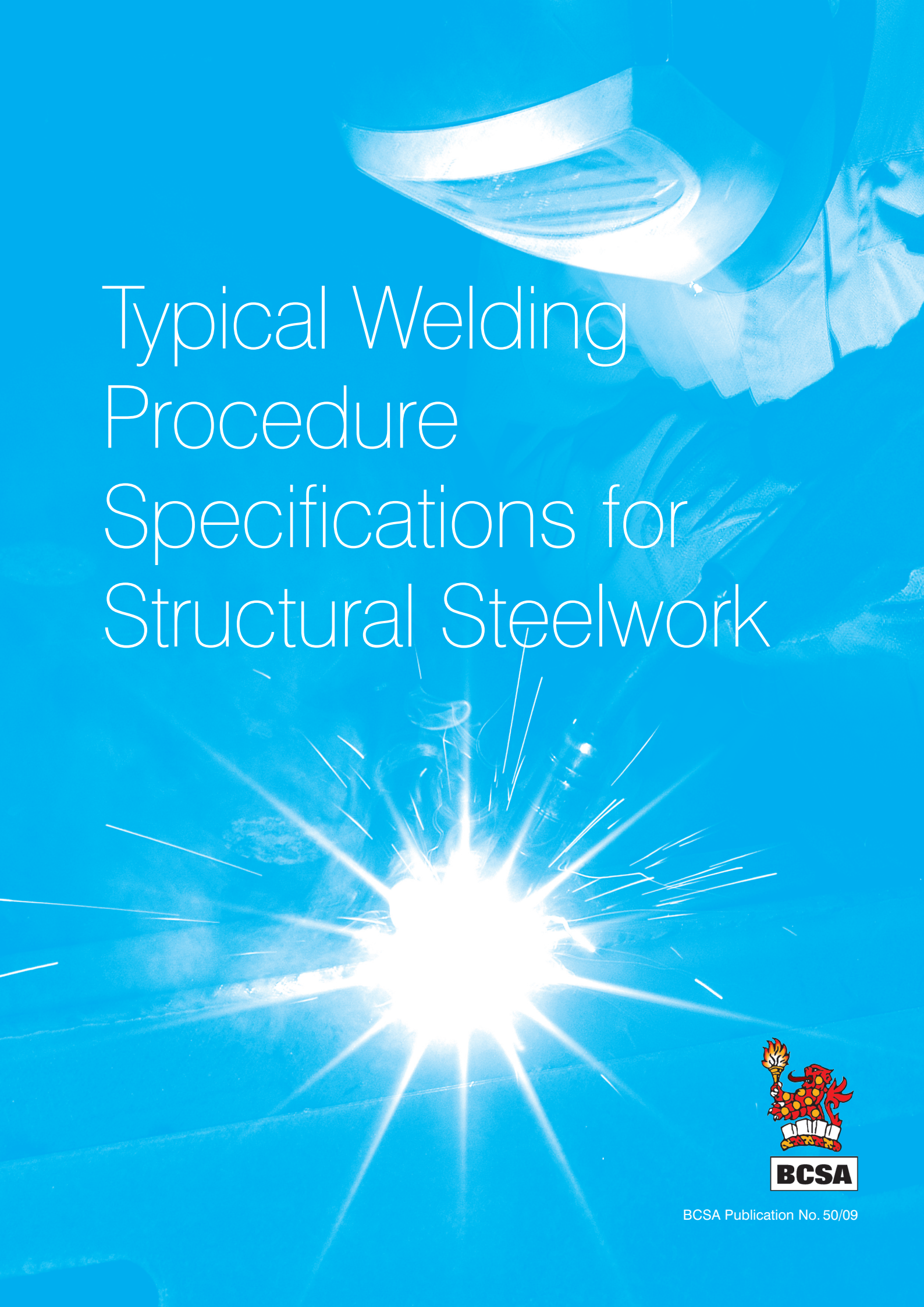

# Typical Welding Procedure Specifications for Structural Steelwork

BCSA

BCSA Publication No. 50/09

# Typical Welding Procedure Specifications for Structural Steelwork


BCSA Publication No. 50/09

# The British Constructional Steelwork Association Limited



The British Constructional Steelwork Association Limited was formed in 1906 and is the national organisation for the steel construction industry; its Member companies undertake the design, fabrication and erection of steelwork for all forms of construction in building and civil engineering; its Associate Members are those principal companies involved in the direct supply to all or some Members of components, materials or products. Corporate Members are clients, professional offices, etc which support the development of national specifications, design, fabrication and erection techniques, and overall industry efficiency and best practice.

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Dr David Moore - BCSA
Mr David Brown - SCI

# Contents

# 1 Foreword

This publication has been prepared with the aim of simplifying and standardising welding procedures used in structural steelwork. The need for such a document was first identified some years ago by a group of welding engineers, steelworks contractors, metallurgists and industry experts and a draft document was produced outlining how this might be achieved and the range of variables which typically needed to be considered. This publication draws on the wealth of experience, knowledge and work put in to the early document and has been updated to reflect current welding practice, standards and specifications.

This document contains 14 preliminary Welding Procedure Specifications (pWPS) as defined in BS EN ISO 15614-1, and 40 partially completed Welding Procedure Specifications (WPS), called typical WPS in this document. The pWPS have been identified as those required to support the necessary welding procedure tests on the route to qualifying the typical WPS. The typical WPS have been chosen to cover the majority of WPS required for the welding of structural steelwork for buildings and bridges. They cover weld types ranging from simple fillet welds to the more difficult butt welds made from one side, with backing.

To assist the user the weld types are placed in five categories where, in general terms, the skill level required by the welder increases the higher the category number. The categories are as follows:

Category 1: Fillet welds only (PA, PB positions)

Category 2: Fillet welds only (PA, PB and PF positions)

Category 3: Fillet welds (PA, PB positions); butt welds made from two sides in the PA position

Category 4: Fillet welds (PA, PB and PF positions); butt welds made from two sides in the PA position

Category 5: Fillet welds (PA, PB and PF positions); butt welds made from two sides or with permanent backing in the PA, PC and PF positions

Depending on contract requirement and welder competence, a steelwork contractor may select the appropriate range of weld types to be approved and the associated pWPS. More details on the choice of pWPS are given in Section 3.3 “How to use this document”.

The five categories are recommendations; a steelwork contractor is at liberty to choose a different selection of pWPS resulting in a different range of approved WPS.

# 2 Scope

This document is intended for use by steelwork contractors, welding engineers and inspectors, and those actively involved in welding and welding technology. Familiarity with BS EN ISO 15614, BS EN 287, and the welding principles contained in BS EN 1011 is required. Structural capacity checking and weld inspection are not addressed in this document.

This document contains 14 preliminary Welding Procedure Specifications (pWPS) written in accordance with the requirements of BS EN ISO 15609-1. They cover the welding of plate and rolled sections up to 25mm thick in carbon manganese structural steels to BS EN 10025, with a maximum carbon equivalent value (CEV) of 0.45[1] (see BS EN 1011-2 Clause C.2.1). The maximum combined thickness is limited to 75mm.

The welding process is solid wire partly mechanised Metal-arc Active Gas (MAG), process 135 in BS EN ISO 4063. It is assumed that preparation, control and use of a suitable consumable will achieve a hydrogen content of 5ml/100g or below in the deposited weld metal i.e. Scale D in BS EN 1011-2, Table C.2. In order to achieve the required hydrogen content, the steelwork contractor should ensure that consumables are stored and used in accordance with manufacturers' recommendations - i.e. they should be kept clean, dry and free from contamination.

The welding parameters proposed in the pWPS are designed to produce welds which meet the mechanical requirements of BS EN 10025 steel grades up to and including S355J2; with a minimum Charpy impact value of 27J at -20°C.

Restriction on the CEV, material thickness and hydrogen Scale D results in procedures which do not require pre-heating. Appendix A demonstrates how this has been achieved, and the effect of alternative hydrogen scales.

This document also contains 40 partially completed WPS which have been prepared for general application in the welding of structural steelwork for buildings and bridges. The partially completed WPS require welding procedure tests and Welding Procedure Qualification Records (WPQR) to be completed before they may be used.

When qualified in accordance with the requirements of BS EN ISO 15614-1, some of the pWPS in this document would qualify parent metal thicknesses up to and including 30mm. However, using the welding parameters suggested, a thickness limitation of 25mm is applied so as to avoid the requirement for preheating. Should a steelwork contractor choose to develop Welding Procedure Specifications (WPS) outside the scope of this document i.e. utilising the full extent of approval, the requirements for preheating must be reviewed.

The proposed details may not be appropriate in all circumstances (such as arrangements with a high degree of restraint, or butt welds without backing in relatively thin materials) nor is the performance of welds completed in accordance with these details guaranteed.

Vertical-down (PG) and overhead (PE butt and PD fillet) welding are excluded from the procedures in this document.

[1] The WPS in this document are based on using steel with a CEV of 0.45, since this is the maximum allowable in BS EN 10025 for grade S355 steels $\leqslant$ 30mm thick. However, reputable steel makers typically supply products with CEV's lower than the specified maximum. In light of this, when developing WPS outside the scope of this document, a steelwork contractor may wish to consider purchasing steel with a CEV lower than the maximum to accommodate a greater thickness range without the requirement for preheating. Specifying a maximum CEV of 0.43 may not be unreasonable for S275 and S355 grade steels.

# 3 Typical Welding Procedures

## 3.1 Introduction

Steelwork contractors have, traditionally, tended to develop and qualify welding procedures on a contract by contract basis as a specific need arises. Whilst this has resulted in an extensive range of available welding procedures within the industry, there is evidence to suggest that this has resulted in a considerable amount of duplication and, perhaps more importantly, unnecessary cost.

A careful assessment of workshop welding activities at a typical steelwork contractor would identify a limited number of variables and the potential for adopting a rationalised range of welding procedures. The advantages of which would be as follows:

- a broad range of welds may be covered by a few carefully prepared procedures
- these procedures may be qualified using a limited range of procedure qualification tests
- standard weld preparations in terms of included angle, root face and root gap considerably improve the probability of achieving the required weld quality
- when the weld preparations are standard, the chances of identifying incorrect preparations before fabricating and welding is improved
- use of standard welding conditions generates consistent quality and can give greater control of production costs

This document is aimed at providing the framework for a steelwork contractor to develop and qualify rationalised welding procedures, appropriate to its range of welding activities, in accordance with the requirements of BS EN ISO 15614-1.

## 3.2 Basis of the system

The system of preliminary Welding Procedure Specifications (pWPS) and partially completed WPS contained in this document has been developed to meet the requirements of the majority of workshop fabrication for steel buildings and bridges.

The welding details have been developed for the standard grades of structural steels, S275 and S355 up to and including sub-grade J2, using the Metal-arc Active Gas (MAG) process. Joint configurations and welding positions have been chosen to meet the majority of practical requirements.

The joint details have been so arranged such that up to a specified maximum combined thickness, (the sum of the parent metal thicknesses averaged over a distance of 75mm from the weld line) preheat is not required. This assumes that the shop floor preparation and control is sufficient to eliminate hydrogen-generating contaminants such as oil, grease, rust and condensation, to reduce the possibility of hydrogen-induced cracking. The maximum material thickness is limited to 25mm and the maximum combined thickness to 75mm.

Guidance on the Metal-arc Active Gas process is given in Appendix B

## 3.3 Qualification of Welding Procedure Specifications to BS EN ISO 15614-1

This document is intended to assist steelwork contractors to develop qualified Welding Procedure Specifications (WPS) for use in the fabrication workshop. The method of qualification is by welding procedure tests to BS EN ISO 15614-1.

In general, qualification of a WPS to BS EN ISO 15614-1 requires the steelwork contractor to:

1. Determine the range of weld joints to be qualified (i.e. thickness, configuration etc.)
2. Prepare a preliminary welding procedure specification (pWPS) - which is assumed to be adequate. These are prepared in accordance with BS EN ISO 15609-1, using previous experience and the general fund of knowledge of welding technology.
3. Carry out a welding procedure test to prove the feasibility of the procedure described in the pWPS. Details of the test pieces and the necessary destructive tests and non-destructive examinations are described in BS EN ISO 15614-1.
4. Prepare a welding procedure qualification record (WPQR) detailing the actual welding parameters and other relevant data from the welding procedure test together with the results of the destructive testing and non-destructive examination.
5. Use the WPQR data to prepare Welding Procedure Specifications (WPS) within the ranges of qualification given in BS EN ISO 15614-1.

Figure 3.1 shows how these steps relate to the information given in this document:

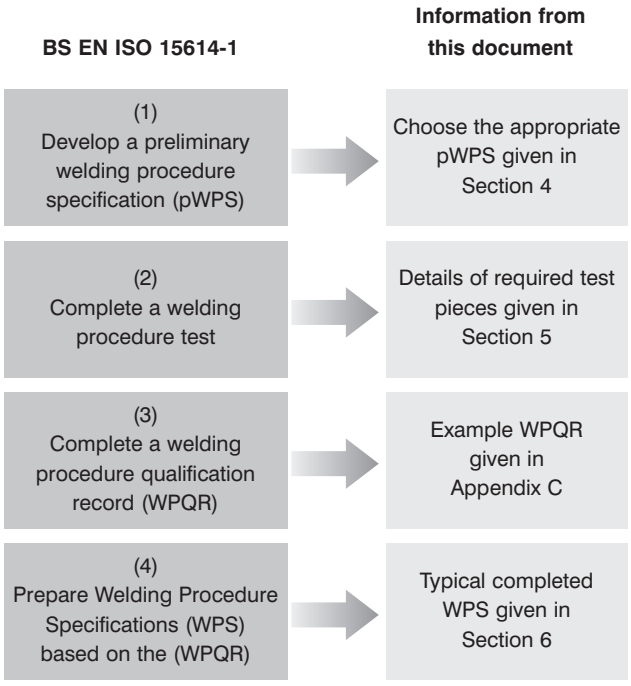



**Figure 3.1 Method of qualifying welding procedures to BS EN ISO 15614-1**

## 3.4 How to use this document

**A steelwork contractor using this document should:**

1. Decide which weld types best suit its welding activities from the five recommended categories given in Table 3.1. This decision should generally be based on product range, contract requirements, welder competence, anticipated future requirements and whether or not the steelwork can typically be turned so that all welding is carried out in the flat (PA) or horizontal vertical (PB) position. If the steelwork cannot be turned, a higher category will be required to cover the positional limitations in BS EN ISO 15614-1.

   The degree of difficulty in producing satisfactory welds increases with the higher the category number selected. Equally, the anticipated need for the additional weld types decreases. For example, whilst all steelwork contractors will require approval for fillet welds, fewer joints are welded as single sided butt welds with backing.

| Category | pWPS | Qualification Range |
|---|---|---|
| 1 | 01p, 02p, 03p, 04p | Fillet welds only in PA and PB positions |
| 2 | 01p, 02p, 03p, 04p, 05p, 06p, 07p, 08p | Fillet welds only in PA, PB and PF positions |
| 3 | 01p, 02p, 03p, 04p | Fillet welds in PA and PB positions |
| | 09p, 10p | Two sided butt welds in the PA position |
| 4 | 01p, 02p, 03p, 04p, 05p, 06p, 07p, 08p | Fillet welds in PA, PB and PF positions |
| | 09p, 10p | Two sided butt welds in the PA position |
| 5 | 01p, 02p, 03p, 04p, 05p, 06p, 07p, 08p | Fillet welds in PA, PB and PF positions |
| | 09p, 10p | Two sided butt welds in the PA position |
| | 11p, 12p, 13p, 14p | Butt welds with backing in PC and PF positions |

**Table 3.1 Category, pWPS and qualification range**

2. Using the pWPS identified within the chosen category in Table 3.1, carry out welding procedure test pieces witnessed by an appropriate examiner / examining body and have these tested in accordance with the requirements given in BS EN ISO 15614-1. The pWPS may be modified to reflect individual workshop practice.
3. Collate and review the mechanical and non-destructive testing results provided by the test laboratory and, if acceptable, complete the appropriate Welding Procedure Qualification Record (WPQR) documentation to support the procedure tests. Depending on the contractual arrangements, the WPQR documentation might be completed by either the steelwork contractor's Responsible Welding Coordinator or the examiner / examining body. An example of a completed WPQR is given in Appendix C.
4. Using Table 6.1 in Section 6, select the relevant partially completed WPS(s) qualified by the chosen category and complete them by, if necessary, revising the welding parameters and adding the appropriate WPQR reference number. A number of WPS may be prepared based on one or more WPQR, according to the ranges permitted in BS EN ISO 15614-1.

# 4 Preliminary Welding Procedure Specifications (pWPS)

## 4.1 pWPS sheets

For consistency and ease of use, the format of the pWPS, and subsequent WPS, is based on the example given in Annex A of BS EN ISO 15609-1. Section 4 contains 14 preliminary Welding Procedure Specifications (pWPS). Table 3.1 in Section 3 shows the selection of pWPS which, when completed, tested, examined and qualified, allow the completion and provide qualification of the WPS contained in Section 6. The pWPS are placed in categories based upon level of complexity and, as such, the steelwork contractor may elect to qualify whichever category it considers most appropriate for its product range.

The details given on the pWPS are described in the following sections.

### *Location*

Stating 'Workshop' or 'Site' will generally suffice unless the steelwork contractor operates from a number of different workshop / site locations then the site reference should be specified.

### *WPS number*

Procedures are presented in numerical order followed by the letter (p) to signify that they are preliminary and require qualification.

### *WPQR*

The WPQR number is not applicable since the welding procedure is only at the preliminary stage and, as such, is unqualified.

### *Manufacturer*

The procedures state 'to be confirmed'. When a manufacturer chooses to qualify a particular pWPS then the manufacturer's own name, address etc. should be entered here.

### *Welder's name*

Each of the pWPS states 'to be confirmed'. Whilst there is typically no requirement to specify the welder's name on a WPS, it may be prudent to do so on a pWPS since the welder who satisfactorily undertakes the welding procedure qualification test is automatically qualified within the range of qualification given in BS EN 287.

### *Welding process*

On each pWPS the welding process is given its numeric reference number according to BS EN ISO 4063 along with its standard abbreviation (i.e. 135 - MAG)

### *Joint type*

Each pWPS specifies the type of joint and whether it is to be welded single or double sided, with or without backing etc.

### *Method of preparation and cleaning*

Each pWPS specifies thermal cut and or grinding, wire brush and degrease if required. Thermal cut could be plasma, laser or oxy-fuel gas cutting. The method of preparation should be that most suited to the steelwork contractor's environment, equipment and working practices. Whichever method is selected, care should be taken to ensure that all fusion faces are clean and free from oil, grease, scale and other contaminants which may be detrimental to the welding process.

If a steelwork contractor's normal procedure is to weld materials which have been coated with a prefabrication primer, the test pieces used to qualify the Welding Procedure Specification (WPS) should be coated accordingly. It should be noted that welding material coated in this way may invalidate the assumption that Scale D hydrogen levels will be achieved (see Pre-heat temperature on page 10). If welding pre-coated material, hydrogen levels in the deposited weld metal should be determined by test in accordance with BS EN ISO 3690.

### *Parent material designation*

BS EN 10025 S355J2 steel with a maximum Carbon Equivalent Value (CEV) of 0.45 is specified for the pWPS, as successful tests in this material will also cover steels of lower yield strength and the sub-grades JR and J0.

### *Material thickness*

The material thickness specified is the actual thickness to be used during qualification of the pWPS.

### *Outside diameter*

Each pWPS states 'not applicable' since they are all designed for use on plate.

