2.6110 Totals				

Pricing table 2: Field painting of supports

Unit no.	Description		<Curr>	
2.6200	Painting of Supports	Weight (kg)	Base Unit Rate	Total amounts
2.6201	Field painting of field pipe supports			
2.6202	Field painting of pipe supports (0-5kg)			
2.6203	Field painting of pipe supports (5-10kg)			
2.6204	Field painting of pipe supports (10-20kg)			
2.6205	Field painting of pipe supports (20-50kg)			
2.6206	Field painting of pipe supports >50kg			
2.6200	Totals			

Pricing table 2: Drilling / Threading

			<Curr>		
Unit no.	Description	Quantity	Base Unit Rate	Total amounts	
2.8020	Totals				

**Pricing table 2: Double handling of straight run pipe
(modification work)**

Material type	Size	Wall thickness (mm)	Pipe length (m)	Base Unit Rate	Multipliers			Total amounts
					Mat'l type	Size	Wall thickness	
2.8102	Totals							

Pricing table 2: Flanged joints (modification works)

				Multipliers		
Size	Flange rating	No. of flanged joints	<Curr> Base Unit Rate	Size	Flange rating	Total amounts
2.8500	Totals					

Pricing table 2: Breaking of flanged joints (modification works)

Size	Flange rating	No. of flanged joints	<Curr>		Multipliers		Total amounts
			Base Unit Rate	Size	Flange rating		
2.8550	Totals						

5. Examples

The purpose of this section is to give examples of piping pricing calculation according to the ECI Pricing System.

Three examples are given:

- Example 1 refers to prefabrication of piping
- Example 2 refers to erection of piping
- Example 3 refers to erection of piping

To support these three examples, two isometrics have been drawn:

- Isometric nr 1007 rev 2 to support calculation examples nr 1 and 2
- Isometric nr 1003 rev 3 to support calculation example nr 3

The Base Unit Rates used in these three examples are delivered from an example of what a 'contractual summary of Base Unit Rates' could be:

- Pricing table 1: Piping prefabrication
- Pricing table 2: Piping erection

Prices given in these tables are not a reflection of a pricing level in any particular currency. They are just figures given for a better understanding of the ECI Pricing System.

5.1 Example of a contractual summary of Base Unit Rates

**Pricing table 1: Piping prefabrication
Summary of Base Unit Rates**

Unit no.	Description: Piping prefabrication			Grand Total
		Currency	Contractual	3,473.97

1.2000	Joints	Unit	Base Unit Rate	Subtotal
				3,211.00
1.2100	Welds	ea	100.00	3,211.00

1.4000	Testing and heat treatment	Unit	Base Unit Rate	Subtotal
				93.50
1.4102	Radiographs (Gamma-Ray)	ea	35.00	77.00
1.4110	Dye penetrant testing (DP)	ea	5.00	16.50

1.6000	Painting	Unit	Base Unit Rate	Subtotal
				169.47
1.6110	Painting of pipe spools (incl fittings) - paint system A	m ¹	6.00	169.47

Pricing table 2: Piping erection
Summary of Base Unit Rates

Unit no.	Description: Piping erection			Grand Total
		Currency	Contractual	4,630.77

2.1000	Handling	Unit	Base Unit Rate	Subtotal
				2,517.30
2.1110	Handling of pipe spools	m ¹	70.00	1,786.50
2.1200	Handling of in-line items	ea	120.00	730.80

2.2000	Joints	Unit	Base Unit Rate	Subtotal
				1,544.86
2.2100	Field welds	ea	130.00	443.56
2.2200	Flanged joints	ea	70.00	805.00
2.2300	Screwed joints	ea	50.00	296.30

