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## 7. DESIGN GUIDE 1: BOLTING IN STRUCTURAL STEEL CONNECTIONS

This design guide revises the renowned third edition of Bolting of steel structures as Design Guide 1, now known as Bolting in Structural Steel Connections. The

former publication has been redeveloped into the new design guide format bringing the key designer reference material from the former appendices into the relevant sections of this design guide. New technological developments in the area of specialised direct tension measuring devices have been incorporated along with high strength structural blind bolts that are becoming a key component with the growing use of large closed sections in building construction. For this guide, international standards have been reviewed and global manufacturers of erection equipment investigated to provide updated guidance on the standard wrenches for determining erection clearances.

Structural designs are now leaner as a direct result of advanced analysis, design tools and the supply of higher strength structural members. This has increased bolt design actions, often making them the critical item in design. The most significant upgrade to this design guide lies in the area of bolt quality and certification along with the dimensional and mechanical properties of common structural assemblies. Minimising designer risk in certification of bolt quality is now a necessary process and a necessary duty of care in the structural design. All Australian standard high strength bolt assemblies are supplied from international sources following the increasing trend to reduce project costs through these commodity items. A simple checklist and guide have been developed to assist the designer in this design guide.

Following many ASI technical enquiries and feedback from the fabrication industry, Best Practice in bolt installation has been reinforced with warnings not to weld any heat treated high-strength bolt assemblies. There are very few bolt experts and designers have seldom dedicated courses at undergraduate level focusing on these key structural items. Bolts would have the least design time but generally play the key role and this design guide has been developed to consolidate the necessary bolt knowledge when using bolts in structural steel connections.

### Contents of Design Guide 1 include:

1	CONCEPT OF DESIGN GUIDES
1.1	Background
2	INTRODUCTION
3	CHARACTERISTICS OF STRUCTURAL BOLTS
3.1	Thread form
3.2	Bolt types
3.3	Identification
3.4	Commercial bolts
3.5	High strength structural bolts

3.6	Testing of bolts
3.7	Washers
3.8	Welding of bolts
3.9	Lock nuts
4	BOLTING CATEGORIES
5	BOLT LENGTH CONSIDERATIONS
5.1	Plain shank lengths
5.2	Threads included in shear plane
5.3	Threads excluded from shear plane
5.4	Discussion
6	DETAILING
6.1	Bolt holes
6.2	Limitations
7	INSTALLATION OF BOLTS
7.1	Introduction
7.2	Snug-tightening
7.3	Full tensioning methods
7.4	Part turn of nut method
7.5	Direct tension indication method
7.6	Issues with tensioning bolts
7.7	Clearances
7.8	Inspection of bolted connections
7.9	Blind bolts
8	CORROSION PROTECTION
8.1	Corrosion protection of bolts
8.2	Corrosion protection of interfaces
9	Certification to AS/NZS 1252:1996
10	REFERENCES
	APPENDIX
A	ASI Design Guide 1 comment form

## 8. DESIGN GUIDE 2: WELDING IN STRUCTURAL STEEL CONNECTIONS

Design Guide 2: Welding in Structural Steel Connections has been introduced into the ASI Connection Series as a complementary document to Design Guide 1: Bolting in Structural Steel Connections. The intention of Design Guide 2 is to act as a basic primer on all aspects of welding as applied to structural steel connections. Extensive reference is made to sources which can supply more detailed information - many of these references are more general and apply to fabricating in general using welding.

Design Guide 2 addresses the matters covered in Australian Standards with the exception of weld design which is dealt with in Handbook 1. This design guide discusses welding processes, consumables and

procedures in sufficient detail for the structural engineer to understand the basis of what occurs in a fabrication shop when connections are being fabricated. Welding in the fabrication shop and bolting onsite remain the key to economical structural steelwork.

Design Guide 2 also discusses the issues of workmanship, imperfections in welds, when imperfections become defects, how welds can be inspected and repair of welds.

### Contents of Design Guide 2 include:

1	CONCEPT OF DESIGN GUIDES
1.1	Background
2	INTRODUCTION
3	TYPES OF WELD
3.1	Weld types
3.2	Fillet welds
3.3	Butt welds
3.4	Edge preparations
3.5	Prequalified joint preparations
3.6	Standard weld symbols
4	WELDABILITY OF STEEL
5	WELDING PROCESSES
5.1	Introduction
5.2	Fusion welding process
5.3	Terminology
5.3.1	Weld metal
5.3.2	Partially mixed weld metal
5.3.3	Fusion (boundary) line
5.3.4	Heat-affected zone
5.3.5	Multi-run welds
5.4	Manual metal arc welding
5.5	Gas metal arc welding and flux cored arc welding
5.6	Summary of characteristics of welding processes
5.7	Welding positions
6	WELDING CONSUMABLES
6.1	Manual metal arc welding
6.2	Gas metal arc welding
6.3	Flux cored arc welding
6.4	Prequalified welding consumables
7	WELDING PROCEDURES
7.1	Qualification of a welding procedure
7.2	Prequalified welding procedure
7.3	Qualification by testing
7.4	Requalification of welding procedures