### *Welding position*

Welding positions are described by the BS EN ISO 6947 designation. The correspondence between these and the American Welding Society (AWS) designations is shown in Table 4.1. The pWPS in Section 4 cover welding in the PA, PB, PC and PF positions.

| Weld Type | Position | Designation | |
|---|---|---|---|
| | | BS EN | AWS |
| Butt | Flat | PA | 1G |
| | Horizontal | PC | 2G |
| | Vertical downwards | PG | 3G |
| | Vertical upwards | PF | 3G |
| | Overhead | PE | 4G |
| Fillet | Flat | PA | 1F |
| | Horizontal vertical | PB | 2F |
| | Vertical downwards | PG | 3F |
| | Vertical upwards | PF | 3F |
| | Horizontal overhead | PD | 4F |

**Table 4.1 Comparison of BS EN and AWS weld position designations**

Figure 4.1 Illustrates the designated positions for plates and open sections

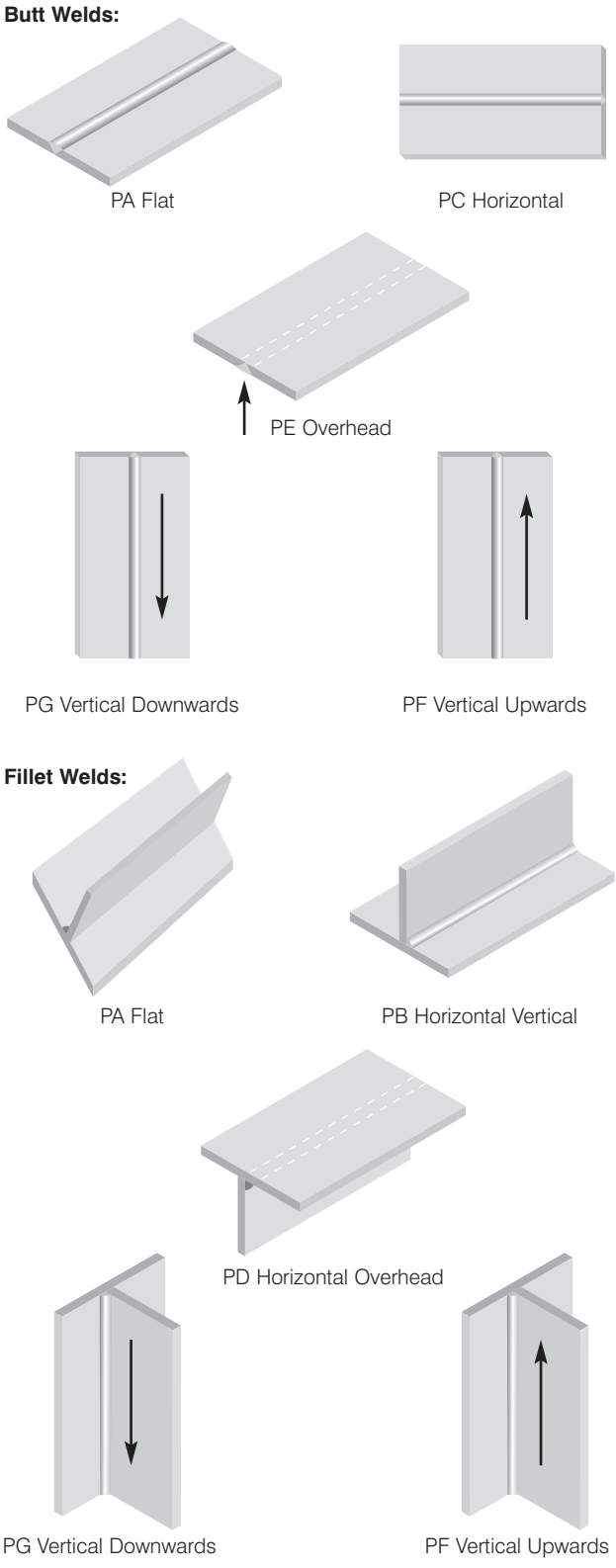



**Figure 4.1 Welding positions according to BS EN ISO 6947**

### *Joint design*

A sketch of the joint preparation is given on each pWPS. This typically includes such items as the material dimensions, root gap, root face, included angle etc. The preparations indicated generally conform to the requirements of BS EN ISO 9692-1: 2003.

### *Welding Sequence*

A sketch of the welding sequence is given. This shows the intended deposition sequence, run number(s) and any dimensional requirements.

### *Run*

Each weld run is given a number that is linked to the welding sequence sketch.

### *Process*

The MAG process is identified as process 135 in BS EN ISO 4063.

### *Size of filler metal*

The wire electrode size stated in the pWPS is that considered most appropriate to cover the proposed range of material thicknesses. If an alternative wire electrode size is required to suit a particular environment (i.e. where the work is predominantly on thin sections or where extensive positional welding is envisaged) the welding procedure qualification test should be undertaken using a wire diameter most suited to that application.

### *Welding parameters*

The welding parameters, travel speeds, wire feed rates etc. given on the pWPS are taken from previously qualified welding procedures and are thus considered appropriate for the joint configurations and material thicknesses they are assigned to. The specified heat inputs are calculated using the formula given in BS EN 1011-1. It is recognised however, that alternative welding parameters and conditions could be used to achieve successful welding. In view of this, when carrying out welding procedure qualification tests, the steelwork contractor should not be precluded from selecting alternative parameters and welding conditions to suit working practices that are already established. The welding procedure qualification test should be based on a revised pWPS.

### *Filler metal classification and trade name*

The consumable classification given in the pWPS is BS EN ISO 14341: G3Si1. This is the equivalent classification given in the old BS 2901-1 Type A18. Whilst not a specific requirement of BS EN ISO 15614-1 for solid wires, it is recommended that the consumable trade name should be confirmed by the steelwork contractor during the procedure qualification test.

### *Any special baking or drying*

There are no special drying or baking requirements for solid wires. They should, however, be kept clean, dry and stored in accordance with manufacturers' recommendations.

### *Gas/flux: - shielding / backing*

In accordance with as BS EN ISO 15614-1, qualification given to the shielding gas used in the welding procedure test is restricted to the symbol of the gas according to BS EN ISO 14175. The shielding gas adopted in the pWPS, BS EN ISO 14175 M26 (Argon / 20%$CO_2$ / 2%$O_2$), is a general purpose gas composition commonly used for the range of thicknesses proposed in the pWPS. However, other similar compositions could be used. The chosen gas composition should be specified on the pWPS and used in the welding procedure qualification test.

### *Shielding gas flow rate*

The pWPS give a range of shielding gas flow rates typical of those normally used with the proposed welding parameters.

### *Tungsten electrode type / size*

Each pWPS states 'not applicable' since this is not relevant to the MAG process.

### *Details of back gouging / backing*

The term back gouging is used to cover all means of removing material from the second side of a welded joint back to sound metal. It includes all forms of gouging techniques i.e. arc/air, plasma, grinding etc. In those pWPS where back gouging is required, it is recommended that some form of NDT is applied before completing the second side weld (i.e. Magnetic particle inspection or liquid penetrant testing).

### *Preheat temperature*

The welding procedures within this document are limited to a maximum material thickness of 25mm (75mm maximum combined thickness) to eliminate the requirements for preheating. It should be noted, however, that this is based on the following assumptions:

- a workpiece temperature of at least 0°C
- the control applied to the weld preparation, welding process and consumables will achieve a diffusible hydrogen content of 5 ml/100 g or below (i.e. scale D in BS EN 1011 Table C.2) in the deposited weld metal.

Combined thicknesses greater than 75 mm are outside the scope of this document.

### *Interpass temperature*

For certain types of steel too high an interpass temperature may have an undesirable affect on notch toughness in the heat affected zone, or may cause an alteration of properties produced by a previous heat treatment of the steel.

The maximum interpass temperature stated on the pWPS (250°C) is based on recommended good practice for Group 1 type steels. However, in accordance with BS EN ISO 15614-1, the upper limit of approval is the nominal maximum interpass temperature reached during the welding procedure test.

### *Post-weld heat treatment and / or ageing*

Each pWPS states 'not applicable'. Post-weld heat treatment on Group 1 type steels used in buildings and bridges is generally not required and, as such, is outside the scope of this document.

### *Time, temperature, method*

Each pWPS states 'not applicable' since this relates to the control of parameters for the post-weld heat treatment.

### *Heating and cooling rates*

Each pWPS states 'not applicable' since this relates to the control of parameters for the post-weld heat treatment.

### *Other information*

Each pWPS contains additional general information relevant to successful implementation of the procedure. It typically includes the recommended nozzle diameter on the welding torch, the method for checking the interpass temperature, any specific in-process non-destructive testing requirements and the required weld finish.

### *For manufacturer*

Each pWPS states 'RWC's Signature'. When a steelwork contractor chooses to qualify a WPS, the Responsible Welding Coordinator (RWC) is required to sign and date the pWPS so as to verify that the proposed welding parameters are considered suitable and that the subsequent range of qualification will be adequate for the intended future application.

### *For examiner / examining body*

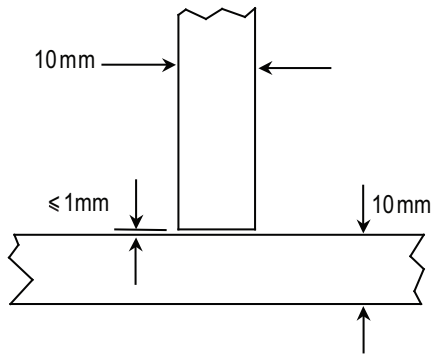
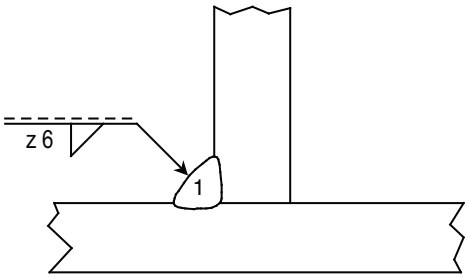
Each pWPS states 'to be confirmed'. The examiner / examining body who witnesses the welding procedure qualification test should sign and date this once the pWPS is revised to reflect the actual welding parameters used in the tests; at which time the pWPS will become part of the documentation used to support the WPQR.

# preliminary Welding Procedure Specification (pWPS)

**Location:** Workshop
**Manufacturer's Welding Procedure Specification No:** 01p
**WPQR:** N/A*
**Manufacturer:** To be confirmed

**Welder's Name:** To be confirmed
**Welding Process:** 135 (MAG)
**Joint Type:** Fillet Weld (Single or Double Sided)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S355 J2 (Max CEV = 0.45)
**Material Thickness:** 10mm
**Outside Diameter:** N/A
**Welding Position:** PB (Horizontal - Vertical)

| Joint Design | Welding Sequence |
|---|---|
|  |  |





Dimension z = Fillet weld leg length in mm

**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| 1 | 135 (MAG) | 1.2 | 270 - 290 | 29 - 31 | DC +ve | 7.5 - 8.3 | 320 - 340 | 1.1 - 1.3 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3 Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum |
| **Interpass Temperature** | N/A |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:** Nozzle diameter = 16mm.
Weld finish to be left as-welded.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
To be confirmed

*N/A = Not Applicable

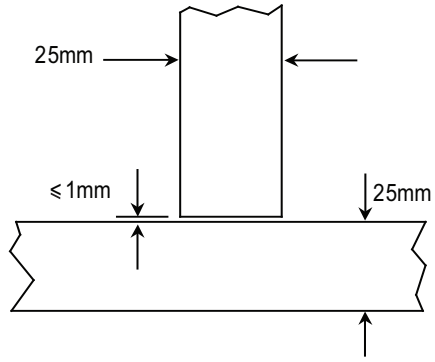
# preliminary Welding Procedure Specification (pWPS)

**Location:** Workshop
**Manufacturer's Welding Procedure Specification No:** 02p
**WPQR:** N/A*
**Manufacturer:** To be confirmed

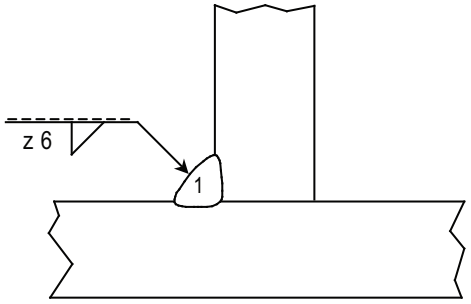
**Welder's Name:** To be confirmed
**Welding Process:** 135 (MAG)
**Joint Type:** Fillet Weld (Single or Double Sided)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S355 J2 (Max CEV = 0.45)
**Material Thickness:** 25mm
**Outside Diameter:** N/A
**Welding Position:** PB (Horizontal - Vertical)

**Joint Design**




**Welding Sequence**




Dimension z = Fillet weld leg length in mm

**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| 1 | 135 (MAG) | 1.2 | 290 - 310 | 29 - 31 | DC +ve | 8.3 - 9.0 | 300 - 330 | 1.2 - 1.5 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3 Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum |
| **Interpass Temperature** | N/A |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:** Nozzle diameter = 16mm.
Weld finish to be left as-welded.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
To be confirmed

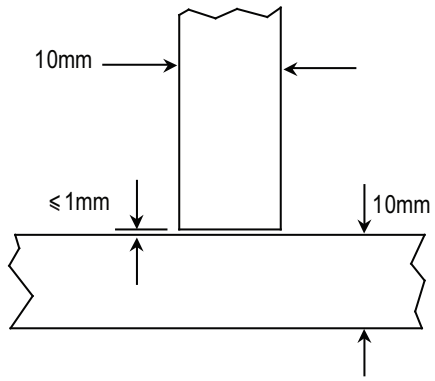
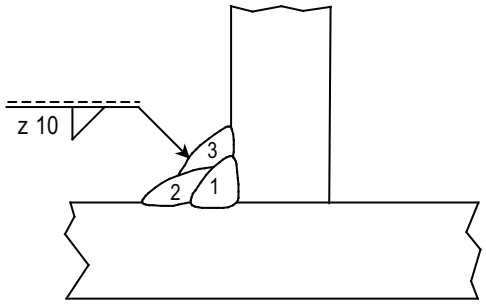
*N/A = Not Applicable

# preliminary Welding Procedure Specification (pWPS)

**Location:** Workshop
**Manufacturer's Welding Procedure Specification No:** 03p
**WPQR:** N/A*
**Manufacturer:** To be confirmed

**Welder's Name:** To be confirmed
**Welding Process:** 135 (MAG)
**Joint Type:** Fillet Weld - Multi-run (Single or Double Sided)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S355 J2 (Max CEV = 0.45)
**Material Thickness:** 10mm
**Outside Diameter:** N/A
**Welding Position:** PB (Horizontal - Vertical)

| Joint Design | Welding Sequence |
|---|---|
|  |  |





Dimension z = Fillet weld leg length in mm

**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| 1 | 135 (MAG) | 1.2 | 270 - 290 | 29 - 31 | DC +ve | 7.5 - 8.3 | 320 - 340 | 1.1 - 1.3 |
| 2 - 3 | 135 (MAG) | 1.2 | 270 - 290 | 29 - 31 | DC +ve | 7.5 - 8.3 | 340 - 380 | 0.9 - 1.3 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3 Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum |
| **Interpass Temperature** | 250°C Maximum |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:** Nozzle diameter = 16mm.
Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
Weld finish to be left as-welded.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
To be confirmed

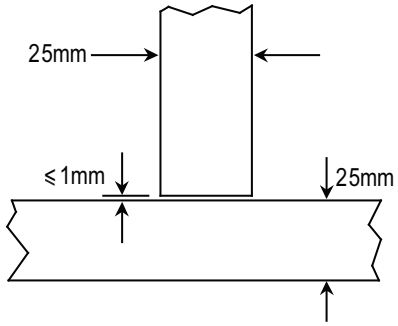
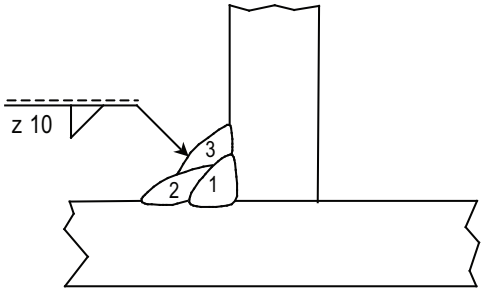
*N/A = Not Applicable

# preliminary Welding Procedure Specification (pWPS)

**Location:** Workshop
**Manufacturer's Welding Procedure Specification No:** 04p
**WPQR:** N/A*
**Manufacturer:** To be confirmed

**Welder's Name:** To be confirmed
**Welding Process:** 135 (MAG)
**Joint Type:** Fillet Weld – Multi-run (Single or Double Sided)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S355 J2 (Max CEV = 0.45)
**Material Thickness:** 25mm
**Outside Diameter:** N/A
**Welding Position:** PB (Horizontal - Vertical)

| Joint Design | Welding Sequence |
|---|---|
|  |  Dimension z = Fillet weld leg length in mm |

**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| 1 | 135 (MAG) | 1.2 | 290 - 310 | 29 - 31 | DC +ve | 8.3 - 9.0 | 300 - 330 | 1.3 - 1.5 |
| 2 - 3 | 135 (MAG) | 1.2 | 290 - 310 | 29 - 31 | DC +ve | 8.3 - 9.0 | 310 - 330 | 1.2 - 1.5 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3 Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum |
| **Interpass Temperature** | 250°C Maximum |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:** Nozzle diameter = 16mm.
Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
Weld finish to be left as-welded.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
To be confirmed

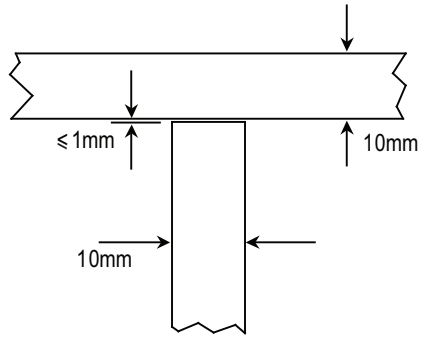
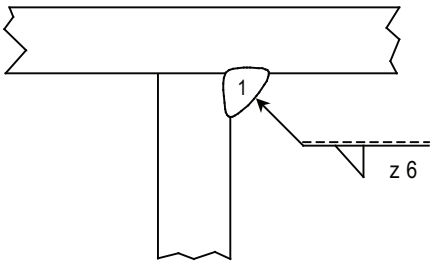
*N/A = Not Applicable

# preliminary Welding Procedure Specification (pWPS)

**Location:** Workshop
**Manufacturer's Welding Procedure Specification No:** 05p
**WPQR:** N/A*
**Manufacturer:** To be confirmed

**Welder's Name:** To be confirmed
**Welding Process:** 135 (MAG)
**Joint Type:** Fillet Weld (Single or Double Sided)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S355 J2 (Max CEV = 0.45)
**Material Thickness:** 10mm
**Outside Diameter:** N/A
**Welding Position:** PF (Vertical Upwards)

| Joint Design | Welding Sequence |
|---|---|
|  |  Dimension z = Fillet weld leg length in mm |

**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| 1 | 135 (MAG) | 1.2 | 160 - 180 | 19 - 21 | DC +ve | 4.6 - 5.3 | 120 - 140 | 1.0 - 1.5 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3 Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum |
| **Interpass Temperature** | N/A |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:** Nozzle diameter = 16mm.
Weld finish to be left as-welded.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
To be confirmed

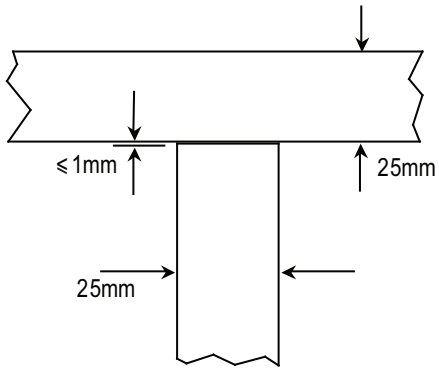
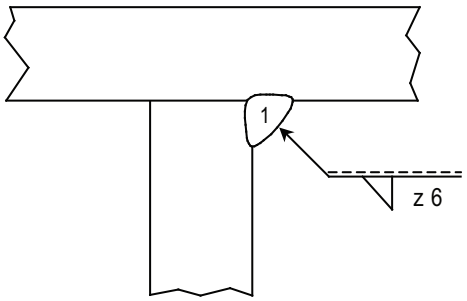
*N/A = Not Applicable

# preliminary Welding Procedure Specification (pWPS)

**Location:** Workshop
**Manufacturer's Welding Procedure Specification No:** 06p
**WPQR:** N/A*
**Manufacturer:** To be confirmed

**Welder's Name:** To be confirmed
**Welding Process:** 135 (MAG)
**Joint Type:** Fillet Weld (Single or Double Sided)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S355 J2 (Max CEV = 0.45)
**Material Thickness:** 25mm
**Outside Diameter:** N/A
**Welding Position:** PF (Vertical Upwards)

| Joint Design | Welding Sequence |
|---|---|
|  |  Dimension z = Fillet weld leg length in mm |

**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| 1 | 135 (MAG) | 1.2 | 190 - 200 | 19 - 21 | DC +ve | 5.1 - 5.5 | 120 - 140 | 1.3 - 1.6 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3 Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum |
| **Interpass Temperature** | N/A |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:** Nozzle diameter = 16mm.
Weld finish to be left as-welded.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
To be confirmed

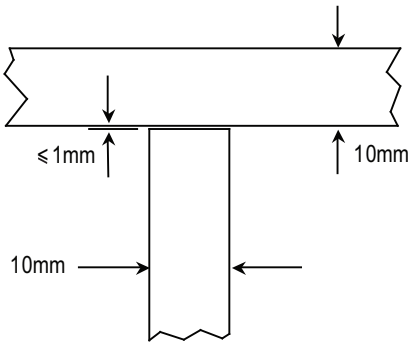
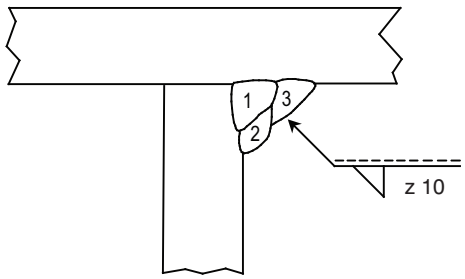
*N/A = Not Applicable

