

SPECIFICATION FOR STEEL SHEET PILES

1.0 DEFINITIONS AND STANDARDS

1.1 Definitions

In this Specification the terms 'submitted', 'demonstrated', 'notified' and 'required' mean submitted to the Engineer', demonstrated to Engineer, 'notified to the Engineer' and required by the Engineer' respectively.

Commencing surface: is the level at which the piling equipment first enters the ground.

Cut-off-level: is the level to which the pile is trimmed.

Element: means an individual component utilized in a particular embedded retaining walling system, which can be constructed in isolation.

1.2 British Standards and other Codes of Practice

All materials and workmanship shall be in accordance with the appropriate British Standards, Codes of Practice and other specified standards current at the date of tender except where the requirements of these Standards or Codes of Practice are in conflict with this Specification in which case the requirements of this Specification shall take precedence.

2.0 PROGRESS REPORT

The Contractor shall submit to the Engineer on the first day of each week a progress report showing the current rate of progress and progress during the previous period on all important items of each section of the Works.

3.0 WALL LAYOUT, DESIGN AND CONSTRUCTION

The Contractor is required to construct elements of the type(s) and dimensions specified and having the qualities of materials and workmanship specified.

4.0 MATERIALS

The sources of supply of materials shall not be changed until the Contractor has demonstrated that the materials from the new source can meet all the requirements of the Specification.

Materials failing to comply with the Specification shall be removed promptly from the site.

5.0 SAFETY

5.1 Standards

Safety precautions through the piling operations shall comply with the DOSH safety requirements and The Occupational Safety and Health Act 1994, or any subsequent re-enactment thereof and with BS 8004.

5.2 Live-saving Appliance

The Contractor shall provide and maintain on the Site sufficient proper and efficient life-saving appliances. The appliances must be conspicuous and available for use at all times.

Site operators shall be conversant with the use of safety equipment and drills shall be carried out sufficiently frequently to ensure that all necessary procedures can be correctly observed.

6.0 GROUND CONDITIONS

The Contractor shall report immediately to the Engineer any circumstance which indicates that in the Contractor's opinion the ground conditions differ from those reported in or which could have been inferred from the subsurface investigation reports.

7.0 TOLERANCES ON SETTING OUT

Marker pins for the sheet pile wall positions shall be set out and installed by the Contractor. Prior to installation of the sheet pile wall, the element positions shall be checked by the Contractor and confirmed by Consultant.

8.0 CONSTRUCTION METHOD

The Contractor shall submit with his tender all relevant details of the method of construction of the sheet pile wall and the plant and monitoring equipment he plans to adopt. Alternative methods may be stated provided it is demonstrated that they satisfy the requirements of the Specification.

9.0 PROGRAMME OF WORKS FOR SHEET PILES

The Contractor shall submit a provisional programme for the execution of the Works at the time of tender and a detailed programme prior to commencement of the Works. He shall inform the Engineer each day of the intended programme of sheet piles wall construction for the following day and shall give 24 hours' notice of his intention to work outside normal hours and at weekends.

The Contractor shall ensure that during the course of the work, displacement or damage which would impair either performance or durability does not occur to completed elements.

10.0 RECORDS

The Contractor shall keep records as indicated in section 19 of Piling Records for sheet pile walls, and shall submit two signed copies of these records to the Engineer not later than noon of the next working day after the element was installed.

Any unexpected driving conditions shall be noted in the records.

11.0 NUISANCE AND DAMAGE

11.1 Noise and Disturbance

The Contractor shall carry out the work in such a manner and at such times as to minimize noise, vibration and other disturbance in order to comply with current environmental legislation. Particular restrictions on permissible working hours are stated in regulations of local authorities and the Particular Specification or Tender Documents.

11.2 Damage to Adjacent Structures

Permissible damage criteria for adjacent structures or services are given in the Particular Specification. If in the opinion of the Contractor damage may be caused to other structures or services by his execution of the Works he shall immediately notify the Engineer and make good at his own cost and time. The Contractor shall submit his plans for making surveys and monitoring movements or vibration before the commencement of the Works at his own cost and time.

The Contractor shall determine the positions of all known services and structures before commencing work on site.

11.3 Damage to Completed Wall Elements

The Contractor shall ensure that during the course of the work, displacement or damage which would impair either performance or durability does not occur to completed wall elements.

The Contractor shall submit to the Engineer his planned sequence and timing for installing wall elements, having regard to the avoidance of damage to adjacent wall elements and other structures or services.

12.0 SUPERVISION AND CONTROL OF THE WORKS

The Contractor shall have a competent full-time site supervisor at the site to be in charge of the sheet pile wall construction or installation.

The site supervisor must be experienced in the sheet pile wall construction necessitated by the Contract. A curriculum vitae for the supervisor shall be submitted prior to commencement. The whole time of the site supervisor shall be devoted to the sheet pile wall works. The site supervisor shall not be removed from the Works without the Engineer being notified in advance with at least one week's notice.

