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PREFACE

This manual is intended to provide guidance for experienced estimators and project managers in compiling bids and valuing variations in the process and piping industry. It is not meant to replace the experience built up by people in the industry over many years, but it can be regarded as a second opinion.

It is suited mainly to large projects and assumes the use of a highly qualified workforce, supported by a sophisticated infrastructure.

The labour constants in this book have been developed by and obtained from leading sub-contractors by Steven Howard, who has owned and operated construction companies and been involved in process plant construction in Australia, Asia, Africa and the Pacific Islands.

Labour outputs allow for a high standard of workmanship particularly in the oil and gas areas, and the use of the most advanced technical plant currently available.

The compilers of this book would welcome any comments that readers may have or any additional information that may be beneficial to future editions.

INTRODUCTION

Charts and procedures in this book are those that have been developed from experience and used as a practical guide for tendering projects. Where actual figures are not available, an interpolation or extrapolation calculation has been adapted. For instance, if a 500mm (20") standard weight pipe takes 6.3 man hours to complete and the rate for a 550mm (22") is not listed, then by interpolation or extrapolation, a rate for this size becomes the circumference of the weld divided by the weld rate applied to the 550mm (22") pipe. Both pipes have a 9.53mm wall thickness, therefore the weld travel would be assumed to be the same.

This book provides information to allow an understanding of the processes and estimating criteria used in these industries and a better appreciation of production methods.

There are other publications available, all of which have their own methods of setting out installation times. The format of this book has been simplified to make it user-friendly. All the figures quoted are in man-hours per metre or man-hours per kilogram. Imperial measurements are included as secondary.

Project schedule comparisons of tendered man-hours versus actual man-hours and thousands of job time sheets, have been used to develop the man-hour references used in this book.

Discounting up to 30% from book figures has been acceptable for quotation purposes. This publication has been compiled to change this trend, providing fabrication times in varying levels from general purpose to high-end oil and gas projects.

Country efficiency factors for the man-hours in this publication are based on using primarily local workforces with expatriate supervision.

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PUBLISHER'S NOTE

While every effort has been made to ensure the accuracy of the information given in this publication, neither the editors nor the publishers in any way accept liability for loss of any kind resulting from the use of such information.

METAL PIPING

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PIPING

GENERAL

The piping section of this book allows for ease of use by giving as much information as possible rather than adding percentages for material types and differing processes associated with the fabrication. It also allows the easy transfer of this information which is given in spreadsheet format and as such, can be placed in a data base without seeking different disciplines of the fabrication requirement.

The material specific pages for carbon steel through to titanium materials, are used generally for piping estimates direct from the charts. There are more specific times for actions that allow the calculation of more precise data required for small projects or minor fabrication work, where averages are less accurate.

Two very different levels in the rates for pipe fabrication are included; they are listed as general purpose pipe and, oil and gas standard pipe. The times required to absorb all the methods, standards and degree of accuracy of the oil and gas industry are much greater than water pipe or gold mine type pipework. In very low pressure systems for slurry transportation and non-aggressive media, the focus is much less stringent than that of a gas compressor station, for example. In the gold and mineral sands industries, piping for mine process work rarely has a requirement for radiography, just a welding procedure, visual inspection and hydrotesting.

The non-destructive testing and quality assurance for gas pipework including carbon equivalent tests and inspection levels, etc., take up a great deal of time and can consume as much as the process itself.

It is essential to consider all the facts prior to tendering, assessing areas of low profitability and the reasons for this, so that a reasonable profit can be made.

ESTIMATING

The labour hours listed in the charts in the following chapters are for direct labour and working supervision for each task. They include unloading of the goods at the construction site, the hauling of each item to the work-front on the site, setting up the item for the task to be undertaken, through to the finished product. Project management and discipline supervisors (non-working) are not included in the hours. The manning levels for these positions as well as office backup staff and site clerical employees, should be considered.

These data charts have been compiled to calculate the actual physical working time it takes to complete each individual task, i.e. the direct labour. This will allow the calculation of the project duration and the total working man-hours involved in the project materials, transport, equipment, management, overheads and profit margin, etc., - should then be applied to the calculations.

PIPING (cont'd)

ESTIMATING (cont'd)

ADHERANCE TO THE BASIC PRINCIPALS IN THE EXPLANATORY NOTES WILL HELP ENSURE A SUCCESSFUL AND PROFITABLE PROJECT.

A good estimator should always be used and paid for, as this is the foundation of each tender. The reason that many projects give little return to contractors is that the basics of the project plan, the fundamental building block of the project - 'the estimate', is incorrect, incomplete or underestimated.

PIPING

GENERAL PURPOSE

DIAMETER/INCH RATE

NB Size mm	NB Size inch	Carbon Steel SCH40 STW			Carbon Steel SCH80		
		Shop Hours	Site Hours	Field In-situ Hours	Shop Hours	Site Hours	Site In-situ Hours
15	½"	0.80	1.05	1.95	0.91	1.19	2.21
20	¾"	0.80	1.05	1.95	0.91	1.19	2.21
25	1"	0.80	1.05	1.95	0.91	1.19	2.21
32	1¼"	0.80	1.05	1.95	0.91	1.19	2.21
40	1½"	0.80	1.05	1.95	0.91	1.19	2.21
50	2"	0.80	1.05	1.95	0.91	1.19	2.21
65	2½"	0.80	0.98	1.82	0.91	1.12	2.07
80	3"	0.80	0.94	1.82	0.85	1.06	2.07
100	4"	0.80	0.94	1.80	0.85	1.06	2.07
150	6"	0.80	0.90	1.80	0.85	1.06	2.07
200	8"	0.73	0.90	1.67	0.86	0.92	1.71
250	10"	0.73	0.90	1.67	0.86	0.92	1.71
300	12"	0.73	0.90	1.67	0.86	0.92	1.71
350	14"	0.73	0.90	1.67	0.86	0.92	1.71
400	16"	0.73	0.90	1.67	0.86	0.92	1.71
450	18"	0.73	0.90	1.67	0.86	0.92	1.71
500	20"	0.73	0.90	1.67	0.86	0.92	1.71
550	22"	0.73	0.90	1.67	0.86	0.92	1.71
600	24"	0.73	0.90	1.67	0.86	0.92	1.71
650	26"	0.73	0.90	1.67	-	-	-
700	28"	0.73	0.90	1.67	-	-	-
750	30"	0.73	0.90	1.67	-	-	-
800	32"	0.73	0.90	1.67	-	-	-
850	34"	0.73	0.90	1.67	-	-	-
900	36"	0.73	0.90	1.67	-	-	-
1050	42"	0.73	0.90	1.67	-	-	-