# preliminary Welding Procedure Specification (pWPS)

**Location:** Workshop
**Manufacturer's Welding Procedure Specification No:** 07p
**WPQR:** N/A*
**Manufacturer:** To be confirmed

**Welder's Name:** To be confirmed
**Welding Process:** 135 (MAG)
**Joint Type:** Fillet Weld – Multi-run (Single or Double Sided)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S355 J2 (Max CEV = 0.45)
**Material Thickness:** 10mm
**Outside Diameter:** N/A
**Welding Position:** PF (Vertical Upwards)

| Joint Design | Welding Sequence |
|---|---|
|  |  Dimension z = Fillet weld leg length in mm |

**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| 1 | 135 (MAG) | 1.2 | 160 - 180 | 19 - 21 | DC +ve | 4.6 - 5.3 | 120 - 140 | 1.0 - 1.5 |
| 2 - 3 | 135 (MAG) | 1.2 | 160 - 180 | 19 - 21 | DC +ve | 4.6 - 5.3 | 140 - 160 | 0.9 - 1.3 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3 Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum |
| **Interpass Temperature** | 250°C Maximum |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:** Nozzle diameter = 16mm.
Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
Weld finish to be left as-welded.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
To be confirmed

*N/A = Not Applicable

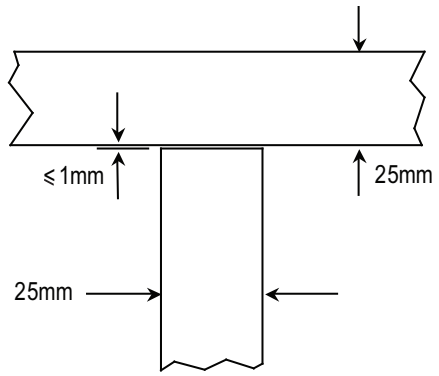
# preliminary Welding Procedure Specification (pWPS)

**Location:** Workshop
**Manufacturer's Welding Procedure Specification No:** 08p
**WPQR:** N/A*
**Manufacturer:** To be confirmed

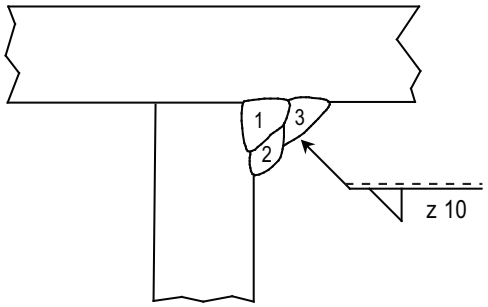
**Welder's Name:** To be confirmed
**Welding Process:** 135 (MAG)
**Joint Type:** Fillet Weld – Multi-run (Single or Double Sided)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S355 J2 (Max CEV = 0.45)
**Material Thickness:** 25mm
**Outside Diameter:** N/A
**Welding Position:** PF (Vertical Upwards)

**Joint Design**




**Welding Sequence**




Dimension z = Fillet weld leg length in mm

**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| 1 | 135 (MAG) | 1.2 | 190 - 200 | 19 - 21 | DC +ve | 5.1 - 5.5 | 120 - 140 | 1.3 - 1.6 |
| 2 - 3 | 135 (MAG) | 1.2 | 190 - 200 | 19 - 21 | DC +ve | 5.1 - 5.5 | 110 - 130 | 1.3 - 1.8 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3 Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum |
| **Interpass Temperature** | 250°C Maximum |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:** Nozzle diameter = 16mm.
Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
Weld finish to be left as-welded.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
To be confirmed

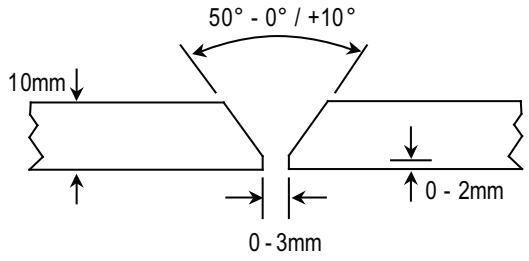
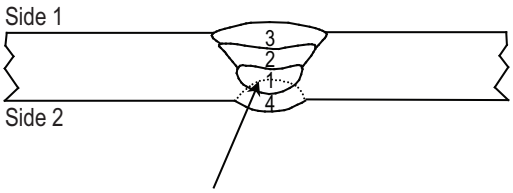
*N/A = Not Applicable

# preliminary Welding Procedure Specification (pWPS)

**Location:** Workshop
**Manufacturer's Welding Procedure Specification No:** 09p
**WPQR:** N/A*
**Manufacturer:** To be confirmed

**Welder's Name:** To be confirmed
**Welding Process:** 135 (MAG)
**Joint Type:** Single Vee Butt Weld
(full penetration, welded from both sides)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S355 J2 (Max CEV = 0.45)
**Material Thickness:** 10mm
**Outside Diameter:** N/A
**Welding Position:** PA (Flat)

| Joint Design | Welding Sequence |
|---|---|
|  |  Grind back Side 2 to sound metal and MPI |





**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| 1 | 135 (MAG) | 1.2 | 220 - 240 | 26 - 28 | DC +ve | 5.5 - 6.2 | 250 - 270 | 1.0 - 1.3 |
| 2 - 4 | 135 (MAG) | 1.2 | 270 - 290 | 29 - 31 | DC +ve | 7.5 - 8.3 | 300 - 320 | 1.1 - 1.4 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3 Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | Grind back to sound metal and MPI |
| **Preheat Temperature** | 0°C Minimum |
| **Interpass Temperature** | 250°C Maximum |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:** Nozzle diameter = 16mm.
Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
Weld finish to be left as-welded.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
To be confirmed

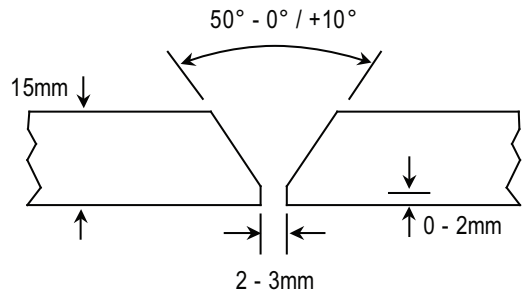
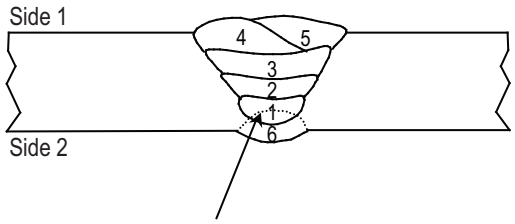
*N/A = Not Applicable

# preliminary Welding Procedure Specification (pWPS)

**Location:** Workshop
**Manufacturer's Welding Procedure Specification No:** 10p
**WPQR:** N/A*
**Manufacturer:** To be confirmed

**Welder's Name:** To be confirmed
**Welding Process:** 135 (MAG)
**Joint Type:** Single Vee Butt Weld
(full penetration, welded from both sides)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S355 J2 (Max CEV = 0.45)
**Material Thickness:** 15mm
**Outside Diameter:** N/A
**Welding Position:** PA (Flat)

| Joint Design | Welding Sequence |
|---|---|
|  |  |





Grind back Side 2 to sound metal and MPI

**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| 1 | 135 (MAG) | 1.2 | 220 - 240 | 26 - 28 | DC +ve | 5.5 - 6.2 | 250 - 270 | 1.0 - 1.3 |
| 2 - 6 | 135 (MAG) | 1.2 | 270 - 290 | 29 - 31 | DC +ve | 7.5 - 8.3 | 300 - 320 | 1.1 - 1.4 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3 Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | Grind back to sound metal and MPI |
| **Preheat Temperature** | 0°C Minimum |
| **Interpass Temperature** | 250°C Maximum |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:** Nozzle diameter = 16mm.
Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
Weld finish to be left as-welded.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
To be confirmed

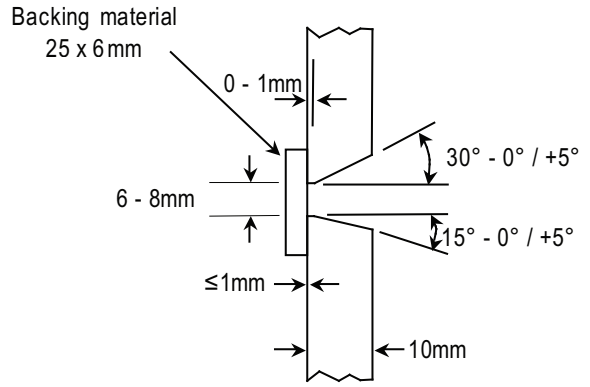
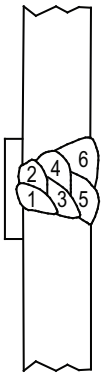
*N/A = Not Applicable

# preliminary Welding Procedure Specification (pWPS)

**Location:** Workshop
**Manufacturer's Welding Procedure Specification No:** 11p
**WPQR:** N/A*
**Manufacturer:** To be confirmed

**Welder's Name:** To be confirmed
**Welding Process:** 135 (MAG)
**Joint Type:** Single Vee Butt Weld
(full penetration, with permanent backing)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S355 J2 (Max CEV = 0.45)
**Material Thickness:** 10mm
**Outside Diameter:** N/A
**Welding Position:** PC (Horizontal)

| Joint Design | Welding Sequence |
|---|---|
|  |  |





**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| 1 | 135 (MAG) | 1.2 | 220 - 240 | 26 - 28 | DC +ve | 5.5 - 6.2 | 250 - 270 | 1.0 - 1.3 |
| 2 - 5 | 135 (MAG) | 1.2 | 270 - 290 | 29 - 31 | DC +ve | 7.5 - 8.3 | 300 - 320 | 1.2 - 1.4 |
| 6 | 135 (MAG) | 1.2 | 220 - 240 | 26 - 28 | DC +ve | 5.5 - 6.2 | 250 - 270 | 1.0 - 1.3 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3 Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | 25mm x 6mm thick backing from S355 J2 |
| **Preheat Temperature** | 0°C Minimum |
| **Interpass Temperature** | 250°C Maximum |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:** Nozzle diameter = 16mm.
Backing material tack welded in position using parameters as for run number 1.
Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
Weld finish to be left as-welded.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
To be confirmed

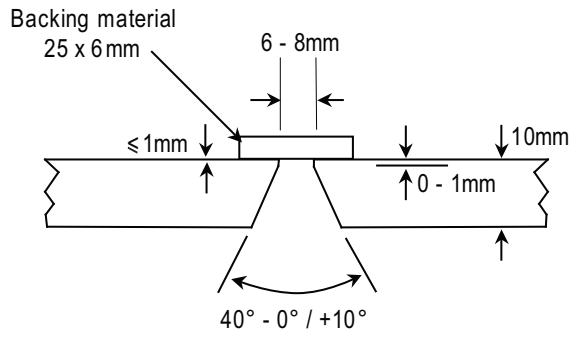
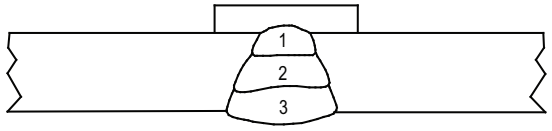
*N/A = Not Applicable

# preliminary Welding Procedure Specification (pWPS)

**Location:** Workshop
**Manufacturer's Welding Procedure Specification No:** 12p
**WPQR:** N/A*
**Manufacturer:** To be confirmed

**Welder's Name:** To be confirmed
**Welding Process:** 135 (MAG)
**Joint Type:** Single Vee Butt Weld
(full penetration - with permanent backing)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S355 J2 (Max CEV = 0.45)
**Material Thickness:** 10mm
**Outside Diameter:** N/A
**Welding Position:** PF (Vertical Upwards)

| Joint Design | Welding Sequence |
|---|---|
|  |  |





**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| 1 | 135 (MAG) | 1.2 | 170 - 190 | 19 - 21 | DC +ve | 4.8 - 5.5 | 120 - 140 | 1.1 - 1.6 |
| 2 - 3 | 135 (MAG) | 1.2 | 170 - 190 | 19 - 21 | DC +ve | 4.8 - 5.5 | 100 - 120 | 1.2 - 1.9 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3 Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | 25mm x 6mm thick backing from S355 J2 |
| **Preheat Temperature** | 0°C Minimum |
| **Interpass Temperature** | 250°C Maximum |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:** Nozzle diameter = 16mm.
Backing material tack welded in position using parameters as for run number 1.
Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
Weld finish to be left as-welded.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
To be confirmed

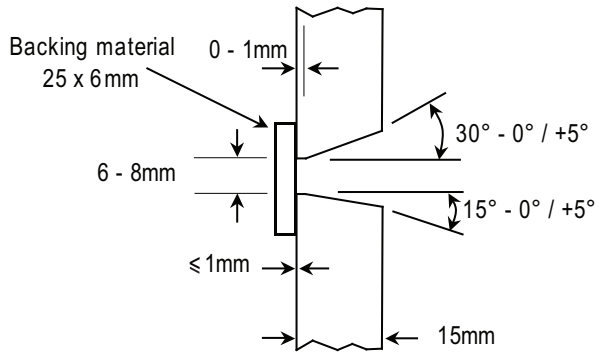
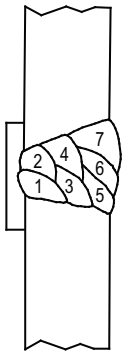
*N/A = Not Applicable

# preliminary Welding Procedure Specification (pWPS)

**Location:** Workshop
**Manufacturer's Welding Procedure Specification No:** 13p
**WPQR:** N/A*
**Manufacturer:** To be confirmed

**Welder's Name:** To be confirmed
**Welding Process:** 135 (MAG)
**Joint Type:** Single Vee Butt Weld
(full penetration - with permanent backing)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S355 J2 (Max CEV = 0.45)
**Material Thickness:** 15mm
**Outside Diameter:** N/A
**Welding Position:** PC (Horizontal)

| Joint Design | Welding Sequence |
|---|---|
|  |  |





**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| 1 | 135 (MAG) | 1.2 | 220 - 240 | 26 - 28 | DC +ve | 5.5 - 6.2 | 250 - 270 | 1.0 - 1.3 |
| 2 - 6 | 135 (MAG) | 1.2 | 270 - 290 | 29 - 31 | DC +ve | 7.5 - 8.3 | 300 - 320 | 1.2 - 1.4 |
| 7 | 135 (MAG) | 1.2 | 220 - 240 | 26 - 28 | DC +ve | 5.5 - 6.2 | 250 - 270 | 1.0 - 1.3 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3 Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | 25mm x 6mm thick backing from S355 J2 |
| **Preheat Temperature** | 0°C Minimum |
| **Interpass Temperature** | 250°C Maximum |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:** Nozzle diameter = 16mm.
Backing material tack welded in position using parameters as for run number 1.
Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
Weld finish to be left as-welded.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
To be confirmed

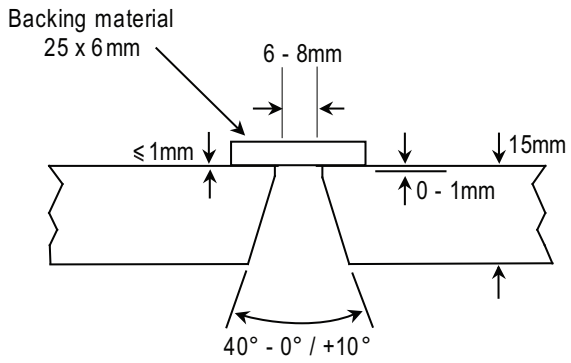
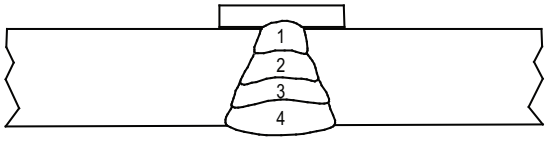
*N/A = Not Applicable

# preliminary Welding Procedure Specification (pWPS)

**Location:** Workshop
**Manufacturer's Welding Procedure Specification No:** 14p
**WPQR:** N/A*
**Manufacturer:** To be confirmed

**Welder's Name:** To be confirmed
**Welding Process:** 135 (MAG)
**Joint Type:** Single Vee Butt Weld
(full penetration - with permanent backing)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S355 J2 (Max CEV = 0.45)
**Material Thickness:** 15mm
**Outside Diameter:** N/A
**Welding Position:** PF (Vertical Upwards)

| Joint Design | Welding Sequence |
|---|---|
|  |  |



**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| 1 | 135 (MAG) | 1.2 | 170 - 190 | 19 - 21 | DC +ve | 4.8 - 5.5 | 120 - 140 | 1.1 - 1.6 |
| 2 - 4 | 135 (MAG) | 1.2 | 170 - 190 | 19 - 21 | DC +ve | 4.8 - 5.5 | 100 - 120 | 1.2 - 1.9 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3 Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | 25mm x 6mm thick backing from S355 J2 |
| **Preheat Temperature** | 0°C Minimum |
| **Interpass Temperature** | 250°C Maximum |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:** Nozzle diameter = 16mm.
Backing material tack welded in position using parameters as for run number 1.
Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
Weld finish to be left as-welded.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
To be confirmed

*N/A = Not Applicable

# 5 Qualification of Welding Procedure Specifications

## 5.1 Introduction

The welding procedures presented in Section 4 are classified as preliminary Welding Procedure Specifications (pWPS) by BS EN ISO 15614-1 and, as such, will require qualification prior to use. The general rules for qualification of welding procedures are given in BS EN ISO 15607. This allows qualification by a number of methods, each having certain limits of application with respect to parent material, consumables etc. The method generally adopted in the UK is to carry out joint specific weld procedure tests and produce a Welding Procedure Qualification Record (WPQR) in accordance with the requirements of BS EN ISO 15614-1.

The WPQR is the document used to record all the necessary data for qualification of the pWPS. It contains the actual welding parameters used in the weld procedure test and the results of the required non-destructive and destructive tests. Satisfactory completion of a WPQR turns the pWPS into a 'qualified' Welding Procedure Specification (WPS). An example of a completed WPQR is given in Appendix C of this document.

To minimise the number of weld procedure tests required, BS EN ISO 15614-1 uses a limiting range of variables which allow the steelwork contractor to produce a number of 'qualified' WPS from a single WPQR. A company's Responsible Welding Coordinator (RWC) will therefore carefully select the features of a weld procedure test so that the resulting WPQR qualifies a wide range of WPS.

Sections 5.2 and 5.3 demonstrate the link between the pWPS in Section 4 and the typical WPS contained in Section 6 which may be qualified according to the standard.

## 5.2 Fillet welds

Clause 8.4.3 of BS EN ISO 15614-1 states that fillet welds can be qualified by butt weld test pieces unless fillet welds are the predominant form of production welding; in which case fillet weld tests are required. Since fillet welds are considered to be the most common form of weld used by UK steelwork contractors, it is recommended that appropriate fillet weld qualification tests are carried out.

Fillet welds are covered by pWPS 01p to 08p.

The pWPS have been selected to achieve approval over a range of material thicknesses and fillet weld sizes in single and multiple runs.

### *Material thickness*

The material thicknesses of 10 and 25mm cover thickness ranges of 5 to 12mm and 12.5 to 30mm respectively.

### *Weld size*

The 6mm fillet covers single run fillets with leg lengths of 4.5 to 9mm.

The 10mm fillet covers multi-run fillets with no restriction on leg length.

### *Welding position*

In accordance with the welding position and process specific requirements of BS EN ISO 15614-1 (Sections 8.4.2 and 8.5.2), this document recommends separate tests (pWPS 05p, 06p, 07p and 08p) to cover the PF positions.