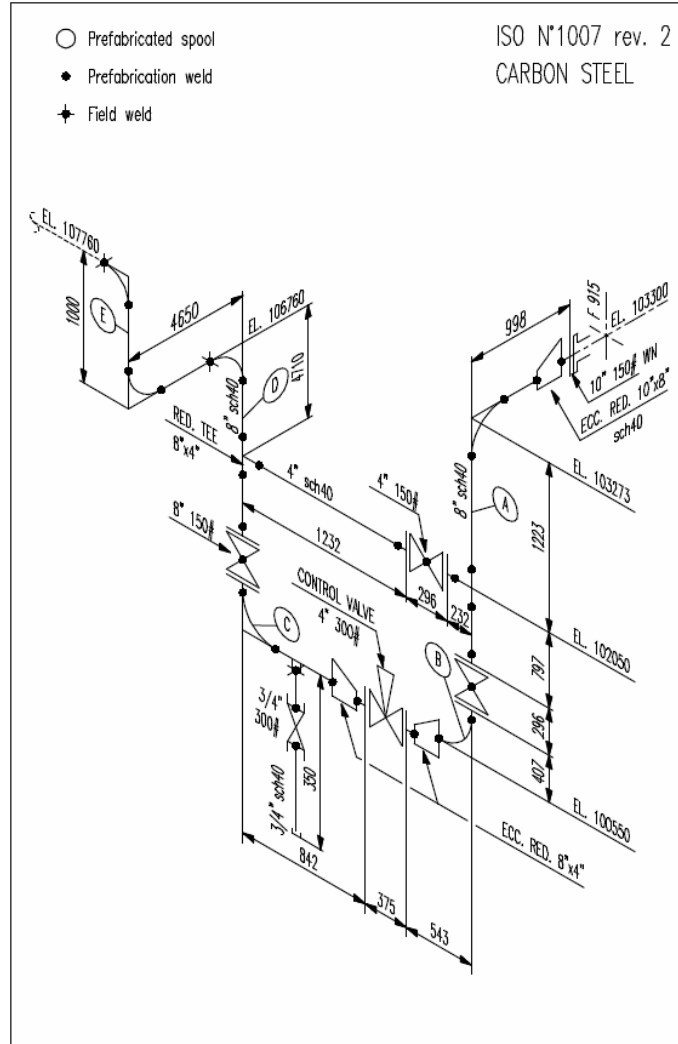
2.3000	Cold bends	Unit	Base Unit Rate	Subtotal
				119.70
2.3000	Cold bends	ea	50.00	119.70

2.4000	Testing and heat treatment	Unit	Base Unit Rate	Subtotal
				448.91
2.4102	Radiographs (Gamma-Ray)	m ¹	50.00	57.50
2.4300	Hydrostatic testing, flushing and reinstatement	ea	15.00	391.41

5.2 Example 1: Prefabrication of piping

(Isometric nr 1007 rev 2)

This calculation is based on the Base Unit Rates shown in
Pricing table 1: Piping prefabrication