PIPING

Carbon Steel SCH160			Stainless Steel SCH40		
Shop Hours	Site Hours	Field In-situ Hours	Shop Hours	Site Hours	Site In-situ Hours
1.12	1.40	2.26	1.02	1.34	2.34
1.12	1.40	2.26	1.02	1.34	2.34
1.12	1.40	2.26	1.02	1.34	2.34
1.12	1.40	2.26	1.02	1.34	2.34
1.12	1.40	2.26	1.02	1.34	2.34
1.12	1.40	2.26	1.02	1.34	2.34
1.11	1.33	2.18	1.03	1.10	2.34
1.03	1.33	2.18	0.96	1.10	2.00
1.03	1.33	2.18	0.96	1.10	2.00
1.03	1.33	2.18	0.96	1.10	2.00
1.01	1.21	2.15	0.97	1.14	1.73
1.01	1.21	2.15	0.97	1.14	1.73
1.01	1.21	2.15	0.97	1.14	1.73
1.01	1.21	2.15	0.97	1.14	1.73
1.01	1.21	2.15	0.97	1.14	1.73
1.01	1.21	2.15	0.97	1.14	1.73
1.01	1.21	2.15	0.97	1.14	1.73
1.01	1.21	2.15	0.97	1.14	1.73
1.01	1.21	2.15	0.97	1.14	1.73
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-

PIPELINES

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PIPELINE INSTALLATION

PRE-CONSTRUCTION EXAMPLE

The pre-construction phase of the project will involve the following :

- Establish project management team
- Establish site facilities
- Establish communications systems and utilities
- Establish the construction camp
- Qualify all approved procedures related to welding and NDT
- Initiate pipeline easement pre-construction survey
- Mobilise project management and construction supervisory personnel
- Mobilise construction equipment and materials

SURVEY

Before construction can commence pipeline surveys are required. Firstly a proposed pipeline easement is defined, then a complete archaeological and environmental survey is to be completed and pipeline route adjusted accordingly to accommodate native heritage sites and environmentally sensitive areas.

Existing utilities need to be identified and clearly marked to allow for a management plan to be implemented.

The pipeline centre line route and right of way (easement) is them pegged.

SURVEY PROCEDURE

- Set out and peg limits of the right-of-way
- Set out the temporary fencing
- Set out and peg the pipeline offset
- Map and mark out changes to wall thickness and inline equipment
- Mark out existing buried services
- Survey trench centre line and profile

CREW CONFIGURATION : SURVEY

- Plant
- Survey Equipment - 1
- Vehicle - 1

LABOUR

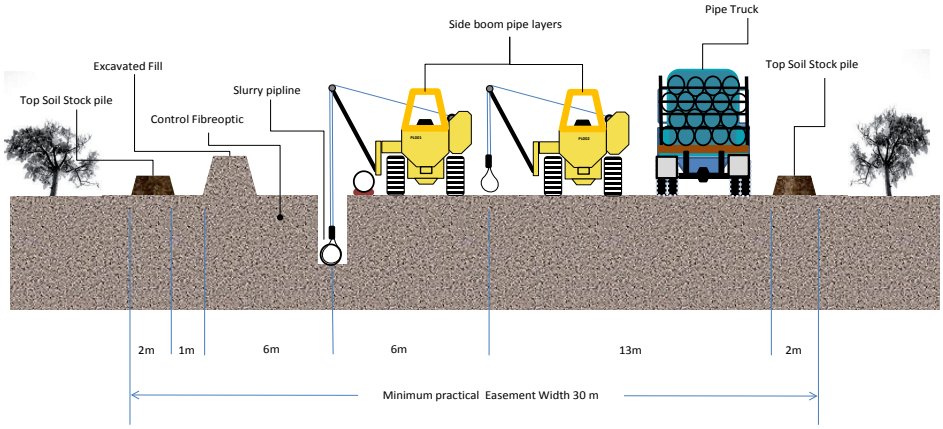
- Surveyor - 1
- Chainman - 1

PIPELINE INSTALLATION (cont'd)

CLEAR, GRUB AND GRADE

The easement development crew works well in advance of the pipe laying crews

- The establishment of the ROW which best facilitates the installation of the pipeline is critical
- In order to minimise disturbance, follow the natural contours and only remove topsoil from the trench line.
- Topsoil will be placed in a separate windrow for use during rehabilitation. The total working width will be limited to a cleared easement of 25 metres wide with a further 5 metres being available to stockpile cleared vegetation.



- This crew is firstly responsible for clearing trees, shrubs and undergrowth within the easement corridor.
- The trees and shrubs are stockpiled along the easement, timber is staked for collection while shrubs, smaller timber and undergrowth are shredded for use in rehabilitation or properly disposed of in agricultural areas.
- Topsoil is removed to a predetermined depth and stockpiled along the easement for use in rehabilitation.