Table 5.1 indicates the pWPS and consequent range of approval based strictly on BS EN ISO 15614-1. It should be noted, however, that achieving the 9mm maximum allowable leg length for single run fillets may be impractical.

| pWPS | Fillet Weld Approval |
|---|---|
| 01p | single run fillet, 4.5 - 9mm leg length, 5 - 12mm material, PB and PA position |
| 02p | single run fillet, 4.5 - 9mm leg length, 12.5 - 30mm material, PB and PA position |
| 03p | multi-run fillet, unrestricted leg length, 5 - 12mm material, PB and PA position |
| 04p | multi-run fillet, unrestricted leg length, 12.5 - 30mm material, PB and PA position |
| 05p | single run fillet, 4.5 - 9mm leg length, 5 - 12mm material, PF position |
| 06p | single run fillet, 4.5 - 9mm leg length, 12.5 - 30mm material, PF position |
| 07p | multi-run fillet, unrestricted leg length, 5 - 12mm material, PF position |
| 08p | multi-run fillet, unrestricted leg length, 12.5 - 30mm material, PF position |

**Table 5.1 Fillet weld pWPS and range of approval**

## 5.3 Butt welds

In similar fashion to the fillet welds, the pWPS for butt welds have been chosen to achieve approval over a range of material thickness, and for a variety of weld types and positions. The pWPS for butt welds are arranged as shown in Table 5.2, and the range of approval described in the following sub-sections.

| pWPS | Joint Type | Position | Material Thickness (mm) |
|---|---|---|---|
| 09p | Single vee butt (welded from both sides) | PA | 10 |
| 10p | Single vee butt (welded from both sides) | PA | 15 |
| 11p | Single vee butt with backing | PC | 10 |
| 12p | Single vee butt with backing | PC | 15 |
| 13p | Single vee butt with backing | PF | 10 |
| 14p | Single vee butt with backing | PF | 15 |

**Table 5.2 Butt weld pWPS**

***Material thickness***

The material thicknesses of 10 and 15mm cover thickness ranges of 3 to 12mm and 7.5 to 30mm respectively.

***Welding position***

BS EN ISO 15614-1 indicates that where neither impact nor hardness requirements are specified, welding in any one position qualifies for welding in all positions. In almost all instances, impact requirements will have been specified by the choice of steel sub-grade made by the structural designer. When either impact or hardness requirements must be satisfied, the range of positions approved is determined by the positions in which the weld procedure test pieces were carried out and is related to the heat input during welding. The range of positions approved are those with heat inputs between the highest and lowest heat inputs tested.

pWPS 09p and 10p reflect the most straightforward type of butt welding in the PA position and approval is limited to PA positions only.

To achieve a wider range of qualified positions, pWPS 11p to 14p are completed in the PF and PC positions. PF is generally the highest heat input position and PC the lowest, approving PA, PC and PF.

***Joint type***

Clause 8.4.3 of BS EN ISO 15614-1 specifies the range of qualification for joint types. All the butt welds in this document are in-line butt welds on plate. PWPS 09p and 10p are used to qualify the butt welds covered in the Category 3 and 4 WPS (See Table 6.1). These pWPS are welded from both sides with back gouging and / or grinding and, as such, only qualify butt welds made from both sides with back gouging and / or grinding. Single sided welds and those with backing are not qualified.

Some of the butt welds in the Category 5 WPS (See Table 6.1) are qualified by single sided butt welds made with permanent backing (pWPS 11p to 14p). In accordance with BS EN ISO 15614-1, butt welds with backing also qualify butt welds welded from both sides. However, this document also recommends qualification of pWPS 09p and 10p when qualifying the Category 5 WPS so as to demonstrate full positional capability.

In-line butt welds on plate also qualify T butt welds on plate. However, it should be noted that T butt welds are generally considered difficult to form and it may be advisable to carry out weld procedure tests for T butt welds.

***Welder approval***

The procedure qualification tests in this document have been chosen primarily to qualify the procedures, not the welders. However, Clause 5 of BS EN ISO 15614-1 states that the welder who undertakes the welding procedure test satisfactorily is qualified within the range of qualification given in BS EN 287.

***Material***

It is recommended that the test material is BS EN 10025 - S355J2, as successful tests in this material will also cover steels of lower yield strength and those with lesser impact properties.

## 5.4 Examination and testing

The examination and testing requirements of the test pieces are specified in Table 1 of BS EN ISO 15614-1. Clause 1 states that additional tests may be specified by the relevant application standard. Examples of the additional tests that may be required are given in Clause 7.1 of BS EN ISO 15614-1. However, these are not typically requested for structural steelwork used in buildings and bridges and so are not covered in this document.

The range of welding positions qualified depends on heat input, as described above. When a range of positional qualification is required (as opposed to a single position) the specimens for impact tests should be taken from the position with highest heat input (PF in this document) and the specimens for the hardness tests taken from the position with lowest heat input (PC in this document).

Additionally, impact tests are only required when the material thickness is greater than 12mm, and thus if required, impact test specimens should be taken from the weld procedure test in the 15mm material.

# 6 Typical Welding Procedure Specifications

This section contains 40 partially completed Welding Procedure Specifications (WPS), described in this publication as "typical" WPS. These may be completed and approved for use once the appropriate welding procedure tests described have been completed. Each WPS will be linked to one or more Welding Procedure Qualification Record (WPQR).

Section 4 describes the information shown on the preliminary Welding Procedure Specifications. Much of this is repeated in the typical WPS in this Section and the user should refer to Section 4. The features of the WPS which differ from the pWPS are described in the following paragraphs.

### *Welding procedure specification number*

Procedures are presented in numerical order. The letters indicate the welding position, as described in Section 4.1.

A suffix (a, b or c) differentiates minor changes to essentially the same procedure due to slight differences in preparation or welding from one / both sides.

### *Welding procedure qualification record (WPQR) number(s)*

Each WPS is approved by one or more WPQR, which should be referenced.

### *Weld preparation*

The joint design sketches on the partial penetration butt weld WPS in this document use the term 'design throat' as a means of specifying the depth of preparation required. Whilst responsibility for specifying the design throat thickness rests with the structural designer, the steelwork contractor is responsible for selecting the appropriate depth of preparation to ensure the required design throat thickness (i.e. depth of penetration) is achieved.

### *Run*

Where a weld can be completed within the same range of welding parameters the term 'All' is used to show that there is no distinction between passes. For those welds requiring the use of a broad range of welding parameters, the welding runs are described as 'root' (the first weld pass), 'fill' (all intermediate passes) and 'cap' (the final pass).

### *Welding details*

The welding parameters, travel speeds, wire feed rates etc. shown on the WPS are based on those used in the welding procedure test. Each parameter will normally be quoted as a range (as specified in BS EN ISO 15614-1), the mid-point being the nominal value recorded during the test. The ranges shown on the partially completed WPS indicate typical values, and will need to be replaced with ranges based on the actual values recorded during the tests.

### *Tack welds*

Tack welds (to maintain fit-up, or to attach backing strips) should be made using the same parameters as for the first run of the main welds. The length of the tack should be the lesser of 4 times the thickness of the thicker part joined, or 50mm, unless demonstrated in the WPQR that shorter lengths can be deposited without detriment to the properties of the material and finished weld. Tack welds should be dressed or thoroughly removed by grinding or gouging such that subsequent welding is unaffected. Defective tack welds, or tack welds made by a different procedure to the main weld must be removed completely. Alternatively, those which are not defective may be incorporated into main welds providing it is proven in the WPQR that they are subsequently fully re-melted.

### *NDT*

It is recommended that inspection and testing is carried out in accordance with either the National Structural Steelwork Specification (NSSS) 5th Edition or the new 'CE Marking' Edition, if no alternative application standard is specified in the contract.

### *Weld finish*

In all cases, this is stated as 'as-welded unless otherwise specified'.

### *Interpass temperature*

Each WPS states interpass temperature as (°C) 'maximum recorded in WPQR'. Under normal circumstances, within the range of materials and joint types used in this document, interpass temperatures up to 250°C are unlikely to be detrimental to the weld quality or properties of the parent material. BS EN ISO 15614-1, however, sets the upper limit of approval as the nominal maximum interpass temperature reached during the welding procedure test. Therefore, on satisfactory completion of the WPQR, the RWC is required to record the actual value on the WPS.

### *For examiner / examining body*

Whilst the steelwork contractor's RWC is required to sign and date the WPS, there is no specific requirement in BS EN ISO 15614-1 for the examiner / examining body to do so unless this is a specific contract requirement. Each WPS therefore states 'N/A' (i.e. not applicable).

## 6.1 Typical WPS - contents

| Category | | | | | Approved Procedures | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | Procedure | pWPS to be qualified | Joint Type | Preparation | Access | Page No |
| | | ✓ | ✓ | ✓ | 01-PA | 10p | Single bevel butt (partial penetration) | single bevel | one side | 29 |
| | | | | ✓ | 01-PC | 12p | Single bevel butt (partial penetration) | single bevel | one side | 30 |
| | | | | ✓ | 01-PF | 14p | Single bevel butt (partial penetration) | single bevel | one side | 31 |
| | | ✓ | ✓ | ✓ | 02-PA | 09p & 10p | Single bevel butt (full penetration) | single bevel | both sides | 32 |
| | | | | ✓ | 02-PC | 12p | Single bevel butt (full penetration) | single bevel | both sides | 33 |
| | | | | ✓ | 02-PF | 14p | Single bevel butt (full penetration) | single bevel | both sides | 34 |
| | | ✓ | ✓ | ✓ | 03-PA | 09p & 10p | Single vee butt (partial penetration) | double bevel | one side | 35 |
| | | | | ✓ | 03-PF | 14p | Single vee butt (partial penetration) | double bevel | one side | 36 |
| | | ✓ | ✓ | ✓ | 04-PA | 09p & 10p | Single vee butt (full penetration) | double bevel | both sides | 37 |
| | | | | ✓ | 04-PF | 14p | Single vee butt (full penetration) | double bevel | both sides | 38 |
| | | | | ✓ | 05-PA | 13p & 14p | Single bevel butt (with backing) | single bevel | one side | 39 |
| | | | | ✓ | 05-PC | 11p & 12p | Single bevel butt (with backing) | single bevel | one side | 40 |
| | | | | ✓ | 05-PF | 13p & 14p | Single bevel butt (with backing) | single bevel | one side | 41 |
| | | | | ✓ | 06-PA | 13p & 14p | Single vee butt (with backing) | double bevel | one side | 42 |
| | | | | ✓ | 06-PF | 13p & 14p | Single vee butt (with backing) | double bevel | one side | 43 |
| ✓ | ✓ | ✓ | ✓ | ✓ | 07-PB(a) | 01p & 02p | 6, 8mm fillet | - | one side | 44 |
| ✓ | ✓ | ✓ | ✓ | ✓ | 07-PB(b) | 03p & 04p | 10, 12mm fillets | - | one side | 45 |
| | ✓ | | ✓ | ✓ | 07-PF(a) | 05p & 06p | 6, 8mm fillet | - | one side | 46 |
| | ✓ | | ✓ | ✓ | 07-PF(b) | 07p & 08p | 10, 12mm fillets | - | one side | 47 |
| | | ✓ | ✓ | ✓ | 08-PA | 10p | Single bevel T butt (partial penetration) | single bevel | one side | 48 |
| | | | | ✓ | 08-PC | 11p & 12p | Single bevel T butt (partial penetration) | single bevel | one side | 49 |
| | | | | ✓ | 08-PF | 13p & 14p | Single bevel T butt (partial penetration) | single bevel | one side | 50 |
| | | ✓ | ✓ | ✓ | 09-PA | 09p & 10p | Single bevel T butt (full penetration) | single bevel | both sides | 51 |
| | | | | ✓ | 09-PC | 11p & 12p | Single bevel T butt (full penetration) | single bevel | both sides | 52 |
| | | | | ✓ | 9-PF | 13p & 14p | Single bevel T butt (full penetration) | single bevel | both sides | 53 |
| | | ✓ | ✓ | ✓ | 10-PA | 09p & 10p | Single bevel T butt | single bevel | both sides | 54 |
| | | | | ✓ | 10-PC | 11p & 12p | Single bevel T butt | single bevel | both sides | 55 |
| | | | | ✓ | 10-PF | 13p & 14p | Single bevel T butt | single bevel | both sides | 56 |
| | | | | ✓ | 11-PC(a) | 11p & 12p | Partial penetration butt | single bevel | one side | 57 |
| | | | | ✓ | 11-PC(b) | 11p & 12p | Partial penetration butt | single bevel | both sides | 58 |
| | | | | ✓ | 11-PC(c) | 11p & 12p | Full penetration butt | single bevel | both sides | 59 |
| | | | | ✓ | 11-PF(a) | 13p & 14p | Partial penetration butt | single bevel | one side | 60 |
| | | | | ✓ | 11-PF(b) | 13p & 14p | Partial penetration butt | single bevel | both sides | 61 |
| | | | | ✓ | 11-PF(c) | 13p & 14p | Full penetration butt | single bevel | both sides | 67 |
| | | ✓ | ✓ | ✓ | 12-PA(a) | 09p & 10p | Double bevel T butt (partial penetration) | double bevel | both sides | 63 |
| | | ✓ | ✓ | ✓ | 12-PA(b) | 09p & 10p | Double bevel T butt (full penetration) | double bevel | both sides | 64 |
| | | | | ✓ | 12-PC(a) | 11p & 12p | Double bevel T butt (partial penetration) | double bevel | both sides | 65 |
| | | | | ✓ | 12-PC(b) | 11p & 12p | Double bevel T butt (full penetration) | double bevel | both sides | 66 |
| | | | | ✓ | 12-PF(a) | 13p & 14p | Double bevel T butt (partial penetration) | double bevel | both sides | 67 |
| | | | | ✓ | 12-PF(b) | 13p & 14p | Double bevel T butt (full penetration) | double bevel | both sides | 68 |

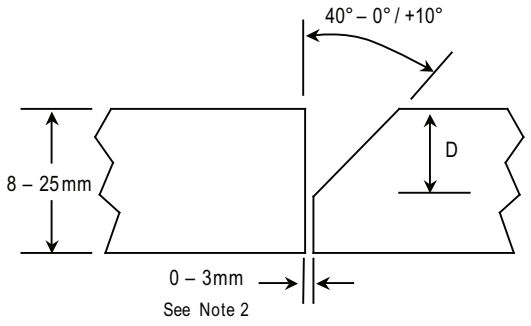
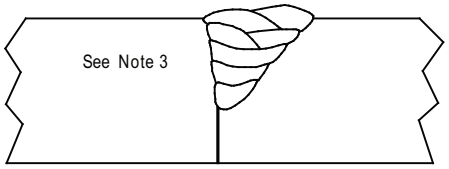
**Table 6.1 Typical WPS and pWPS to be qualified in order to support their approval**

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 01-PA
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Single Bevel Butt Weld (partial penetration)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 8 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PA (Flat)

| Joint Design | Welding Sequence |
|---|---|
|  |  |



**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| All | 135 (MAG) | 1.2 | 250 - 270 | 28 - 30 | DC +ve | 7.5 - 8.0 | 280 - 300 | 1.1 - 1.4 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 50mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 4) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. In all cases the gap between component parts shall be kept to a minimum.
3. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
4. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
5. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

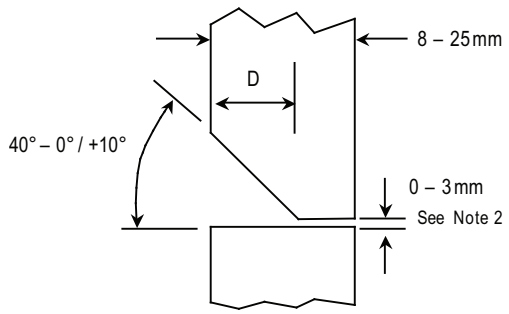
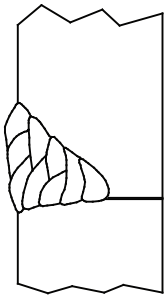
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 01-PC
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Single Bevel Butt Weld (partial penetration)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 8 - 25mm
**Outside Diameter:** N/A
**Welding Position:** PC (Horizontal)

| Joint Design | Welding Sequence |
|---|---|
|  D = Design Throat | See Note 3  |

**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| Root | 135 | 1.2 | 240 - 260 | 29 - 30 | DC +ve | 7.5 - 8.0 | 280 - 300 | 1.1 - 1.3 |
| Fill (Note 4) | 135 | 1.2 | 270 - 290 | 29 - 30 | DC +ve | 8.5 - 9.0 | 300 - 320 | 1.2 - 1.4 |
| Cap | 135 | 1.2 | 240 - 260 | 29 - 30 | DC +ve | 7.5 - 8.0 | 280 - 300 | 1.1 - 1.3 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 50mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 5) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. In all cases the gap between component parts shall be kept to a minimum.
3. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
4. Material thickness may not always allow deposition of fill passes.
5. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
6. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

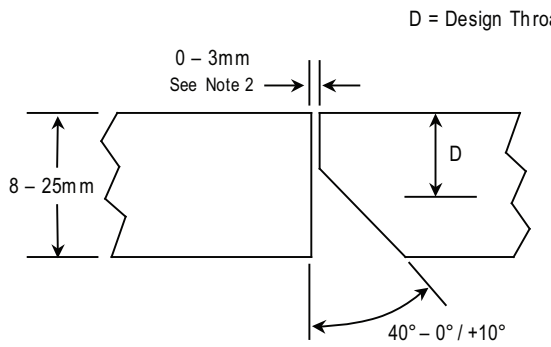
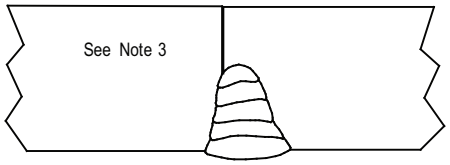
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 01-PF
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Single Bevel Butt Weld (partial penetration)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 8 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PF (Vertical Upwards)

| Joint Design | Welding Sequence |
|---|---|
|  |  |



**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| All | 135 (MAG) | 1.2 | 160 - 180 | 22 - 24 | DC +ve | 3.5 - 4.0 | 150 - 210 | 0.8 - 1.4 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 50mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 4) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. In all cases the gap between component parts shall be kept to a minimum.
3. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
4. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
5. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

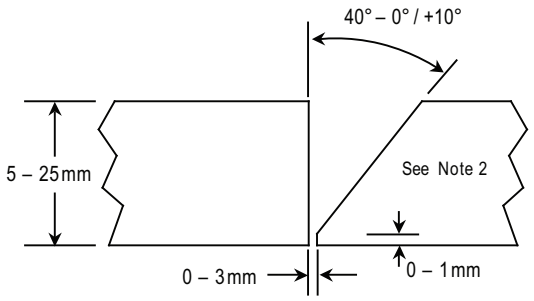
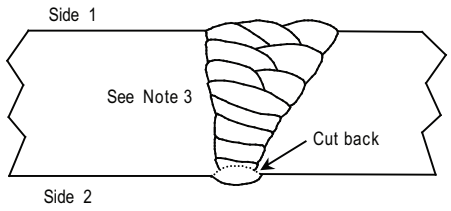
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 02-PA
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Single Bevel Butt Weld (welded from both sides)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 5 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PA (Flat)

| Joint Design | Welding Sequence |
|---|---|
|  |  |





**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| Root | 135 | 1.2 | 220 - 240 | 26 - 28 | DC +ve | 5.5 - 6.0 | 300 - 360 | 0.75 - 1.0 |
| Fill (Note 4) | 135 | 1.2 | 270 - 290 | 29 - 30 | DC +ve | 8.5 - 9.0 | 300 - 320 | 1.2 - 1.4 |
| Cap & Side 2 | 135 | 1.2 | 270 - 290 | 29 - 30 | DC +ve | 8.5 - 9.0 | 300 - 320 | 1.2 - 1.4 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | Arc air gouge and / or grind back Side 2 to sound metal |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 50mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 5) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. For thicknesses ⩾15mm, where access is not restricted, a double bevel preparation should be considered.
3. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
4. Material thickness may not always allow deposition of fill passes.
5. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
6. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

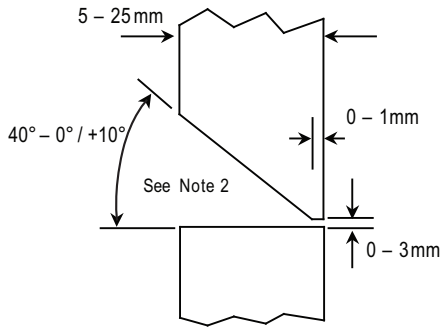
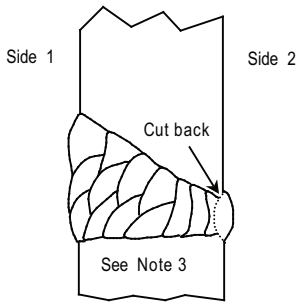
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 02-PC
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Single Bevel Butt Weld (welded from both sides)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 5 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PC (Horizontal)

| Joint Design | Welding Sequence |
|---|---|
|  |  |





**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| Root | 135 | 1.2 | 220 - 240 | 26 - 28 | DC +ve | 5.5 - 6.0 | 300 - 360 | 0.75 - 1.0 |
| Fill (Note 4) | 135 | 1.2 | 270 - 290 | 28 - 30 | DC +ve | 8.5 - 9.0 | 300 - 320 | 1.2 - 1.4 |
| Cap & Side 2 | 135 | 1.2 | 240 - 260 | 26 - 28 | DC +ve | 8.5 - 9.0 | 280 - 300 | 1.0 - 1.25 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | Arc air gouge and / or grind back Side 2 to sound metal |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 50mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 5) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. For thicknesses ⩾15mm, where access is not restricted, a double bevel preparation should be considered.
3. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
4. Material thickness may not always allow deposition of fill passes.
5. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
6. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