The Contractor shall submit to the Engineer one week prior to commencement of retaining wall works his Quality Plan for the Works. Subsequent revisions, amendments or additions shall be submitted to the Engineer prior to their implementation. Quality Assurance and Quality Control documentation shall be made available to the Engineer on request.

13.0 ORDERING OF PILES

The Contractor shall ensure that the piles are available at the time for incorporation in the Works. All piles and production facilities shall be made available for inspection at any time. Only new piles shall be used for permanent works. Piles shall be carefully examined at the time of delivery and damaged piles repaired or replaced. The records of testing of the steel used in the piles shall be submitted prior to commencing the Works.

14.0 MATERIALS

14.1 Standard Sheet Piles

Unless specified otherwise, all steel for sheet piles shall be manufactured to BS 4360, Grades 43A or 50A or to BS EN10 025 Grades Fe 430A or Fe 510A.

The dimensional tolerances of the sheet piles shall comply with Table 1.0.

14.2 Fabricated Sheet Piles

All fabricated piles, e.g. corners, junctions, box sections, high modulus sections, shall be fabricated and supplied to the sheet pile manufacturer's recommendations.

14.3 Storage

If sheet piles of different grade steel are stored on site, each pile shall be clearly marked as to its grade and piles of different grade shall be stored separately.

14.4 Clutch Sealant

If specified in the Particular Specification, the Contractor shall apply a clutch sealant to the piles prior to pitching in accordance with the manufacturer's recommendations. He shall supply details with his tender of the brand and properties of clutch sealant he plans to use.

Table 1.0. Dimensional tolerances for steel sheet piles

Dimension to which tolerance applies	Tolerance
1. Width (a) Single piles (b) Interlocked piles	$\pm 2\%$ $\pm 3\%$
2. Thickness of section	$\pm 5\%$
3. Weight	$\pm 5\%$
4. Length	$\pm 50\text{mm}$
5. Squareness of cut for each section (a) parallel to line of wall (b) perpendicular to line of wall	$\leq 2\%$ $\leq 10\text{mm}$
6. Straightness	$\leq 0.2\%$ of pile length
7. Depth of section	$\pm 4\%$

15.0 PILE HANDLING AND DRIVING

15.1 Pile Handling

When assembling piles before pitching the Contractor shall ensure that the interlocks are clean and free from distortion. All storage, handling, transporting and pitching of piles shall be carried out in such a way that no significant damage occurs to piles and their coatings.

15.2 Pile Installation

The Contractor shall satisfy himself that the sheet piles can be installed adequately to the correct depths through the reported or anticipated soil conditions. The Engineer shall be notified 24 hours before the commencement of driving.

The piles shall be guided and held in position by temporary gates with each pile properly interlocked with its neighbour. Piles shall not by-pass one another in place of interlocking.

Where sheet piles are driven in panels, the end piles to each panel shall be driven in advance of the general run of piles. After allowing for initial penetration, no pile in the panel shall be driven to an excessive lead in comparison with the toe level of the panel in general and where hard driving is encountered this lead should not exceed 1m.

At all stages during driving the free length of the sheet pile shall be adequately supported and restrained. The Contractor shall ensure that the sheet panels are driven without significant damage or declutching.

The selection of driving and contracting plant shall be made having due regard to the ground conditions and pile type. The sheet piles shall be driven to the specified level and/or resistance or if hard driving is experienced, to practical refusal (which shall be defined as when the rate of penetration is below 100mm per minute when hammering continuously or 12 blows per 25mm movement when using the appropriate equipment), or when visible damage to the pile occurs. Practical refusal for pile extraction shall be defined generally as when the rate of extraction of a pile is below 100mm per minute when back-hammering or pulling (with equipment normally capable of withdrawing a pile) continuously (after an initial effort of 10 minutes), or when damage to the pile head occurs. If the piles have not penetrated to the levels specified in the Particular Specification, or have encountered obstructions, the Contractor shall submit details as to how he will overcome the problem.

If required in the Particular Specification, the Contractor shall install the sheet piles using a vibrationless jacking system.

Pile driving hammers shall be correctly positioned on the pile so that the hammer will be aligned as near to the axis of the pile as is practically possible. Freely suspended piling hammers shall be equipped with correctly adjusted leg guides and inserts. Where a hammer is mounted in a rigid leader, the leader shall be stable. The anvil block or driving plate shall be of sufficient size to cover as much as possible of the cross-section of pile.

Piles previously driven shall not be used until the Contractor can demonstrate that they can meet all the requirements of the Specification.

The Contractor may provide each pile in more than one length. Spliced joints shall be designed to cater for the combined effects of bearing, shear and bending stresses imposed upon the sheet piles. Splices shall be located to avoid maximum stress positions. If splices are to be welded, then these shall be designed in accordance with the guidelines given in BS 5135 and the manufacturer's recommendations. Weld metal shall not encroach within the interlock areas so as not to interfere with the interlocking of the piles.

16.0 POSITIONAL AND ALIGNMENT TOLERANCE

Unless deflected by obstructions, sheet piles shall be installed within the following tolerances:

- In plan ± 75 mm of the given sheet pile line at commencing surface
- Vertical 1 in 75
- Level ± 50 mm of required top level.

