

# Engineering Site Standard

## GPC-MSS-101

## General Mechanical

Endorsed: 20 October 2017

### Brief description

This standard outlines the requirements for general mechanical works carried out at GPC.

### Document information

Current version	1
First released	20 October 2017
Last updated	20 October 2017
Effective by	20 October 2017
Review frequency	Biennially
Review before	20 October 2019
Audience	All GPC personnel and contractors

### Document accountability

Role	Position
Owner	Technical Services Manager
Custodian	Specialist Mechanical Engineer

A person using GPC's documentation or data accepts the risk of Using the documents or data in electronic form without requesting and checking them for accuracy against the original hard copy version; using the documents or data for any purpose not agreed to in writing by GPC.

There are no restrictions on the distribution/circulation of this procedure within Gladstone Ports Corporation Ltd (GPC) or to external parties.

## Contents

---

Document Version Control .....	3
1. Scope.....	4
2. References .....	4
2.1. Australian Standards .....	4
2.2. GPC Engineering Site Standards.....	6
2.3. Queensland Codes Of Practice.....	6
2.4. Regulations and Acts.....	6
3. Definitions.....	7
4. Service Conditions and Criteria .....	7
5. Design.....	7
5.1. Design Parameters .....	7
5.2. Durability.....	7
5.3. Fatigue.....	8
6. General Requirements .....	8
6.1. Mechanical Supply .....	8
6.2. Mechanical Installation .....	11
6.3. Tie In Procedure .....	24
6.4. Inspection, Testing, and Commissioning .....	24

## Document Version Control

---

Version	Date	Author	Change Description
1	20/10/2017	D Lockwood	Issued for use

## 1. Scope

---

This Standard outlines the requirements for general mechanical supply, installation and testing at Gladstone Ports Corporation Limited (GPC).

## 2. References

---

All work shall be in accordance with the relevant Australian Standards. In the absence of relevant Australian standard, the British or ISO Standards shall apply.

As a minimum, refer below for guidance on Australian Standards, Specifications and Codes that shall apply.

If there is a conflict for design requirements between relevant standards, specifications or codes, the most stringent requirements shall be adhered to.

### 2.1. Australian Standards

Standard	Title
AS 1000	The International System of Units (SI) and its Applications
AS 1081	Acoustics—Measurement of airborne noise emitted by rotating electrical machinery
AS 1065	Non-destructive testing – ultrasonic testing of carbon and low alloy steel forgings
AS 1111.1	ISO metric hexagon bolts and screws - Product grade C - Bolts
AS 1112.1	ISO metric hexagon nuts – Product grade A and B Bolts
AS 1122	Recommended Metric Sizes for Engineering
AS 1170	Structural design actions
AS 1214	Hot Dipped Galvanised Coating on Threaded Fasteners
AS 1237	Flat Metal Washers for General Engineering Purposes
AS1252	High strength steel bolts with associated nuts and washers for structural engineering
AS 1275	Metric screw thread fasteners
AS 1319	Safety signs for the occupational environment
AS 1403	Design of Rotating Steel Shafts
AS 1418	Cranes