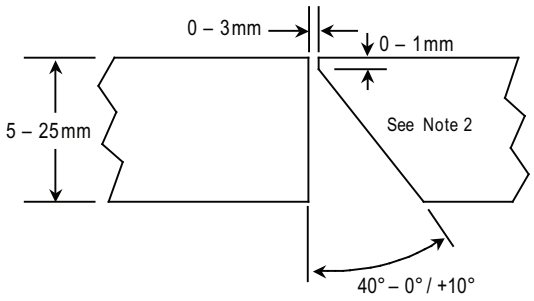
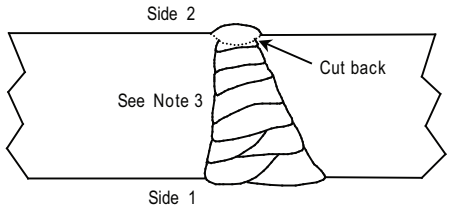
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 02-PF
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Single Bevel Butt Weld (welded from both sides)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 5 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PF (Vertical Upwards)

| Joint Design | Welding Sequence |
|---|---|
|  |  |





**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| All | 135 | 1.2 | 160 - 180 | 22 - 24 | DC +ve | 3.5 - 4.0 | 150 - 210 | 0.8 - 1.4 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | Arc air gouge and / or grind back Side 2 to sound metal |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 50mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 4) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. For thicknesses ⩾15mm, where access is not restricted, a double bevel preparation should be considered.
3. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
4. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
5. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

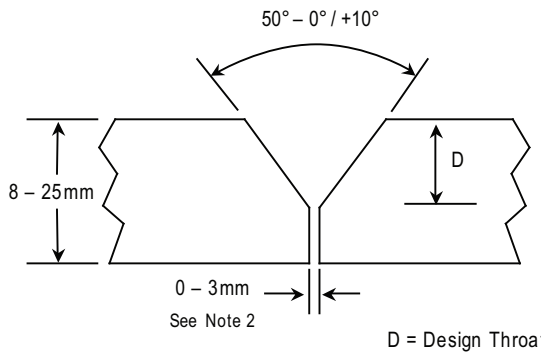
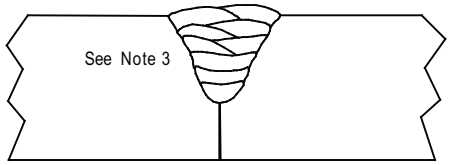
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 03-PA
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Single Vee Butt Weld (partial penetration)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 8 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PA (Flat)

| Joint Design | Welding Sequence |
|---|---|
|  |  |



**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| All | 135 (MAG) | 1.2 | 250 - 270 | 28 - 30 | DC +ve | 7.5 - 8.0 | 280 - 300 | 1.1 - 1.4 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 50mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 4) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. In all cases the gap between component parts shall be kept to a minimum.
3. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
4. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
5. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

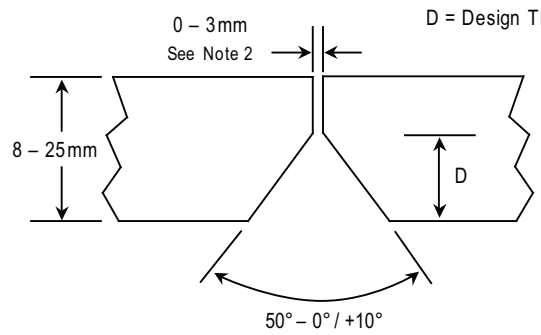
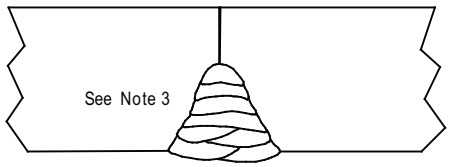
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 03-PF
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Single Vee Butt Weld (partial penetration)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 8 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PF (Vertical Upwards)

| Joint Design | Welding Sequence |
|---|---|
|  |  |





**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| All | 135 (MAG) | 1.2 | 160 - 180 | 22 - 24 | DC +ve | 3.5 - 4.0 | 150 - 210 | 0.8 - 1.4 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 50mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 4) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. In all cases the gap between component parts shall be kept to a minimum.
3. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
4. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
5. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

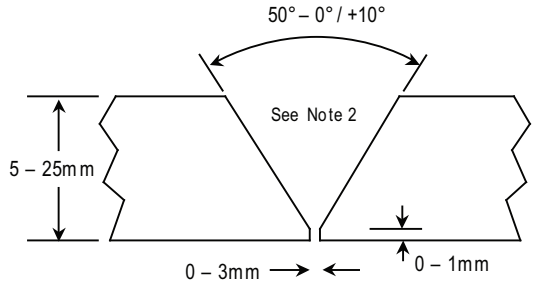
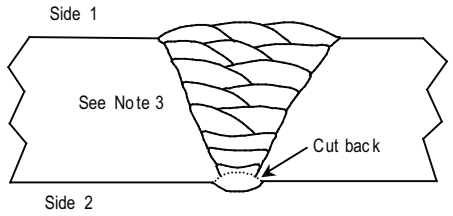
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 04-PA
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Single Vee Butt Weld (welded from both sides)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 5 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PA (Flat)

| Joint Design | Welding Sequence |
|---|---|
|  |  |





**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| Root | 135 | 1.2 | 220 - 240 | 26 - 28 | DC +ve | 5.5 - 6.0 | 300 - 360 | 0.75 - 1.0 |
| Fill (Note 4) | 135 | 1.2 | 270 - 290 | 29 - 30 | DC +ve | 8.5 - 9.0 | 300 - 320 | 1.2 - 1.4 |
| Cap & Side 2 | 135 | 1.2 | 270 - 290 | 29 - 30 | DC +ve | 8.5 - 9.0 | 300 - 320 | 1.2 - 1.4 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | Arc air gouge and / or grind back Side 2 to sound metal |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 50mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 5) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. For thicknesses ⩾15mm, where access is not restricted, a double vee preparation should be considered.
3. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
4. Material thickness may not always allow deposition of fill passes.
5. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
6. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

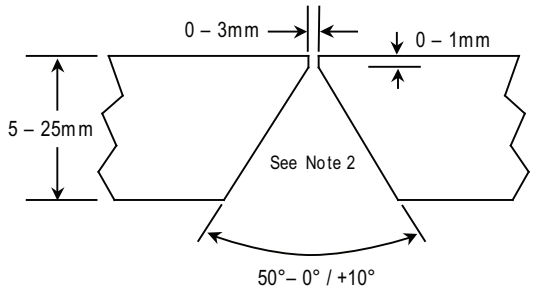
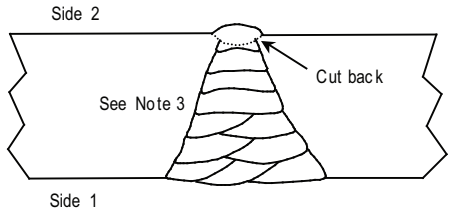
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 04-PF
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Single Vee Butt Weld (welded from both sides)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 5 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PF (Vertical Upwards)

| Joint Design | Welding Sequence |
|---|---|
|  |  |





**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| All | 135 | 1.2 | 160 - 180 | 22 - 24 | DC +ve | 3.5 - 4.0 | 150 - 210 | 0.8 - 1.4 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | Arc air gouge and / or grind back Side 2 to sound metal |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 50mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 4) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. For thicknesses ⩾15mm, where access is not restricted, a double vee preparation should be considered.
3. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
4. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
5. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

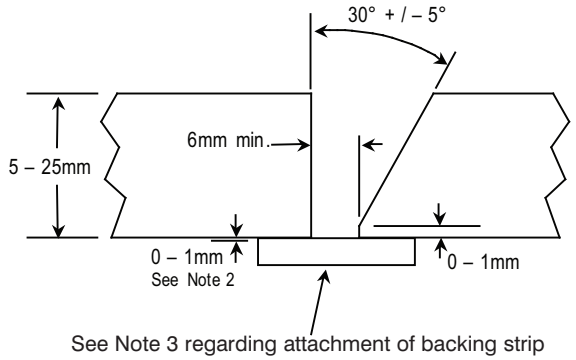
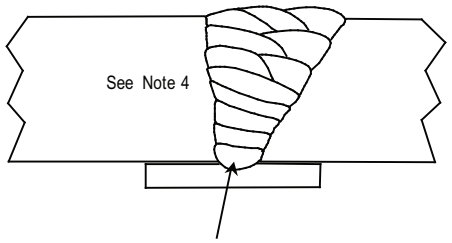
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 05-PA
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Single Bevel Butt Weld (with permanent backing)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 5 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PA (Flat)

| Joint Design | Welding Sequence |
|---|---|
|  See Note 3 regarding attachment of backing strip |  See Note 5 regarding root deposition sequence |

**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| All | 135 | 1.2 | 250 - 270 | 28 - 30 | DC +ve | 7.5 - 8.0 | 280 - 300 | 1.1 - 1.4 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | Nominal 25mm x 6mm S275 or S355 to suit parent material |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 50mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 6) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. In all cases the gap between the parent material and backing strip shall be kept to a minimum.
3. Permanent backing strip to be tack welded in position using the parameters given above.
4. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
5. For root gaps >8mm, 2 adjacent passes shall be deposited in the weld root.
6. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
7. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

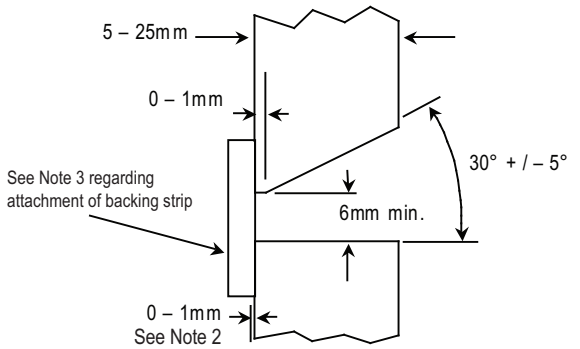
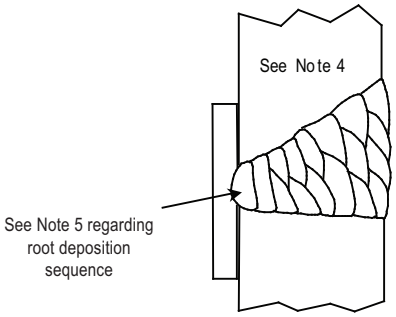
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 05-PC
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Single Bevel Butt Weld (with permanent backing)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 5 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PC (Horizontal)

| Joint Design | Welding Sequence |
|---|---|
|  |  |





**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| Root | 135 | 1.2 | 240 - 260 | 29 - 30 | DC +ve | 7.5 - 8.0 | 280 - 300 | 1.1 - 1.3 |
| Fill (Note 4) | 135 | 1.2 | 270 - 290 | 29 - 30 | DC +ve | 8.5 - 9.0 | 300 - 320 | 1.2 - 1.4 |
| Cap | 135 | 1.2 | 240 - 260 | 29 - 30 | DC +ve | 7.5 - 8.0 | 280 - 300 | 1.1 - 1.3 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | Nominal 25mm x 6mm S275 or S355 to suit parent material |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 50mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 6) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. In all cases the gap between the parent material and backing strip shall be kept to a minimum.
3. Permanent backing strip to be tack welded in position using the parameters given above.
4. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
5. For root gaps >8mm, 2 adjacent passes shall be deposited in the weld root.
6. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
7. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

*N/A = Not Applicable

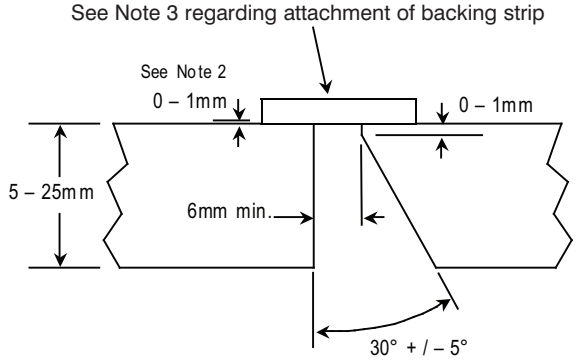
# Welding Procedure Specification (WPS)

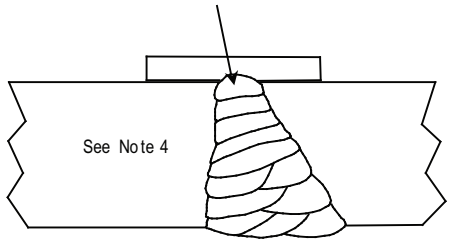
**Location:** Workshop
**Manufacturer's WPS No:** 05-PF
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Single Bevel Butt Weld (with permanent backing)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 5 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PF (Vertical Upwards)

| Joint Design | Welding Sequence |
|---|---|
| See Note 3 regarding attachment of backing strip | See Note 5 regarding root deposition sequence |




**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| All | 135 | 1.2 | 160 - 210 | 22 - 24 | DC +ve | 3.5 - 4.0 | 150 - 210 | 0.8 - 1.4 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | Nominal 25mm x 6mm S275 or S355 to suit parent material |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 50mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 6) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. In all cases the gap between the parent material and backing strip shall be kept to a minimum.
3. Permanent backing strip to be tack welded in position using the parameters given above.
4. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
5. For root gaps >8mm, 2 adjacent passes shall be deposited in the weld root.
6. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
7. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

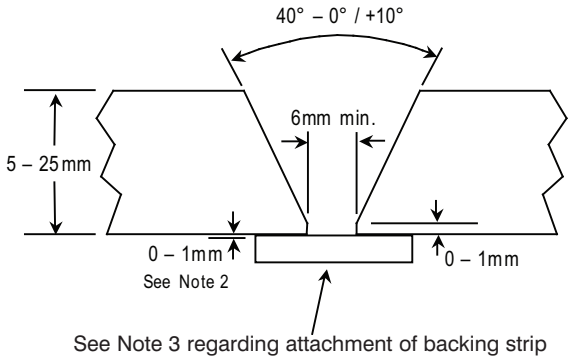
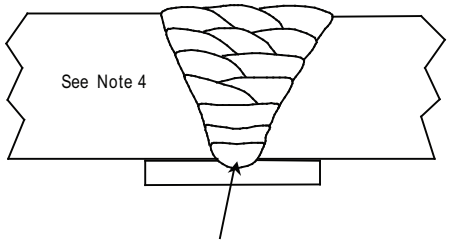
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 06-PA
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Single Vee Butt Weld (with permanent backing)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 5 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PA (Flat)

| Joint Design | Welding Sequence |
|---|---|
|  See Note 3 regarding attachment of backing strip |  See Note 5 regarding root deposition sequence |

**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| All | 135 | 1.2 | 270 - 290 | 29 - 30 | DC +ve | 8.5 - 9.0 | 300 - 320 | 1.2 - 1.4 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | Nominal 25mm x 6mm S275 or S355 to suit parent material |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 50mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 6) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. In all cases the gap between the parent material and backing strip shall be kept to a minimum.
3. Permanent backing strip to be tack welded in position using the parameters given above.
4. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
5. For root gaps greater >8mm, 2 adjacent passes shall be deposited in the weld root.
6. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
7. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

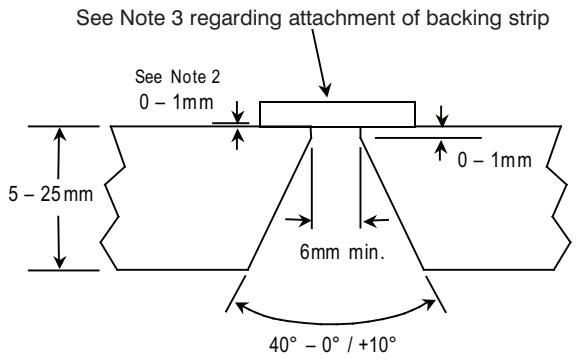
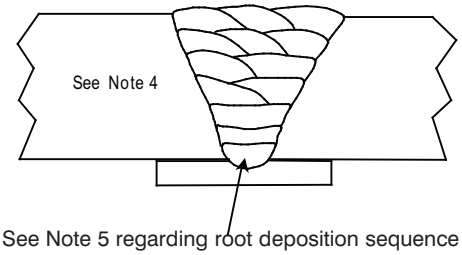
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 06-PF
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Single Vee Butt Weld (with permanent backing)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 5 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PF (Vertical Upwards)

| Joint Design | Welding Sequence |
|---|---|
|  |  |





**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| All | 135 | 1.2 | 160 - 180 | 22 - 24 | DC +ve | 3.5 - 4.0 | 150 - 210 | 0.8 - 1.4 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | Nominal 25mm x 6mm S275 or S355 to suit parent material |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 50mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 6) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. In all cases the gap between the parent material and backing strip shall be kept to a minimum.
3. Permanent backing strip to be tack welded in position using the parameters given above.
4. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
5. For root gaps >8mm, 2 adjacent passes shall be deposited in the weld root.
6. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
7. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

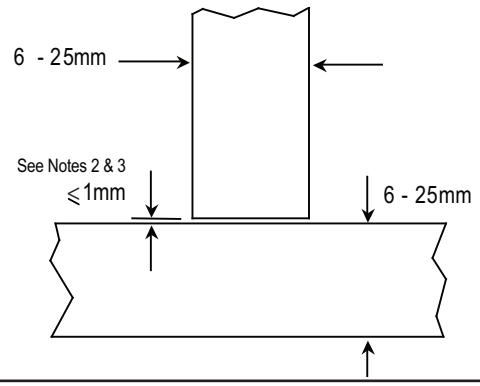
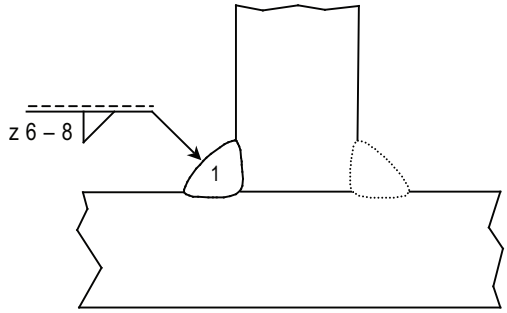
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 07-PB(a)
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Fillet Weld (Single or Double Sided)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 6 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PB (Horizontal / Vertical)

| Joint Design | Welding Sequence |
|---|---|
|  |  |





Dimension z = Fillet weld leg length in mm

**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| All | 135 (MAG) | 1.2 | 270 - 290 | 29 - 31 | DC +ve | 7.5 - 8.0 | 320 - 340 | 1.1 - 1.3 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 75mm) |
| **Interpass Temperature** | N/A |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. In all cases the gap between component parts shall be kept to a minimum.
3. Should the gap between component parts exceed 1mm, the fillet leg length shall be increased in order to achieve the required design throat thickness. Under no circumstance should the gap between component parts exceed 3mm.
4. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

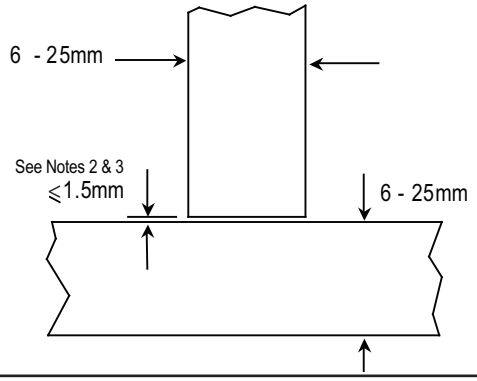
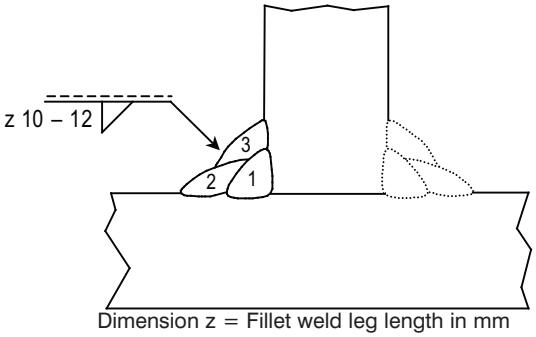
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 07-PB(b)
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Multi-run Fillet Weld (Single or Double Sided)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 10 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PB (Horizontal / Vertical)

| Joint Design | Welding Sequence |
|---|---|
|  |  |





Dimension z = Fillet weld leg length in mm

**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| 1 | 135 (MAG) | 1.2 | 270 - 290 | 29 - 31 | DC +ve | 7.5 - 8.0 | 280 - 300 | 1.1 - 1.3 |
| 2 - 3 | 135 (MAG) | 1.2 | 250 - 270 | 26 - 28 | DC +ve | 6.0 - 6.5 | 260 - 280 | 1.1 - 1.4 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 75mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (See Note 4) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. In all cases the gap between component parts shall be kept to a minimum.
3. Should the gap between component parts exceed 1.5mm, the fillet leg length shall be increased in order to achieve the required design throat thickness. Under no circumstance should the gap between component parts exceed 3mm.
4. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
5. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