Pile line dimensions shall be based on the nominal size of piles. Creep or shrinkage of the pile lines shall not exceed the manufacturer's rolling tolerances.

17.0 WELDING

17.1 Welders' Qualifications

Only welders who are qualified to BS EN 287 or CIDB and have a proven record over the previous six months, or who have attained a similar standard, shall be employed on the Works. Proof of welders' proficiency shall be made available to the Engineer on request.

17.2 Welding Standard

For manual metal arc and semi-automatic welding of carbon and carbon manganese steels, welding of piles and steel framework shall be carried out in accordance with BS 5135, the standard being Quality Category D in accordance with Appendix H, Tables 18 and 19. Defective welds shall be cut out and replaced. Where steel piles are to be spliced by butt welding the interlocks shall not be welded unless a sealing weld is required.

18.0 DURABILITY AND PROTECTION

Protective coating shall be applied, if specified, following the procedures set out in this Specification.

If a structure is to be welded to piles, the piles shall be cut square and to within $\pm 5\text{mm}$ of the levels specified. If pile heads are to be encased in concrete they shall be cut to within $\pm 20\text{mm}$ of the levels specified, and protective coatings shall be removed from the surfaces of the pile heads down to a level 100mm above the soffit of the concrete.

18.1 Definition

The term 'coating' shall include the primer and the coats specified.

18.2 Specialist Labour

The preparation of surfaces and the application of the coats to form the coating shall be carried out by specialist labour having experience in the preparation of the surface and the application of the coating specified.

18.3 Protection During Coating

All work associated with surface preparation and coating shall be undertaken inside a waterproof structure.

18.4 Surface Preparation

All surfaces to be coated shall be clean and dry and prepared by one or both of the following methods, as specified.

Degreasing with detergent wash compatible with the coating shall be carried out where necessary.

All surfaces shall be blast cleaned to Sa 2.5 of BS 7079 Part A1. Blast-cleaning shall be done after fabrication. Unless an instantaneous-recovery blasting machine is used, the cleaned steel surface shall be air-blasted with clean dry air and vacuum-cleaned or otherwise freed from abrasive residues and dust immediately after cleaning.

18.5 Application and Type of Primer

Within 4 hours after surface preparation, before visible deterioration takes place, the surface shall be coated with an appropriate primer or the specified coating. No coating shall be applied to a metal surface which is not thoroughly dry.

The primer shall be compatible with the specified coating and shall be such that if subsequent welding or cutting is to be carried out it shall not emit noxious fumes or be detrimental to the welding.

18.6 Control of Humidity During Coating

No coating shall be applied when the surface metal temperature is less than 3°C above the dewpoint temperature or when the humidity could have an adverse effect on the coat.

When heating or ventilation is used to secure suitable conditions to allow coating to proceed, care shall be taken to ensure the heating or ventilation of a local surface does not have an adverse effect on adjacent surfaces or work already done.

18.7 Parts to be Welded

The coating within 200mm of a weld shall be applied after welding. The method of application shall comply with the manufacturer's recommendations.

18.8 Thickness, Number and Colour of Coats

The nominal thickness of the finished coating and if necessary of each coat shall be as specified. The average coat or finished coating thickness shall be equal to or greater than the specified nominal thickness. In no case shall any coat or finished coating be less than 75% of the nominal thickness. Each coat shall be applied after an interval that ensures the proper hardening or curing of the previous coat.

Where more than one coat is applied to a surface, each coat shall, if possible, be of a different colour from the previous coat. The colour sequence and final coating colour shall be notified.

18.9 Inspection of Coatings

The finished coating shall be generally smooth, of dense and uniform texture and free from sharp protuberances or pin-holes. Excessive sags, dimpling or curtaining shall be retreated.

Any coat damaged by subsequent processes or which has deteriorated to an extent such that proper adhesion of the coating is in doubt shall be removed, and the surface shall be cleaned to the original standard and recoated to provide the specified number of coats.

The completed coating shall be checked for thickness by a magnetic thickness gauge. Areas where the thickness is less than that specified shall receive additional treatment.

The completed coating shall be checked for adhesion by means of an adhesion test to BS 3900 Part E6, carried out on 10% of the piles. The adhesion of any completed coating shall not be worse than Classification 2. Adhesion tests should not be carried out until seven days after coating. On completion of testing the test area shall be made good to the standard specified in the Particular Specification. Areas where the adhesion is defective shall be repaired and reinspected.

19.0 PILING RECORDS

The following records shall be kept where appropriate:

- (a) pile reference number or location
- (b) pile type and grade of steel
- (c) pile length
- (d) type of hammer
- (e) date of driving
- (f) commencing surface level
- (g) depth driven
- (h) length of offcuts
- (i) length of pile extensions
- (j) the measurement of driving resistance at appropriate depths
- (k) all information regarding interruptions, unexpected changes in driving characteristics, obstructions and times taken in overcoming them.



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