AS/NZS 1554	Structural steel welding
AS/NZS 1554.1	Structural steel welding: Welding of steel structures
AS/NZS 1554.4	Structural steel welding: Welding of high strength quenched and tempered steels
AS/NZS 1554.5	Structural steel welding: Welding of steel structures subject to high levels of fatigue loading
AS 1594	Hot Rolled Steel Flat Products
AS 1627	Metal Finishing - Preparation and Pre-treatment of Surfaces
AS 1650	Hot-dipped Galvanized Coatings on Ferrous Articles
AS 1654	Limits and Fits for Engineering (Metric Units).
AS 1657	Fixed Platforms, Walkways, Stairways and Ladders - Design, Construction and Installation
AS 1654.1	ISO system of limits and fits - Bases of tolerances, deviations and fits
AS 1654.2	ISO system of limits and fits - Tables of standard tolerance grades and limit deviations for holes and shafts
AS 1657	Fixed platforms, walkways, stairways and ladders - Design, construction and installation
AS 1674	Safety in Welding
AS 1755	Conveyors - Safety requirements
AS 1796	Certification of Welders and Welding Supervisors
AS 1911	Solid Bearing Housings – Dimensions and Tolerances
AS 2400.2	Packaging – Basic Principles
AS 2400.5	Packaging – Temporary Corrosion Protection
AS 2720	Rolling Bearings – Dynamic Load Ratings and Rating Life.
AS 3569	Steel Wire Ropes
AS 3597	Structural and pressure vessel steel—Quenched and tempered plate
AS 3678	Structural Steel - Hot-rolled Plates, Floor Plates and Slabs
AS 3679	Structural Steel
AS 3900	Quality Management and Quality Assurance Standards
AS 3990	Mechanical Equipment - Steelwork
AS 4024.1	Safety of machinery

AS 4024.3611	Safety of Machinery - Conveyors
AS 4324.1	Mobile equipment for continuous handling of bulk materials
AS 4100	Steel structures
AS 60034.9	Rotating electrical machines - Noise limits
AS 60974.1	Arc welding equipment - Welding power sources (IEC 60974-1:2000, MOD)
AS 9001	Quality Systems – Model for Quality Assurance in Design

## 2.2. GPC Engineering Site Standards

GPC Doc. #	Title
1368888	GPC-CSS-001 Supply, Fabrication and Erection of Structural Steel
1368896	GPC-CSS-007 Protective Coatings
1366632	GPC-GSS-003 Drafting
1368893	GPC-MSS-102 Belt Conveyors
1365165	GPC-MSS-104 Piping Systems
1368899	GPC-MSS-109 Hydraulic Equipment
1368898	GPC-MSS-114 Equipment Guarding

## 2.3. Queensland Codes Of Practice

Plant Code of Practice 2005

Noise Code of Practice 2004

## 2.4. Regulations and Acts

Queensland Workplace Health and Safety Act 2011

Queensland Workplace Health and Safety Regulation 2011

### 3. Definitions

---

Engineer	GPC Engineering Superintendent or nominated representative
GPC	Gladstone Ports Corporation or its nominated representative
RGTCT	RG Tanna Coal Terminal

### 4. Service Conditions and Criteria

---

The equipment covered by this standard will be installed both indoors and outdoors. All assemblies will be subject to coal erosion, coal fines and coal dust build-ups. All assemblies will be subject to high pressure water wash down operations using recycled water. All assemblies will be exposed to a potentially salt laden atmosphere given the proximity of the RGTCT GPC site to a marine environment.

### 5. Design

---

All drawings, calculations, test reports and the like shall use units in accordance with AS 1000 and GPC Standard Specifications. All mechanical, structural, civil and electrical design calculations shall be provided for approval by the Engineer.

#### 5.1. Design Parameters

The following design parameters shall be used:

- Nominal capacity 6000tph
- Surge capacity 6600tph
- Minimum capacity 1000tph
- Max Belt Speed 5.5m/s – Unless Approved Otherwise
- Troughing angle 45° – Unless Approved Otherwise
- Conveyor Belt ST1250 1800mm – Unless Approved Otherwise
- Edge Distance Including Skirting – ISO 5048
- Coal Min Density 700kg/m<sup>3</sup>
- Coal Max Density 900kg/m<sup>3</sup>
- Max Lump Size 75mm
- Nominal size 50mm (95%)
- Daily Max Temperature 40°C
- Daily Min Temperature 6°C

#### 5.2. Durability

All plant shall be designed for a 25-year design life unless noted otherwise in this specification. The 25-year design life shall be achieved under the following conditions:

Continuous operation (365 days per year, 24 hours per day) 98% availability. This shall exclude scheduled maintenance.

### 5.3. Fatigue

In addition to the requirements of this Specification, all shafts and pins shall be designed for infinite fatigue life.

