

Contents

| | |
|--------------------------------------------------------------------------------------------------------------------|-----------|
| Foreword | VIII |
| Acknowledgements..... | VIII |
| Abbreviations/Acronyms used in this Guide..... | IX |
| 1 Background | 1 |
| 2 Scope..... | 3 |
| 2.1 Exclusions..... | 3 |
| 2.2 Alternative Criteria | 3 |
| 3 Basis of Design..... | 5 |
| 3.1 As-Welded Applications | 5 |
| 3.1.1 As-welded residual Stress | 5 |
| 3.1.2 Applied Stress | 5 |
| 3.1.3 Minimum Flaw Size..... | 5 |
| 3.1.4 Fracture Toughness..... | 6 |
| 3.1.5 Application | 6 |
| 3.2 Charpy Impact Exemption Curves..... | 7 |
| 3.3 PWHT Applications | 7 |
| 4 Application Methods..... | 9 |
| 4.1 Method A – Determine the MDMT | 9 |
| 4.2 Method B – Define maximum as-welded thickness against fixed Charpy test temperature depression values | 11 |
| 5 Additional Impact Energy Benefit..... | 13 |
| APPENDIX A Direct Calculation of temperature depression..... | 14 |
| APPENDIX B Impact test exemption curves: SI Units | 15 |
| B.1 SMYS=30ksi (207MPa)..... | 16 |
| B.2 SMYS=35ksi (241MPa)..... | 17 |
| B.3 SMYS=40ksi (276MPa)..... | 18 |
| B.4 SMYS=50ksi (345MPa)..... | 19 |
| B.5 SMYS=60ksi (414MPa)..... | 20 |

| | |
|-------------------------------------------------------------------|-----------|
| APPENDIX C Impact test exemption curves: US Customary Units | 21 |
| C.1 SMYS=30ksi (207MPa) | 22 |
| C.2 SMYS=35ksi (241MPa) | 23 |
| C.3 SMYS=40ksi (276MPa) | 24 |
| C.4 SMYS=50ksi (345MPa) | 25 |
| C.5 SMYS=60ksi (414MPa) | 26 |
| APPENDIX D Impact tested curves: SI Units | 27 |
| D.1 SMYS=30ksi (207MPa)..... | 28 |
| D.2 SMYS=35ksi (241MPa)..... | 29 |
| D.3 SMYS=40ksi (276MPa)..... | 30 |
| D.4 SMYS=50ksi (345MPa)..... | 31 |
| D.5 SMYS=60ksi (414MPa)..... | 32 |
| APPENDIX E Impact tested curves: US Customary Units..... | 33 |
| E.1 SMYS=30ksi (207MPa)..... | 34 |
| E.2 SMYS=35ksi (241MPa)..... | 35 |
| E.3 SMYS=40ksi (276MPa)..... | 36 |
| E.4 SMYS=50ksi (345MPa)..... | 37 |
| E.5 SMYS=60ksi (414MPa)..... | 38 |
| APPENDIX F Worked examples..... | 39 |
| F.1 Example A: Impact test exemption..... | 39 |
| F.2 Worked Example B: Impact tested material | 40 |
| F.3 Example C: Sub size specimen..... | 42 |
| F.4 Example D: Sub size specimen | 44 |
| References | 46 |
| Bibliography..... | 47 |