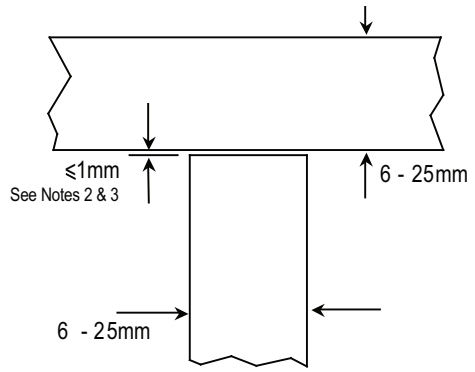
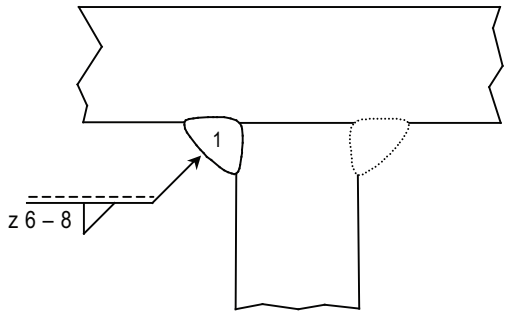
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 07-PF(a)
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Fillet Weld (Single or Double Sided)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 6 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PF (Vertical Upwards)

| Joint Design | Welding Sequence |
|---|---|
|   |   Dimension z = Fillet weld leg length in mm |

**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| 1 | 135 (MAG) | 1.2 | 170 - 190 | 22 - 24 | DC +ve | 4.0 - 4.5 | 120 - 160 | 1.1 - 1.8 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 75mm) |
| **Interpass Temperature** | N/A |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. In all cases the gap between component parts shall be kept to a minimum.
3. Should the gap between component parts exceed 1mm, the fillet leg length shall be increased in order to achieve the required design throat thickness. Under no circumstance should the gap between component parts exceed 3mm.
4. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

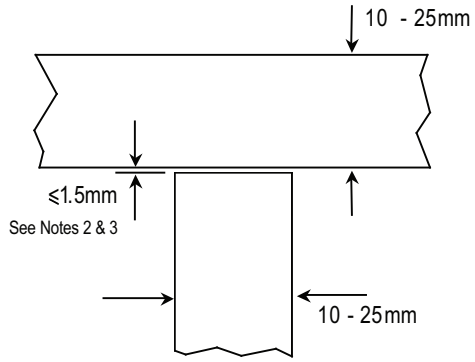
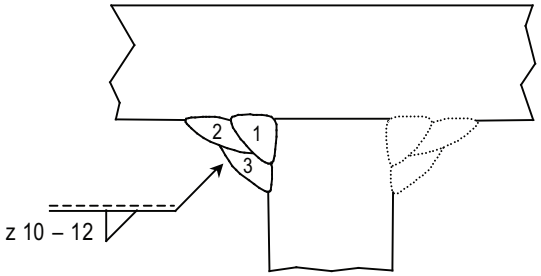
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 07-PF(b)
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Multi-run Fillet Weld (Single or Double Sided)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 10 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PF (Vertical Upwards)

| Joint Design | Welding Sequence |
|---|---|
|  |  |





Dimension z = Fillet weld leg length in mm

**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| 1 - 3 | 135 (MAG) | 1.2 | 170 - 190 | 22 - 24 | DC +ve | 4.0 - 4.5 | 120 - 160 | 1.1 - 1.8 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 75mm) |
| **Interpass Temperature** | 250° Maximum (See Note 4) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. In all cases the gap between component parts shall be kept to a minimum.
3. Should the gap between component parts exceed 1.5mm, the fillet leg length shall be increased in order to achieve the required design throat thickness. Under no circumstance should the gap between component parts exceed 3mm.
4. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
5. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

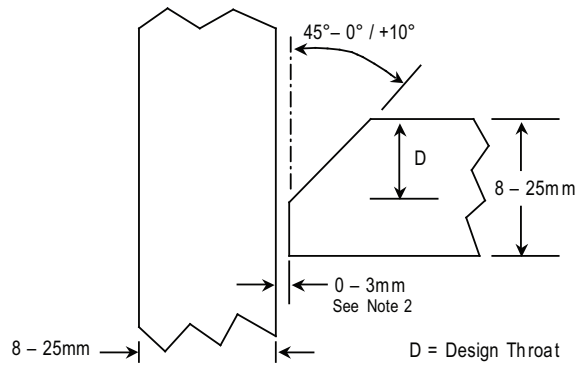
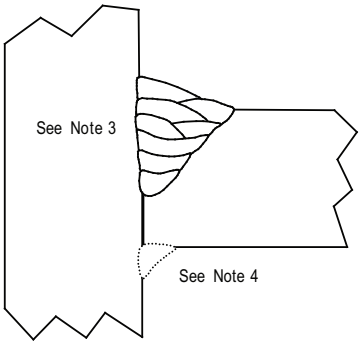
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 08-PA
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Single Bevel Tee Butt Weld (partial penetration)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 8 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PA (Flat)

| Joint Design | Welding Sequence |
|---|---|
|  |  |





**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| All | 135 (MAG) | 1.2 | 250 - 270 | 28 - 30 | DC +ve | 7.5 - 8.0 | 280 - 300 | 1.1 - 1.4 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 75mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 5) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. In all cases the gap between component parts shall be kept to a minimum.
3. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
4. This type of joint might typically be accompanied by a fillet weld on the reverse side.
5. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
6. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

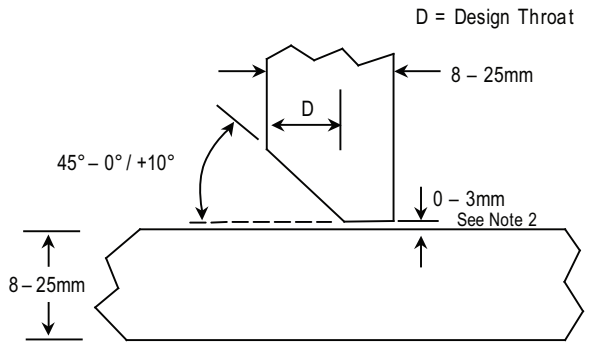
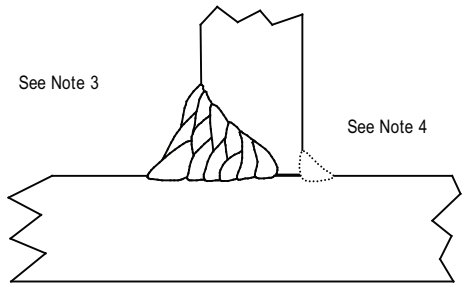
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 08-PC
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Single Bevel Tee Butt Weld (partial penetration)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 8 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PC (Horizontal)

| Joint Design | Welding Sequence |
|---|---|
|  |  |



**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| Root | 135 | 1.2 | 240 - 260 | 29 - 30 | DC +ve | 7.5 - 8.0 | 280 - 300 | 1.1 - 1.3 |
| Fill (Note 4) | 135 | 1.2 | 270 - 290 | 29 - 30 | DC +ve | 8.5 - 9.0 | 300 - 320 | 1.2 - 1.4 |
| Cap | 135 | 1.2 | 240 - 260 | 29 - 30 | DC +ve | 7.5 - 8.0 | 280 - 300 | 1.1 - 1.3 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 75mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 5) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. In all cases the gap between component parts shall be kept to a minimum.
3. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
4. This type of joint might typically be accompanied by a fillet weld on the reverse side.
5. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
6. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

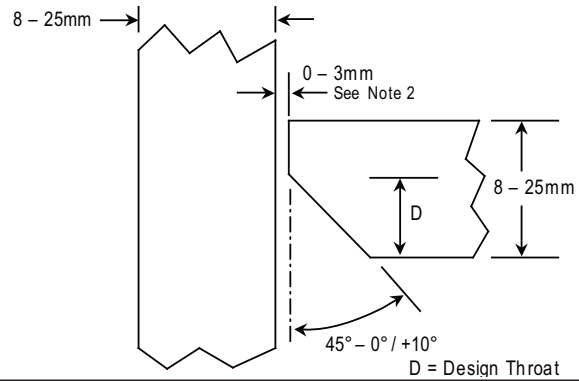
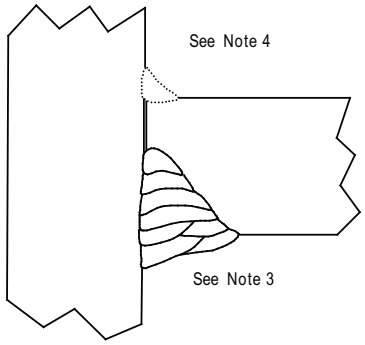
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 08-PF
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Single Bevel Tee Butt Weld (partial penetration)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 8 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PF (Vertical Upwards)

| Joint Design | Welding Sequence |
|---|---|
|  |  |



**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| All | 135 (MAG) | 1.2 | 170 - 190 | 22 - 24 | DC +ve | 3.5 - 4.0 | 120 - 160 | 1.1 - 1.8 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 75mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 5) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. In all cases the gap between component parts shall be kept to a minimum.
3. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
4. This type of joint might typically be accompanied by a fillet weld on the reverse side.
5. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
6. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

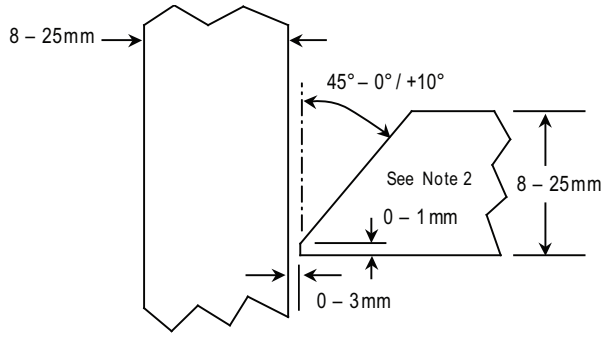
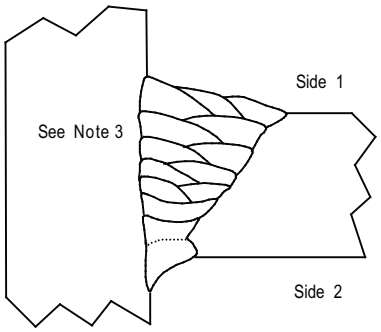
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 09-PA
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Single Bevel Tee Butt Weld (full penetration)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 8 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PA (Flat)

| Joint Design | Welding Sequence |
|---|---|
|  |  |



**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| Root | 135 | 1.2 | 260 - 280 | 26 - 28 | DC +ve | 5.5 - 6.0 | 240 - 285 | 1.1 - 1.5 |
| Fill (Note 4) | 135 | 1.2 | 270 - 290 | 29 - 30 | DC +ve | 8.5 - 9.0 | 300 - 320 | 1.2 - 1.4 |
| Cap & Side 2 | 135 | 1.2 | 270 - 290 | 29 - 30 | DC +ve | 8.5 - 9.0 | 300 - 320 | 1.2 - 1.4 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | Arc air gouge and / or grind back Side 2 to sound metal. |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 75mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 5) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. For thicknesses ⩾15mm, where access is not restricted, a double bevel preparation should be considered.
3. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
4. Material thickness may not always allow deposition of fill passes.
5. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
6. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

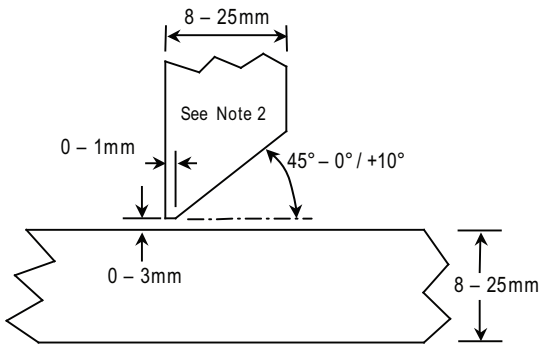
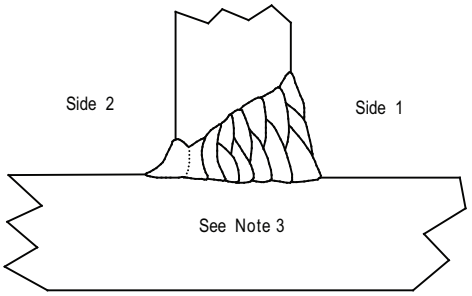
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 09-PC
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Single Bevel Tee Butt Weld (full penetration)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 8 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PC (Horizontal)

| Joint Design | Welding Sequence |
|---|---|
|  |  |



**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| Root | 135 | 1.2 | 260 - 280 | 26 - 28 | DC +ve | 5.5 - 6.0 | 240 - 285 | 1.1 - 1.5 |
| Fill (Note 4) | 135 | 1.2 | 270 - 290 | 29 - 30 | DC +ve | 8.5 - 9.0 | 300 - 320 | 1.2 - 1.4 |
| Cap & Side 2 | 135 | 1.2 | 270 - 290 | 29 - 30 | DC +ve | 8.5 - 9.0 | 300 - 330 | 1.1 - 1.4 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | Arc air gouge and / or grind back Side 2 to sound metal. |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 75mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 5) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. For thicknesses ⩾15mm, where access is not restricted, a double bevel preparation should be considered.
3. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
4. Material thickness may not always allow deposition of fill passes.
5. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
6. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

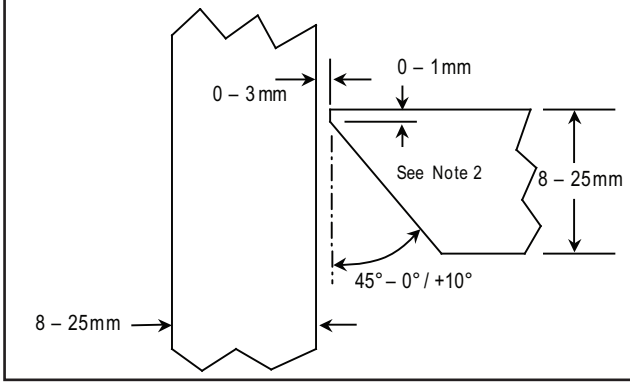
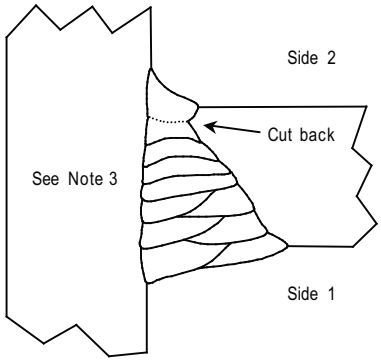
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 09-PF
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Single Bevel Tee Butt Weld (full penetration)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 8 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PF (Vertical Upwards)

| Joint Design | Welding Sequence |
|---|---|
|  |  |



**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| All | 135 (MAG) | 1.2 | 170 - 190 | 22 - 24 | DC +ve | 4.0 - 4.5 | 120 - 160 | 1.1 - 1.8 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | Arc air gouge and / or grind back Side 2 to sound metal. |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 75mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 4) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. For thicknesses ⩾15mm, where access is not restricted, a double bevel preparation should be considered.
3. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
4. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
5. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

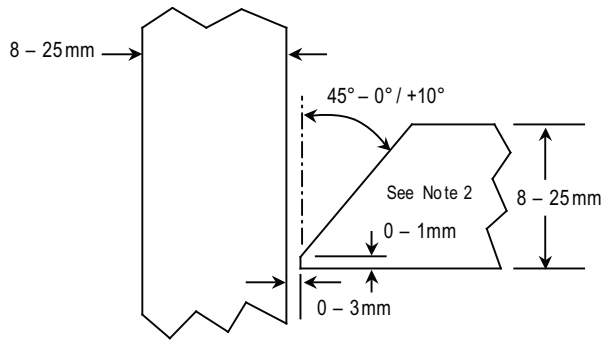
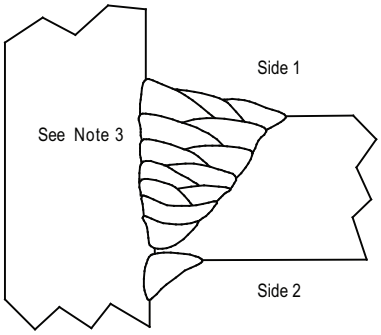
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 10-PA
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Single Bevel Tee Butt Weld (full strength)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 8 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PA (Flat)

| Joint Design | Welding Sequence |
|---|---|
|  |  |



**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| Root | 135 | 1.2 | 260 - 280 | 26 - 28 | DC +ve | 5.5 - 6.0 | 240 - 285 | 1.1 - 1.5 |
| Fill (Note 4) | 135 | 1.2 | 270 - 290 | 29 - 30 | DC +ve | 8.5 - 9.0 | 300 - 320 | 1.2 - 1.4 |
| Cap & Side 2 | 135 | 1.2 | 270 - 290 | 29 - 30 | DC +ve | 8.5 - 9.0 | 300 - 320 | 1.2 - 1.4 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 75mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 5) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. For thicknesses ⩾15mm, where access is not restricted, a double bevel preparation should be considered.
3. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
4. Material thickness may not always allow deposition of fill passes.
5. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
6. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

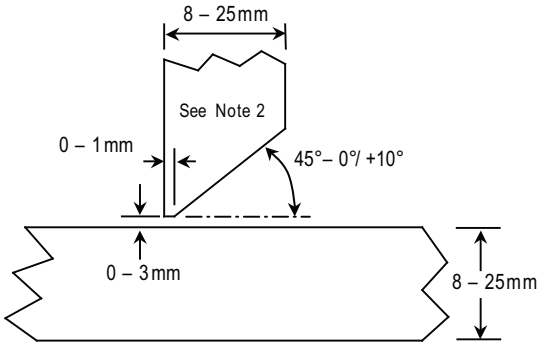
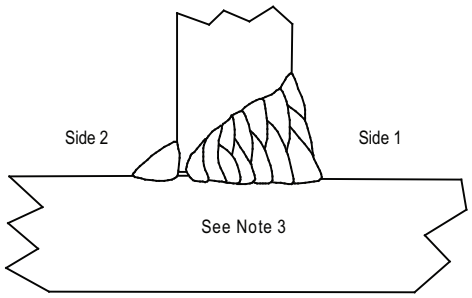
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 10-PC
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Single Bevel Tee Butt Weld (full strength)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 8 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PC (Horizontal)

| Joint Design | Welding Sequence |
|---|---|
|  |  |



**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| Root | 135 | 1.2 | 260 - 280 | 26 - 28 | DC +ve | 5.5 - 6.0 | 240 - 285 | 1.1 - 1.5 |
| Fill (Note 4) | 135 | 1.2 | 270 - 290 | 29 - 30 | DC +ve | 8.5 - 9.0 | 300 - 320 | 1.2 - 1.4 |
| Cap & Side 2 | 135 | 1.2 | 270 - 290 | 29 - 30 | DC +ve | 8.5 - 9.0 | 300 - 330 | 1.1 - 1.4 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 75mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 5) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. For thicknesses ⩾15mm, where access is not restricted, a double bevel preparation should be considered.
3. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
4. Material thickness may not always allow deposition of fill passes.
5. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
6. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

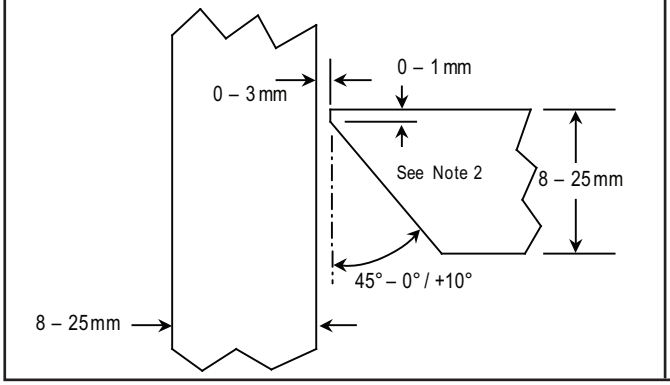
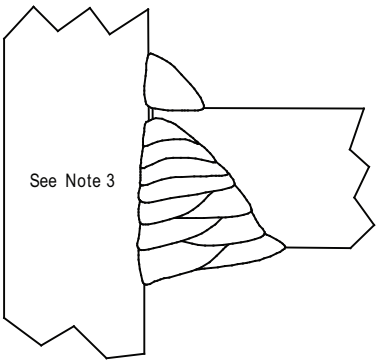
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 10-PF
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Single Bevel Tee Butt Weld (full penetration)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 8 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PF (Vertical Upwards)

| Joint Design | Welding Sequence |
|---|---|
|  |  |



**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| All | 135 (MAG) | 1.2 | 170 - 190 | 22 - 24 | DC +ve | 4.0 - 4.5 | 120 - 160 | 1.1 - 1.8 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 75mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 4) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. For thicknesses ⩾15mm, where access is not restricted, a double bevel preparation should be considered.
3. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
4. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
5. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