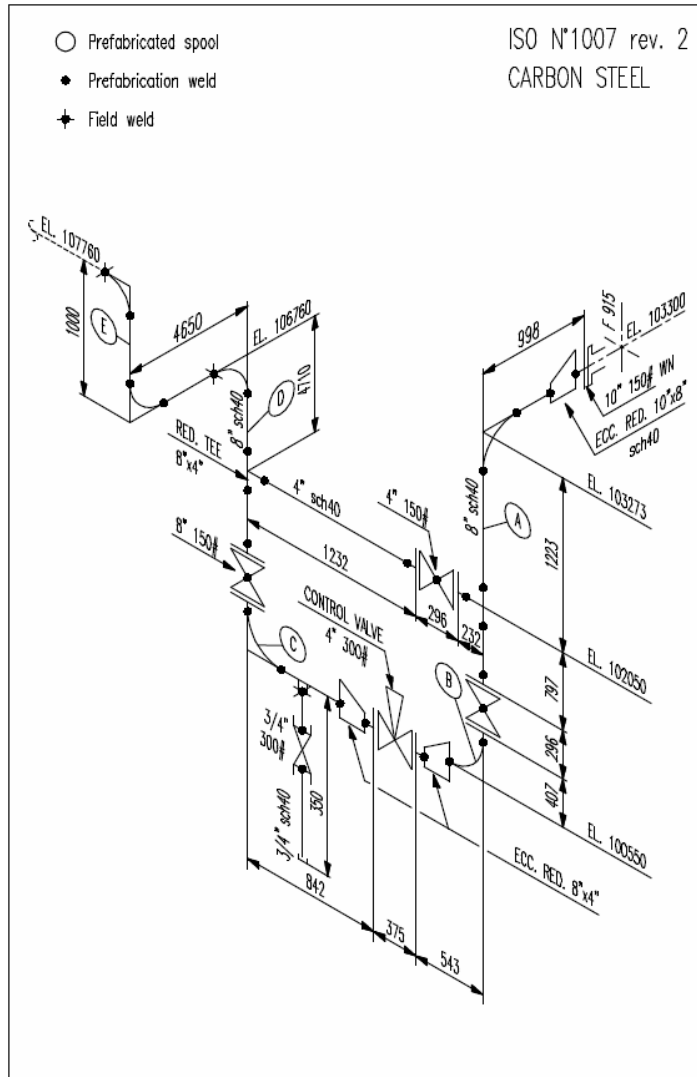


PRICING CALCULATION EXAMPLE nr 1: Prefabrication of Piping						Isometric nr 1007 rev 2 Carbon Steel				
1.2100 Welds						Multipliers				Total Amounts <i>(contractual currency)</i>
Material Type	Size	Wall Thickness (mm)	Weld Type	No. of Welds	Base Unit Rate	Material Type	Size	Wall Thickness	Weld Type	
CS	0.75"	2.87	WELDING OUTLET (90°)	1	100.00	1.00	0.34	1.00	4.00	136.00
CS	4"	6.02	BUTT WELD / SLIP-ON	5	100.00	1.00	0.75	1.00	1.00	375.00
CS	8"	8.18	BUTT WELD / SLIP-ON	18	100.00	1.00	1.40	1.00	1.00	2,520.00
CS	10"	9.27	BUTT WELD / SLIP-ON	1	100.00	1.00	1.80	1.00	1.00	180.00
1.4102 Radiographs (Gamma-Ray)						Multipliers				
Size	Wall Thickness (mm)			No. of Gamma Rays	Base Unit Rate	Size	Wall Thickness			
8"	8.18			2	35.00	1.10	1.00			77.00
1.4110 Dye Penetrant Testing (DP)						Multipliers				
Size				No. of D.P. Tests	Base Unit Rate	Size				
8"				2	5.00	1.20				12.00
4"				1	5.00	0.90				4.50
1.6110 Painting of Pipe Spools (incl. Fittings) - Paint System A						Multipliers				
Size				Spool Length (m)	Base Unit Rate	Size				
0.75"				0.15	6.00	0.30				0.27
4"				2	6.00	0.70				8.40
8"				20	6.00	1.30				156.00
10"				0.5	6.00	1.60				4.80
GRAND TOTAL <i>(contractual currency)</i>										3,473.97

5.3 Example 2: Erection of piping

(Isometric nr 1007 rev 2)

This calculation is based on the Base Unit Rates shown in **Pricing table 2: Piping erection**