List of Figures

| | | |
|--------------|----------------------------------------------------------------|----|
| Figure 1: | MDT Vs CVN Impact test temperature | 2 |
| Figure B-1: | Impact test exemption – 207MPa (30ksi) yield – as welded. | 16 |
| Figure B-2: | Impact test exemption – 207MPa (30ksi) yield – PWHT. | 16 |
| Figure B-3: | Impact test exemption – 241MPa (35ksi) yield – as welded. | 17 |
| Figure B-4: | Impact test exemption – 241MPa (35ksi) yield – PWHT. | 17 |
| Figure B-5: | Impact test exemption – 276MPa (40ksi) yield – as-welded..... | 18 |
| Figure B-6: | Impact test exemption – 276MPa (40ksi) yield – PWHT. | 18 |
| Figure B-7: | Impact test exemption – 345MPa (50ksi) yield – as welded. | 19 |
| Figure B-8: | Impact test exemption – 345MPa (50ksi) yield – PWHT. | 19 |
| Figure B-9 | Impact test exemption – 414MPa (60ksi) yield – as welded. | 20 |
| Figure B-10: | Impact test exemption – 414MPa (60ksi) yield – PWHT. | 20 |
| Figure C-1: | Impact test exemption – 30ksi (207MPa) yield – as welded. | 22 |
| Figure C-2: | Impact test exemption – 30ksi (207MPa) yield – PWHT. | 22 |
| Figure C-3: | Impact test exemption – 35ksi (241MPa) yield – as welded. | 23 |
| Figure C-4: | Impact test exemption – 35ksi (241MPa) yield – PWHT. | 23 |
| Figure C-5: | Impact test exemption – 40ksi (276MPa) yield – as-welded..... | 24 |
| Figure C-6: | Impact test exemption – 40ksi (276MPa) yield – PWHT. | 24 |
| Figure C-7: | Impact test exemption – 50ksi (345MPa) yield – as welded. | 25 |
| Figure C-8: | Impact test exemption – 50ksi (345MPa) yield – PWHT. | 25 |
| Figure C-9: | Impact test exemption – 60ksi (414MPa) yield – as welded. | 26 |
| Figure C-10: | Impact test exemption – 60ksi (414MPa) yield – PWHT. | 26 |
| Figure D-1: | Impact tested curve – 207MPa (30ksi) yield – as welded..... | 28 |
| Figure D-2: | Impact tested curve – 207MPa (30ksi) yield – PWHT. | 28 |
| Figure D-3: | Impact tested curve – 241MPa (35ksi) yield – as welded..... | 29 |
| Figure D-4: | Impact tested curve – 241MPa (35ksi) yield – PWHT. | 29 |
| Figure D-5: | Impact tested curve – 276MPa (40ksi) yield – as welded..... | 30 |
| Figure D-6: | Impact tested curve – 276MPa (40ksi) yield – PWHT..... | 30 |
| Figure D-7: | Impact tested curve – 345MPa (50ksi) yield – as welded..... | 31 |
| Figure D-8: | Impact tested curve – 345MPa (50ksi) yield – PWHT. | 31 |
| Figure D-9: | Impact tested curve – 414MPa (60ksi) yield – as welded..... | 32 |
| Figure D-10: | Impact tested curve – 414MPa (60ksi) yield – PWHT. | 32 |
| Figure E-1: | Impact tested curve – 30ksi (207MPa) yield – as welded..... | 34 |
| Figure E-2: | Impact tested curve – 30ksi (207MPa) yield – PWHT. | 34 |
| Figure E-3: | Impact tested curve – 35ksi (241MPa) yield – as welded..... | 35 |
| Figure E-4: | Impact tested curve – 35ksi (241MPa) yield – PWHT. | 35 |
| Figure E-5: | Impact tested curve – 40ksi (276MPa) yield – as welded..... | 36 |
| Figure E-6: | Impact tested curve – 40ksi (276MPa) yield – PWHT. | 36 |
| Figure E-7: | Impact tested curve – 50ksi (345MPa) yield – as welded..... | 37 |
| Figure E-8: | Impact tested curve – 50ksi (345MPa) yield – PWHT. | 37 |

| | |
|-------------------------------------------------------------------------|----|
| Figure E-9: Impact tested curve – 60ksi (414MPa) yield – as welded..... | 38 |
| Figure E-10: Impact tested curve – 60ksi (414MPa) yield – PWHT..... | 38 |

List of Tables

| | |
|-----------------------------------------------------------------------------------------------------------------|----|
| Table 1: Charpy Temperature Depression vs. Control Thickness (US Customary Units)..... | 9 |
| Table 2: Charpy Temperature Depression vs. Control Thickness (SI Units) | 10 |
| Table 3: Maximum As-Welded Control Thickness [in] vs Charpy Temperature Depression (US Customary Units)..... | 11 |
| Table 4: Maximum As-Welded Thickness [mm] vs Charpy Temperature Depression (SI Units) | 12 |