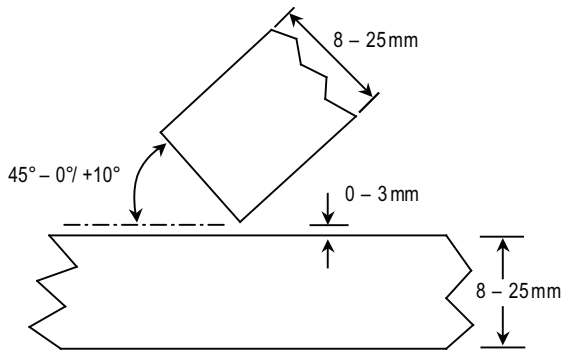
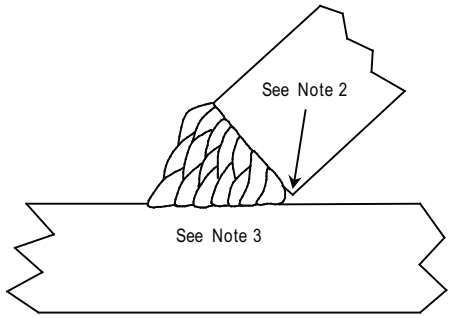
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 11-PC(a)
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Partial Penetration Butt (welded from one side)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 8 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PC (Horizontal)

| Joint Design | Welding Sequence |
|---|---|
|  |  |





**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| All | 135 (MAG) | 1.2 | 250 - 270 | 28 - 30 | DC +ve | 7.5 - 8.0 | 280 - 300 | 1.1 - 1.4 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 75mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 4) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. The maximum unfused root = 3mm
3. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
4. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
5. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

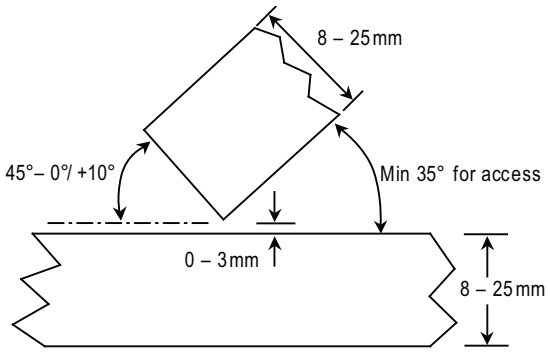
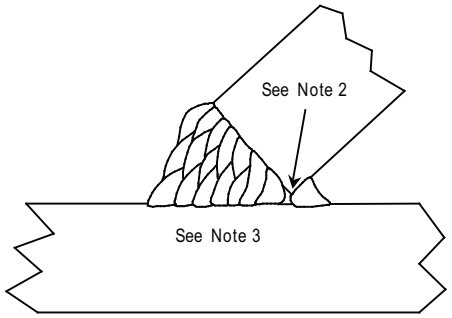
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 11-PC(b)
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Partial Penetration Butt (welded from both sides)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 8 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PC (Horizontal)

| Joint Design | Welding Sequence |
|---|---|
|  |  |





**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| All | 135 (MAG) | 1.2 | 250 - 270 | 28 - 30 | DC +ve | 7.5 - 8.0 | 280 - 300 | 1.1 - 1.4 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 75mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 4) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. The maximum unfused root = 3mm
3. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
4. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
5. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

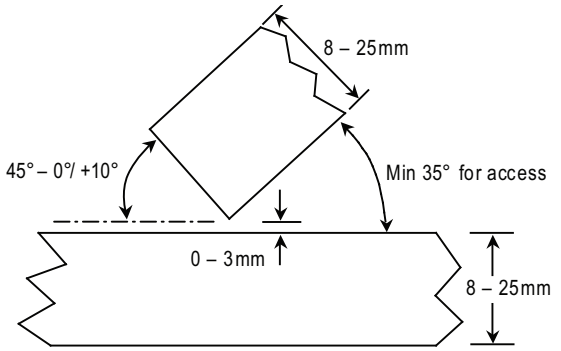
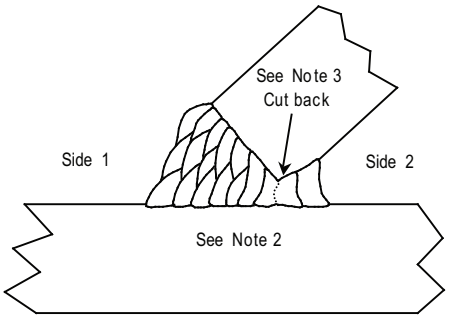
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 11-PC(c)
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Full Penetration Butt (welded from both sides)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 8 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PC (Horizontal)

| Joint Design | Welding Sequence |
|---|---|
|  |  |



**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| All | 135 (MAG) | 1.2 | 250 - 270 | 28 - 30 | DC +ve | 7.5 - 8.0 | 280 - 300 | 1.1 - 1.4 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | Arc air gouge and / or grind back Side 2 to sound metal |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 75mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 4) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
3. It is permissible to weld Side 2 first and cut back to sound metal from Side 1.
4. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
5. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

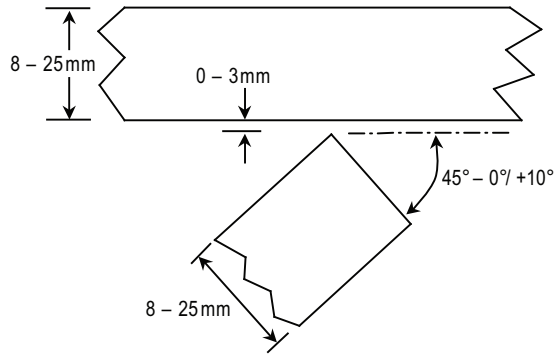
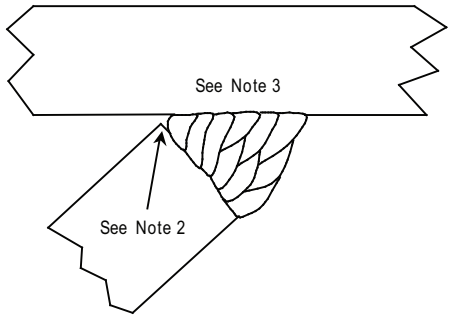
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 11-PF(a)
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Partial Penetration Butt (welded from one side)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 8 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PF (Vertical Upwards)

| Joint Design | Welding Sequence |
|---|---|
|  |  |





**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| All | 135 (MAG) | 1.2 | 170 - 190 | 22 - 24 | DC +ve | 4.0 - 4.5 | 120 - 160 | 1.1 - 1.8 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 75mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 4) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. The maximum unfused root = 3mm
3. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
4. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
5. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

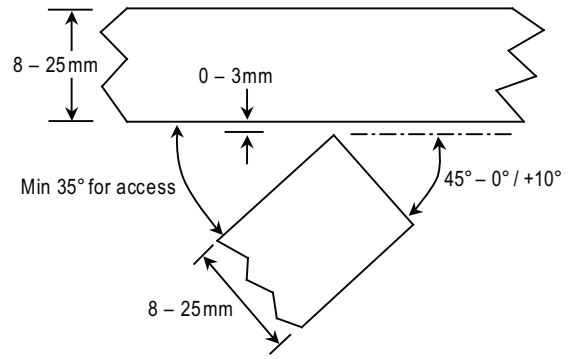
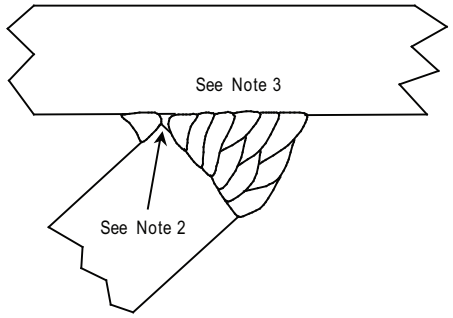
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 11-PF(b)
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Partial Penetration Butt (welded from both sides)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 8 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PF (Vertical Upwards)

| Joint Design | Welding Sequence |
|---|---|
|  |  |



**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| All | 135 (MAG) | 1.2 | 170 - 190 | 22 - 24 | DC +ve | 4.0 - 4.5 | 120 - 160 | 1.1 - 1.8 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 75mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 4) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. The maximum unfused root = 3mm
3. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
4. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
5. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

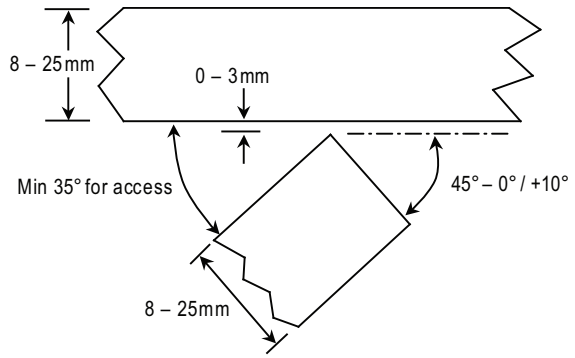
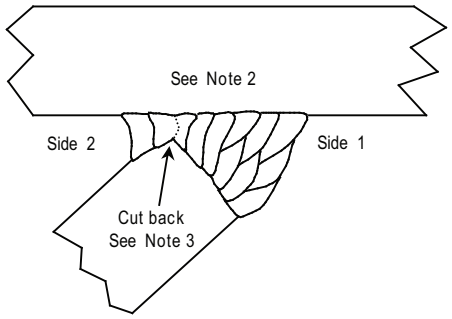
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 11-PF(c)
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Full Penetration Butt (welded from both sides)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 8 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PF (Vertical Upwards)

| Joint Design | Welding Sequence |
|---|---|
|  |  |



**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| All | 135 (MAG) | 1.2 | 170 - 190 | 22 - 24 | DC +ve | 4.0 - 4.5 | 120 - 160 | 1.1 - 1.8 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | Arc air gouge and / or grind back Side 2 to sound metal |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 75mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 4) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
3. It is permissible to weld Side 2 first and cut back to sound metal from Side 1.
4. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
5. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

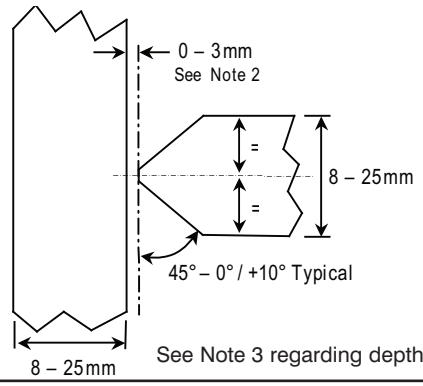
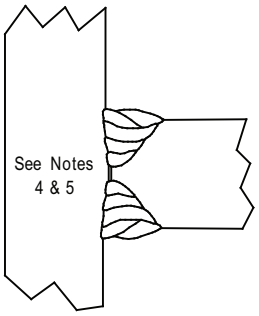
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 12-PA(a)
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Double Bevel Tee Butt Weld (partial penetration)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 8 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PA (Flat)

| Joint Design | Welding Sequence |
|---|---|
|  See Note 3 regarding depth of preparation |  |

**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| All | 135 (MAG) | 1.2 | 250 - 270 | 28 - 30 | DC +ve | 7.5 - 8.0 | 280 - 300 | 1.1 - 1.4 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 75mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 6) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. In all cases the gap between component parts shall be kept to a minimum.
3. The depth of preparation shall be such that the deposited weld will satisfy the required design throat thickness.
4. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
5. A balanced welding sequence may be required to avoid distortion; particularly in the thicker material ranges.
6. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
7. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

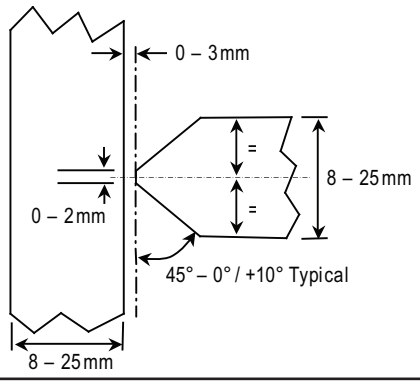
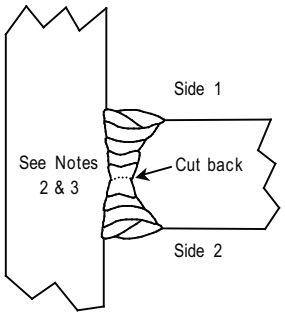
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 12-PA(b)
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Double Bevel Tee Butt Weld (full penetration)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 8 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PA (Flat)

| Joint Design | Welding Sequence |
|---|---|
|  |  |



**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| All | 135 (MAG) | 1.2 | 250 - 270 | 28 - 30 | DC +ve | 7.5 - 8.0 | 280 - 300 | 1.1 - 1.4 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | Arc air gouge and / or grind back Side 2 to sound metal |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 75mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 4) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
3. A balanced welding sequence may be required to avoid distortion; particularly in the thicker material ranges.
4. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
5. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

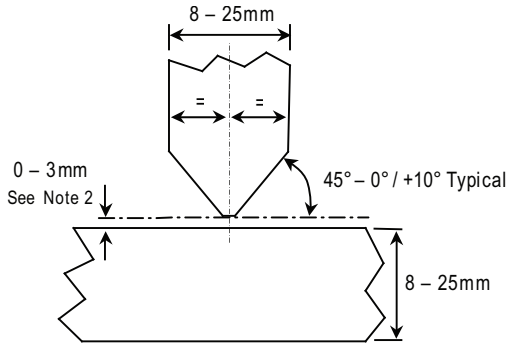
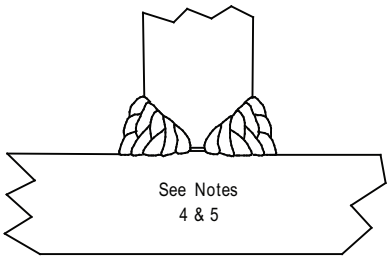
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 12-PC(a)
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Double Bevel Tee Butt Weld (partial penetration)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 8 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PC (Horizontal)

| Joint Design | Welding Sequence |
|---|---|
|  See Note 3 regarding depth of preparation |  |

**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| Root | 135 | 1.2 | 260 - 280 | 26 - 28 | DC +ve | 5.5 - 6.0 | 240 - 285 | 1.1 - 1.5 |
| Fill | 135 | 1.2 | 270 - 290 | 29 - 30 | DC +ve | 8.5 - 9.0 | 300 - 320 | 1.2 - 1.4 |
| Cap | 135 | 1.2 | 270 - 290 | 29 - 30 | DC +ve | 8.5 - 9.0 | 300 - 330 | 1.1 - 1.4 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 75mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 6) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. In all cases the gap between component parts shall be kept to a minimum.
3. The depth of preparation shall be such that the deposited weld will satisfy the required design throat thickness.
4. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
5. A balanced welding sequence may be required to avoid distortion; particularly in the thicker material ranges.
6. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
7. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

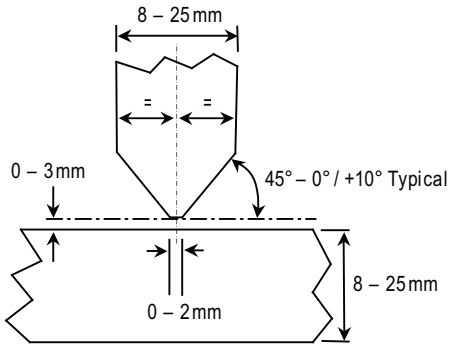
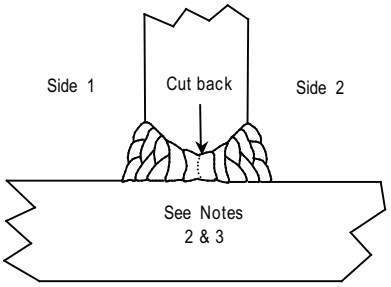
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 12-PC(b)
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Double Bevel Tee Butt Weld (full penetration)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 8 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PC (Horizontal)

| Joint Design | Welding Sequence |
|---|---|
|  |  |





**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| Root | 135 | 1.2 | 260 - 280 | 26 - 28 | DC +ve | 5.5 - 6.0 | 240 - 285 | 1.1 - 1.5 |
| Fill (Note 4) | 135 | 1.2 | 270 - 290 | 29 - 30 | DC +ve | 8.5 - 9.0 | 300 - 320 | 1.2 - 1.4 |
| Cap | 135 | 1.2 | 270 - 290 | 29 - 30 | DC +ve | 8.5 - 9.0 | 300 - 330 | 1.1 - 1.4 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | Arc air gouge and / or grind back Side 2 to sound metal |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 75mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 4) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
3. A balanced welding sequence may be required to avoid distortion; particularly in the thicker material ranges.
4. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
5. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

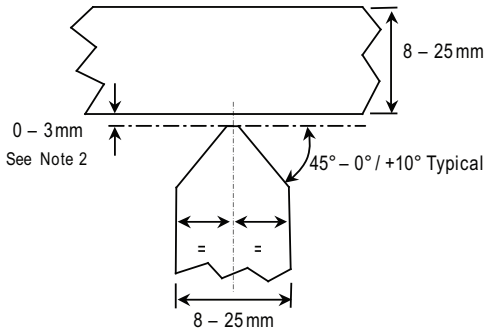
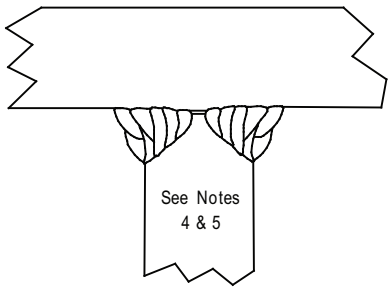
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 12-PF(a)
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Double Bevel Tee Butt Weld (partial penetration)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 8 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PF (Vertical Upwards)

| Joint Design | Welding Sequence |
|---|---|
|  See Note 3 regarding depth of preparation |  |

**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| All | 135 (MAG) | 1.2 | 170 - 190 | 22 - 24 | DC +ve | 4.0 - 4.5 | 120 - 160 | 1.1 - 1.8 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | N/A |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 75mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 6) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. In all cases the gap between component parts shall be kept to a minimum.
3. The depth of preparation shall be such that the deposited weld will satisfy the required design throat thickness.
4. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
5. A balanced welding sequence may be required to avoid distortion; particularly in the thicker material ranges.
6. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
7. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A

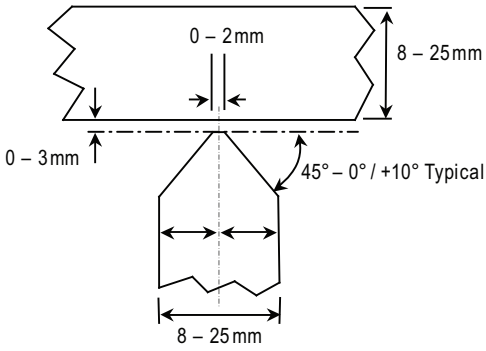
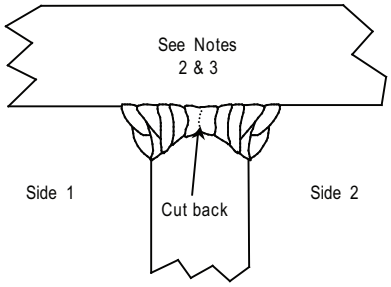
*N/A = Not Applicable

# Welding Procedure Specification (WPS)

**Location:** Workshop
**Manufacturer's WPS No:** 12-PF(b)
**WPQR:** To be confirmed
**Manufacturer:** To be confirmed

**Welder's Name:** N/A
**Welding Process:** 135 (MAG)
**Joint Type:** Double Bevel Tee Butt Weld (full penetration)

**Method of Preparation and Cleaning:**
Thermal cut and / or grinding, wire brush and degrease if required
**Parent Material Designation:**
BS EN 10025-2: S275 & S355 -
Up to and including sub-grade J2 (Max CEV = 0.45)
**Material Thickness:** 8 to 25mm
**Outside Diameter:** N/A
**Welding Position:** PF (Vertical Upwards)

| Joint Design | Welding Sequence |
|---|---|
|  |  |





**Welding Details:**

| Run | Process | Size of Filler Metal Ø mm | Current A | Voltage V | Type of Current/ Polarity | Wire Feed Speed m/min | Travel Speed mm/min | Heat Input kJ/mm |
|---|---|---|---|---|---|---|---|---|
| All | 135 (MAG) | 1.2 | 170 - 190 | 22 - 24 | DC +ve | 4.0 - 4.5 | 120 - 160 | 1.1 - 1.8 |

| | |
|---|---|
| **Filler Metal Classification & Trade Name** | BS EN ISO 14341: G3Si1 (Trade name to be confirmed) |
| **Any Special Baking or Drying** | Stored in accordance with manufacturers recommendations |
| **Gas/Flux: - Shielding / Backing** | Argon / 20% $CO_2$ / 2% $O_2$ |
| **Shielding Gas Flow Rate** | 15 - 18 L/min |
| **Tungsten Electrode Type / Size** | N/A |
| **Details of Back Gouging / Backing** | Arc air gouge and / or grind back Side 2 to sound metal |
| **Preheat Temperature** | 0°C Minimum (for combined thicknesses up to 75mm) |
| **Interpass Temperature** | (°C) 'maximum recorded in WPQR' (Note 4) |
| **Post-Weld Heat Treatment and / or Ageing** | N/A |
| **Time, Temperature, Method** | N/A |
| **Heating & Cooling Rates** | N/A |

**Other Information:**
1. Nozzle diameter = 16mm.
2. Actual run sequence will depend on the thickness of the parent material; that shown is typical only.
3. A balanced welding sequence may be required to avoid distortion; particularly in the thicker material ranges.
4. Interpass temperature shall be checked using a contact thermometer or temperature indicating crayon.
5. Weld finish to be left as-welded unless specified otherwise.