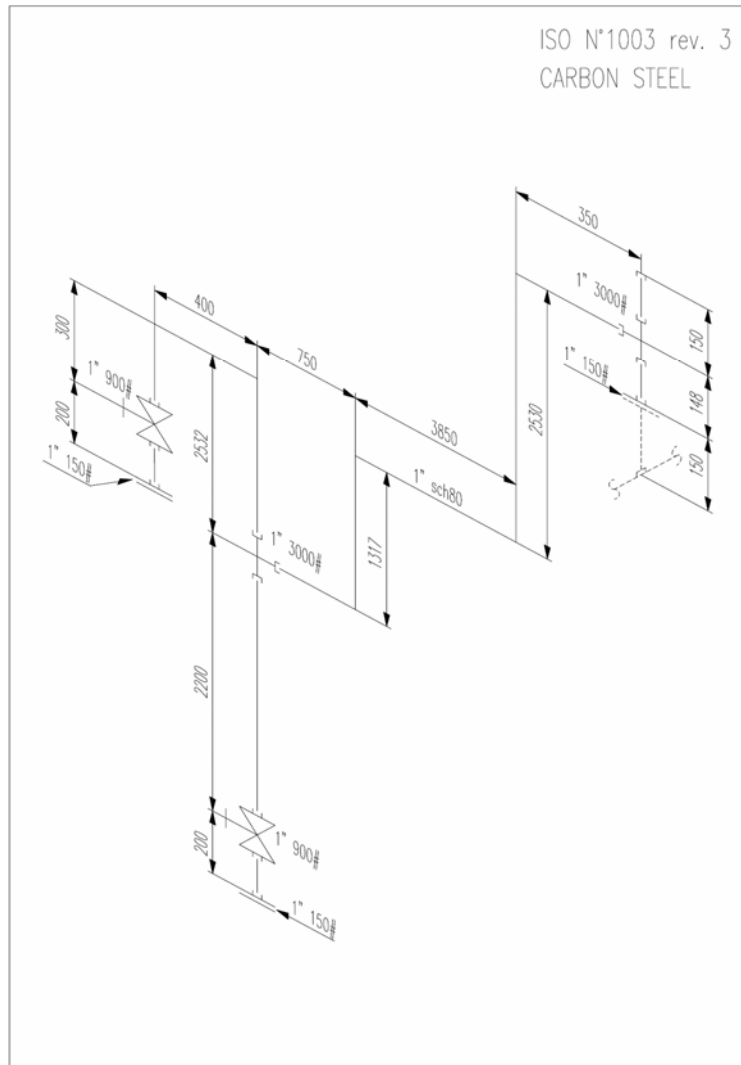


PRICING CALCULATION EXAMPLE nr 2: Erection of Piping						Isometric nr 1007 rev 2 Carbon Steel				
2.110 Handling of Pipe Spools						Multipliers				Total Amounts <i>(contractual currency)</i>
Material Type	Size	Wall Thickness (mm)		Spool Length (m)	Base Unit Rate	Material Type	Size	Wall Thickness		
CS	0.75"	2.87		0.15	70.00	1.00	0.34	1.00		3.57
CS	4"	6.02		1.64	70.00	1.00	0.85	1.00		97.58
CS	8"	8.18		15.92	70.00	1.00	1.10	1.00		1,225.84
CS	10"	9.27		0.28	70.00	1.00	1.30	1.00		25.48
2.1200 Handling of In-line Items						Multipliers				
Size	Flange Rating	Special Item		No. of Items	Base Unit Rate	Size	Flange Rating	Special Item		
0.75"	300 lbs.	STANDARD ITEM		1	120.00	0.2	1.15	1.00		27.60
4"	150 lbs.	STANDARD ITEM		1	120.00	0.80	1.00	1.00		96.00
4"	300 lbs.	CONTROL VALVE		1	120.00	0.80	1.15	2.00		220.80
8"	150 lbs.	STANDARD ITEM		2	120.00	1.25	1.00	1.00		300.00
2.2100 Field Welds						Multipliers				
Material Type	Size	Wall Thickness (mm)	Weld Type	No. of Welds	Base Unit Rate	Material Type	Size	Wall Thickness	Weld Type	
CS	0.75"	2.87	SOCKET WELD	3	130.00	1.00	0.34	1.00	0.60	79.56
CS	8"	8.18	BUTT WELD / SLIP-ON	2	130.00	1.00	1.40	1.00	1.00	364.00
2.2200 Flanged Joints						Multipliers				
Size	Flange Rating			No. of Flanged Joints	Base Unit Rate	Size	Flange Rating			
4"	150 lbs.			2.00	70.00	0.80	1.00			112.00
4"	300 lbs.			2.00	70.00	0.80	1.15			128.80
8"	150 lbs.			4.00	70.00	1.25	1.00			350.00
10"	150 lbs.			1.00	70.00	1.50	1.00			105.00
2.2300 Screwed Joints						Multipliers				
Material Type	Size	Wall Thickness (mm)		No. of Screwed Joints	Base Unit Rate	Material Type	Size	Wall Thickness		
CS	0.75"	2.87		1.00	50.00	1.00	0.34	1.00		17.00
2.4102 Radiographs (Gamma-Ray)						Multipliers				
Size	Wall thickness (mm)			No. of Gamma Rays	Base Unit Rate	Size	Wall thickness			
8"	8.18			1	50.00	1.15	1.00			57.50
2.4300 Hydrostatic Testing						Multipliers				
Size	Flange Rating			Line Length (m)	Base Unit Rate	Size	Flange Rating			
0.75"	300 lbs.			0.24	15.00	0.34	1.00			1.22
4"	150 lbs.			2.31	15.00	0.85	1.00			29.45
8"	150 lbs.			16.51	15.00	1.10	1.00			272.42
10"	150 lbs.			0.28	15.00	1.30	1.00			5.46
GRAND TOTAL <i>(contractual currency)</i>									3,519.28	

5.4 Example 3: Erection of piping

(Isometric nr 1003 rev 3)

This calculation is based on the Base Unit Rates shown in **Pricing table 2: Piping erection**



PRICING CALCULATION EXAMPLE nr 3: Erection of Piping						Isometric nr 1003 rev 3 Carbon Steel				
2.1110 Handling of Pipe Spools						Multipliers				Total Amounts (contractual currency)
Material Type	Size	Wall Thickness (mm)		Line Length (m)	Base Unit Rate	Material Type	Size	Wall Thickness		
CS	1"	4.55		14.70	70.00	1.00	0.37	1.14		434.03
2.1200 Handling of In-line Items						Multipliers				
Size	Flange Rating	Special Item		No. of Items	Base Unit Rate	Size	Flange Rating	Special Item		
1"	900 lbs.	STANDARD ITEM		2.00	120.00	0.24	1.50	1.00		86.40
2.2200 Flanged Joints						Multipliers				
Size	Flange Rating			No. of Flanged Joints	Base Unit Rate	Size	Flange Rating			
1"	150 lbs.			3.00	70.00	0.52	1.00			109.20
2.2300 Screwed Joints						Multipliers				
Material Type	Size	Wall Thickness (mm)		No. of Screwed Joints	Base Unit Rate	Material Type	Size	Wall Thickness		
CS	1"	4.55		14.00	50.00	1.00	0.35	1.14		279.30
2.3000 Cold Bends						Multipliers				
Material Type	Size	Wall Thickness (mm)		No. of Bends	Base Unit Rate	Material Type	Size	Wall Thickness		
CS	1"	4.55		6.00	50.00	1.00	0.35	1.14		119.70
2.4300 Hydrostatic Testing						Multipliers				
Size	Flange Rating			Line Length (m)	Base Unit Rate	Size	Flange Rating			
1"	150 lbs.			14.93	15.00	0.37	1.00			82.86
GRAND TOTAL (contractual currency)									1,111.49	



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