**For Manufacturer:**
RWC's Signature

**For Examiner / Examining Body:**
N/A



*N/A = Not Applicable

# 7 References

## BSI Publications:


BS EN ISO 15614-1: Specification and qualification of welding procedures for metallic materials - Welding procedure test - Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys

BS EN 287-1: Qualification test of welders - Fusion welding - Part 1: Steels

BS EN 1011-1: Welding - Recommendations for welding of metallic materials - Part 1: General guidance for arc welding

BS EN 1011-2: Welding - Recommendations for welding of metallic materials - Part 2: Arc welding of ferritic steels

BS EN ISO 15609-1: Specification and qualification of welding procedures for metallic materials - Welding procedure specification - Part 1: Arc welding

BS EN 10025-1: Hot rolled products of structural steels - Part 1: General technical delivery conditions

BS EN 10025-2: Hot rolled products of structural steels - Part 2: Technical delivery conditions for non-alloy structural steels

BS EN ISO 3690: Welding and allied processes - Determination of hydrogen content in ferritic steel arc weld metal

BS EN ISO 6947: Welds - Working positions - Definitions of angles of slope and rotation

BS EN ISO 9692: Welding and allied processes - Recommendations for joint preparation - Part 1: Manual metal-arc welding, gas-shielded metal-arc welding, gas welding, TIG welding and beam welding of steels

BS EN ISO 4063: Welding and allied processes - Nomenclature of processes and reference numbers

BS EN ISO 14341: Welding consumables - Wire electrodes and deposits for gas shielded metal arc welding of non alloy and fine grain steels - Classification

BS 2901: Filler rods and wires for gas-shielded arc welding - Part 1: Ferritic steels

BS EN ISO 14175: Welding consumables - Gases and gas mixtures for fusion welding

BS EN ISO 15607: Specification and qualification of welding procedures for metallic materials - General rules


## BCSA Publications:


National Structural Steelwork Specification - 5th Edition
National Structural Steelwork Specification - CE Marking Edition

# Appendix A - Calculation of preheating requirements

The following example demonstrates the calculation of pre-heat requirement for the procedures in this publication.

Assuming a T type joint (fillet or butt), using 25mm thick plate (Figure A1):

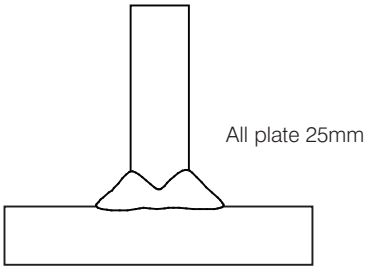
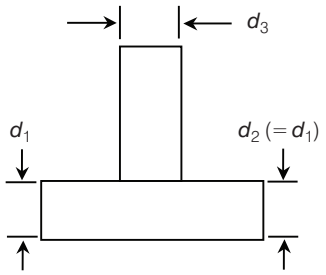



**Figure A1: T type joint**

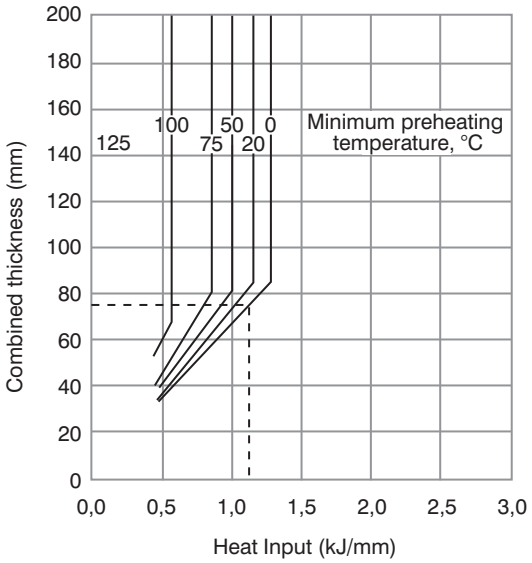
- The combined thickness as determined in Figure C.1 in BS EN 1011-2 is 75mm (Figure A2):




Combined Thickness = $d_1 + d_2 + d_3$

**Figure A2: Determination of combined thickness**

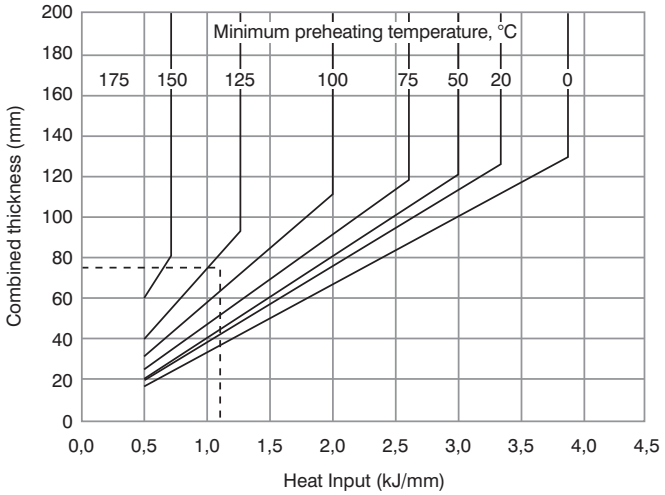
- In the absence of specific material certification, a Carbon Equivalent Value (CEV) of 0.45 has been selected. This is based on the maximum allowable in BS EN 10025 - 2 for grade S355 material ⩽ 30mm thick.
- In accordance with BS EN 1011-2, Section C.2.3.3, solid wires for gas shielded arc welding may be used with a hydrogen scale D.
- With a combined thickness of 75mm and hydrogen scale D, in accordance with BS EN 1011-2 Figure C.2 b) the minimum allowable heat input without preheat is ~1.1 kJ/mm (Figure A3).




| Hydrogen Scale | A | B | C | D | E |
|---|---|---|---|---|---|
| To be used for carbon equivalent not exceeding | 0,34 | 0,39 | 0,41 | 0,46 | 0,48 |

**Figure A3: BS EN 1011-2 Figure C.2 b)**

- All rust, paint, grease and moisture should be removed from the workpiece if hydrogen scale D is to be achieved. Should any of these contaminants be present, the hydrogen scale would have to be increased to scale B; which requires the use of Figure C.2 e) of BS EN 1011-2 (Figure A4). Using the same key parameters (i.e. CEV, combined thickness and a 1.1 kJ/mm heat input) preheating to a minimum of 125°C is required. Procedures requiring preheat are outside the scope of this publication.




| Hydrogen Scale | A | B | C | D | E |
|---|---|---|---|---|---|
| To be used for carbon equivalent not exceeding | 0,43 | 0,45 | 0,47 | 0,53 | 0,55 |

**Figure A4: BS EN 1011-2 Figure C.2 e)**

# Appendix B - Metal-arc Active Gas shielded (MAG) welding with solid wire (Process 135)

This section offers guidance on welding process 135 - metal-arc active gas welding, commonly known as MAG welding.

The number of combinations of wire diameter and shielding gas composition for this process is considerable. The typical WPS in this document incorporate the most commonly used shielding gas composition and a wire size (1.2 mm diameter) which is sufficiently small to produce well controlled weld roots and positional beads whilst being large enough to generate acceptable deposition rates in the flat (PA) position. Although welds can be produced over a range of parameters, the lack of flux to act as an arc stabiliser and wetting agent means that this form of welding is more sensitive to deviations from optimum parameters than most others. Consequently, additional care should be taken with the selection of parameters and monitoring of these with the bead profile. Parameters not correctly set, incorrect technique or improperly adjusted or worn equipment, can usually be identified firstly by the amount of spatter produced and secondly by a poor bead appearance. However, good bead appearance is not a guarantee of good quality, and may conceal sub-surface imperfections.

MAG welding is a partly mechanised semi-automatic welding process that is now commonly introduced into the workshop as a replacement for manual metal arc welding. However, the equipment used is far more sophisticated and more complex to operate, and without correct installation and maintenance, weld quality and production rates are likely to suffer. The required routine maintenance should therefore not be neglected and operators should receive appropriate training. As with all partly mechanised semi-automatic arc welding processes, consistent wire feed (which is achieved by use of correct feed rolls, contact tips and nozzles), is essential. Insufficient gas coverage is another common cause of poor weld appearance and care should be taken to ensure that the gas flow indicated by the flow meter is being delivered to the nozzle, and that spatter inside the nozzle is not causing the emergent gas to swirl and so draw in air. Draughts can also disturb the shielding gas and may result in embrittlement and porosity. Excessive contact tip wear, giving poor wire contact, can result in intermittent arcing and unstable welding conditions. The tip should be replaced before this stage is reached.

Two conventional operating modes can be used for welding, depending on the workpiece thickness and welding position. At high currents a characteristic spray mode of metal transfer is generated in which a spray of fine metallic droplets is propelled across the arc in a stable manner. This spray transfer mode provides high weld deposition rates with deeply penetrating arc characteristics making it suitable for producing fully fused welds in relatively thick sections (usually 6mm and upwards). For a solid wire of 1.2mm diameter, spray transfer welding may be accomplished using welding current in the range 250-400A and Voltage of 26-35V, depending on the shielding gas composition used. The spray transfer mode is appropriate for use in the PA and PB positions.

The dip transfer or short circuiting arc mode is appropriate for welding in all positions. Low current and voltage settings produce a short circuiting arc to achieve controlled transfer of metal droplets. This mode is associated with low heat input. Precise control of the parameter settings is required to attain stable operating conditions and to avoid lack of fusion defects. For a solid wire of 1.2mm diameter, a current range of 80-200A and a voltage range of 15-23V can be used. In addition, it may be necessary to set the inductance or choke level of the equipment. This slows down the surge in current when short circuiting takes place and reduces spatter.

Useful generalisations in setting up and operating solid wire semi-automatic equipment are set out below (see Figure B.1):

1. Constant voltage (flat characteristic power curve) DC power source is preferred;
2. Two or four roll feeders can be used but care should be taken to ensure that their alignment is accurate;
3. For spray transfer mode, an electrode extension of 15-20mm is typical, with the contact tip retracted 3mm within the gas nozzle;
4. For dip transfer mode, an electrode extension of 6-12mm is typical, with the contact tip extended 3mm outside the gas nozzle;
5. A gas nozzle of 16mm diameter is generally used;
6. The preferred torch angles depend on welding position being used. The suggested ranges and directions are as follows:

| Transfer Mode | Welding Postion | Angle of torch in ° and direction |
|---|---|---|
| Spray | PA, PB, PC | 10-20(1) Leading |
| Dip | PF | 0 - 5 Trailing |
| Dip | All except PF | 15 - 20 Leading or Trailing |

Note 1: For a flat bead, 5 - 10° is appropriate.

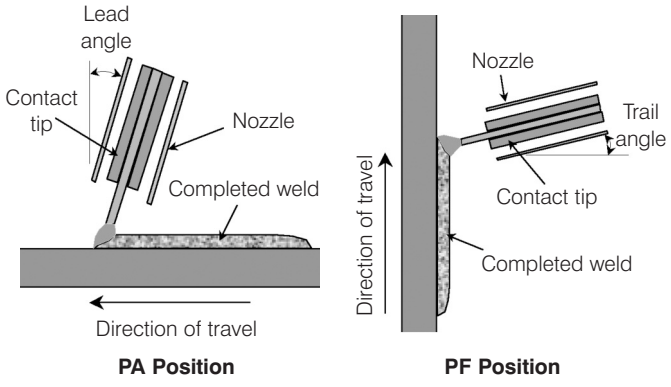



**Figure B.1 Typical torch to workpiece positions**

# Appendix C - Typical Welding Procedure Qualification Record



## Welding Procedure Qualification Test Certificate

*Manufacturer's WPQR No:* XYZ/001 *Examiner or examining body Reference No:* ABC/007

*Manufacturer:* XYZ Fabrications Ltd
*Address:* XYZ Works
ABC Road
Leeds

*Code / Testing Standard:* BS EN ISO 15614-1: 2004 +A1:2008
*Date of Welding:* 1st July 2009

### Range of qualification:

| | |
|---|---|
| *Welding Process(es):* | MAG (135) |
| *Type of joint and weld:* | Butt Weld (1) Fillet Welds (2) |
| *Parent material group(s) and sub-group(s):* | Group 1.2 & 1.1 with Re≤355 N/mm$^2$ |
| *Parent Material Thickness (mm):* | 7.5mm to 30mm |
| *Weld Metal Thickness (mm):* | 7.5mm to 30mm |
| *Throat Thickness (mm)* | N/A |
| *Single run / Multi run:* | Multi Run |
| *Outside Pipe Diameter (mm):* | N/A |
| *Filler Metal Designation:* | EN 440 G4 Si1 |
| *Filler Material Make:* | N/A |
| *Filler Material Size:* | N/A |
| *Designation of Shielding Gas / Flux:* | Argon + 20% $CO^2$ |
| *Designation of Backing Gas:* | N/A |
| *Type of Welding Current and Polarity:* | DC+ve |
| *Mode of Metal Transfer:* | N/A |
| *Heat Input:* | +/- 25% of actual |
| *Welding Positions:* | Flat (PA) |
| *Preheat Temperature:* | 5°C Minimum |
| *Post Heating:* | N/A |
| *Post-Weld Heat Treatment:* | N/A |

**Other Information:**

(1) Double sided butt welds, Single sided with backing
(2) See BS EN ISO 15614-1 Clause 8.4.3

Certified that test welds were prepared, welded and tested satisfactorily in accordance with the requirements of the code / testing standard indicated above.

**Location:** *Leeds*

**Date of Issue:** *5th July 09*

**Examiner or examining body:**
*Name: T Brown*
*Date: 5th July 09*
*Signature:* 

## Details of Weld Test

***Manufacturer's pWPSNo:*** *XYZ/001*
***Manufacturer's WPQR No:*** *XYZ/001*
***Manufacturer:*** XYZ Fabrications Ltd
***Address:*** XYZ Works, ABC Road, Leeds

***Welder's Name:*** R White

***Welding Process:*** MAG (135)
***Joint Type:*** Single Vee Butt (welded from both sides)

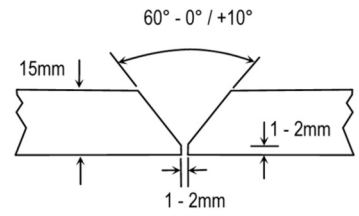
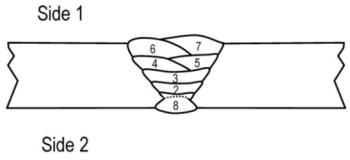
***Examiner or examining body Reference No:*** ABC/007

***Date of Welding:*** 1st July 2009
***Location:*** Workshops

***Method of Preparation & Cleaning:*** Flame Cut & Grinding

***Parent Metal Specification:*** EN 10025: S355 J2
***Parent Metal Thickness (mm):*** 15mm
***Pipe Outside Diameter (mm):*** N/A
***Test Piece / Welding Position:*** Flat (PA)

### Weld Preparation Details (Sketch):

| Joint Design | Welding Sequence |
|---|---|
|  |  |



### Welding Details:

| Run | Process | Size of Filler Metal | Current (A) | Voltage (V) | Type of Current & Polarity | Wire feed / Travel Speed | Heat Input (kJ/mm)* |
|---|---|---|---|---|---|---|---|
| 1 | MAG (135) | 1.2mm | 220 | 29 | DC+ve | 12 mpm / 3.07mm/sec | 1.6 kJ/mm |
| 2-7 | MAG (135) | 1.2mm | 250 | 28 | DC+ve | 12 mpm / 2.29mm/sec | 2.44 kJ/mm |
| 8 | MAG (135) | 1.2mm | 241 | 28 | DC+ve | 12 mpm / 2.73mm/sec | 1.98 kJ/mm |

***Filler Metal Type Designation & Trade Name:*** Bohler EMK 8A, EN 440 G4 Si1 (AWS A5.18 ER70-S6)
***Any Special Baking or Drying:*** N/A
***Gas / Flux:*** Argon + 20% $CO^2$
***Gas Flow Rate – Shield:*** 17 LPM
***Backing:*** N/A
***Tungsten Electrode Type / Size:*** N/A
***Details of Back Gouging / Backing:*** Back Grind to Sound Metal
***Preheat Temperature:*** 5°C Minimum
***Interpass Temperature:*** 210°C Maximum

### Post Weld Heat Treatment:

***Time, Temperature, Method:*** N/A
***Heating and Cooling Rates:*** N/A

### Other Information:

$$\text{*Minimum Heat Input} = \frac{K \times A \times V \times 10^{-3}}{\text{Travel Speed}}$$

K = 0.8 for MAG process

**Manufacturer:**
*Name: S Jones*

*Date: 5th July 09*

*Signature:* S Jones

**Examiner or examining body:**
*Name: T Brown*

*Date: 5th July 09*

*Signature:* T Brown

## Test Results

***Manufacturer's WPQR No:*** *XYZ/001* ***Examiner or examining body Reference No:*** ABC/007

***Visual Examination:*** Acceptable ***Radiography:*** Acceptable

***Penetrant / Magnetic Particle Test:*** Acceptable ***Ultrasonic Examination:*** Not Applicable

***Tensile Tests:*** EN 10002-1: 2001 ***Temperature:*** 20°C

| *Type / No.* | *Re N/mm²* | *Rm N/mm²* | *A % on* | *Z%* | *Fracture Location* | *Remarks* |
|---|---|---|---|---|---|---|
| Requirement | | (490 min) | | | | |
| Transverse 1 | - | 556 | - | - | 38mm Clear of Weld | Acceptable |
| Transverse 2 | - | 568 | - | - | 25mm Clear of Weld | Acceptable |

***Bend Tests:*** EN 910: 1996 ***Former Diameter:*** 4t

| *Type / No.* | *Bend Angle* | *Elongation:* | *Result:* |
|---|---|---|---|
| SIDE 1 | 180° | - | Acceptable |
| SIDE 2 | 180° | - | Acceptable |
| SIDE 3 | 180° | - | Acceptable |
| SIDE 4 | 180° | - | Acceptable |

***Fillet Fracture Test:*** Not Applicable

***Macro Examination:*** Acceptable

***Impact Tests:*** EN 10045-1 1990 ***Type:*** KV 150 ***Size:*** 10 x 10mm ***Requirement:*** 27J Min

| *Notch Location / Direction* | *Temp °C* | *Values* | *Average* | *Remarks* |
|---|---|---|---|---|
| Weld Metal | -20 | 115, 132, 113 | 120J | Acceptable |
| HAZ | -20 | 43, 60, 53 | 52J | Acceptable |

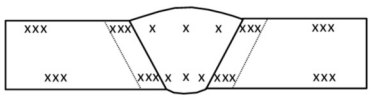
***Hardness Tests:*** EN ISO 6507-1 1997

*Type & Load:* Vickers / 10Kg

*Values – Parent Metal* 180 -212

*- HAZ* 216 – 325

*- Weld Metal* 213 -247




***Other Tests:*** None

***Remarks:*** Tests Acceptable to Specification

***Tests carried out in accordance with the requirements of:*** BS EN ISO 15614-1: 2004 +A1:2008

***Laboratory Reference No.*** ABC/007

***Test Results Were:*** Acceptable / ~~Not Acceptable~~

***Tests carried out in the presence of:*** A Smith (Laboratory Manager)

**Examiner or examining body:**

*Name: T Brown*

*Date: 5th July 09*

*Signature:* T Brown


# Typical Welding Procedure Specifications for Structural Steelwork

BCSA Publication No. 50/09