## 6. General Requirements

---

### 6.1. Mechanical Supply

#### 6.1.1. Steelwork

##### 6.1.1.1. Painting

All supplied steelwork shall be free of the effects of corrosion and mechanical damage. Steel work shall be coated appropriately as per GPC Engineering Site Standard - GPC-CSS-007 Protective Coatings.

##### 6.1.1.2. Marking

All steelwork shall be indelibly marked and tagged before leaving the fabrication shop to facilitate identification and erection at Site.

Each section of plate work shall have the following information stamped on the piece and tagged fixed to the piece in letters at least 20mm high:

- Order/contract number
- Part number
- Drawing number

The marking shall be subject to approval. Painting of mark numbers is not acceptable.

##### 6.1.1.3. Bolting

A washer shall be fitted under the rotating element of all fasteners.

Clearances for fitted bolts shall be in accordance with the drawings or as otherwise specified. Where practicable all holes for fitted bolts shall be reamed on assembly in the works. The mating components, including the bolts, shall be match marked by metal stamping. There shall be no flame cut holes.

All non-structural fastenings used on mechanical equipment shall be coated with an anti-seize compound at final assembly.

Galvanised bolts and nuts shall be used in corrosive and exposed applications unless otherwise noted or approved. Where hot dip galvanised bolts are required, the nuts shall be provided with supplementary lubrication as specified in the standard.

Bolts and nuts of grade 10.9 or greater shall not be galvanised.



### **6.1.2. Shafts and Pins**

Shafts and pins under 50 mm diameter shall be constructed of Grade 316 stainless steel, unless noted otherwise on the drawings or if structural/mechanical limitations of Grade 316 stainless steel make the material not fit for purpose. In the case that 316 S/S is not fit for purpose, the alternative material shall be approved by the GPC Engineer.

Shafts and pins shall be machined on all surfaces, and centre machining marks shall remain on shafts used in rotating machinery, provided that leaving the centre machining mark on the particular item does not structurally and mechanically weaken or decrease the durability of the item.

### **6.1.3. Lubrication**

All lubrication points shall be labelled. Labelling method shall be subject to approval in writing by the GPC.

A detail isometric drawing shall be provided indicating a lubrication flow diagram and piping arrangement, quantity of grease and the greasing interval required for each point. For automatic grease distribution systems, the drawings shall also indicate the frequency and period of pump operation.

All grease lines shall be filled with grease and proved.

### **6.1.4. Guarding**

Guarding shall be as per MSS-114 Guarding, and the following;

Guards shall be supplied locked in place as they would be during operation.

Individual items of equipment needing guards such as couplings, rotating shafts etc, even where enclosed within a generally fenced area, shall be fitted with individual guards.

Where removal of the guard is infrequent for inspection or maintenance purposes, it shall be fixed in position so that it cannot be removed without the use of tools.

Where inspection or cleaning covers are provided and their removal exposes dangerous parts of the conveyor which are within reach, such covers shall be clearly labelled DANGER - ISOLATE DRIVE BEFORE REMOVING COVER.

Lifting handles or lugs shall be provided where required for the safe removal of guards.

Large guards with any dimensions in excess of 1800mm shall not be fabricated in one piece without approval. Large guards shall be easily assembled in component parts that do not exceed 60kg mass. All component parts of the guard shall interlock together to form a rigid and safe assembly.

### **6.1.5. Lifting**

All equipment machinery guards and base frames shall be fitted with readily accessible lifting lugs, eyes, sling points or skids as appropriate for installation, erection and maintenance.

Where applicable, all items of equipment (over 30kg mass) shall be furnished with lifting lugs for crane handling. Lifting lugs are to be positioned to minimise the handling hazards. Each lug shall be designed

to carry a minimum of twice the lifted load. The gross weight of the lift shall be stencilled in a conspicuous location.

#### **6.1.6. ID Plates**

All equipment shall be provided with approved nameplates and information plates permanently secured to or near the equipment in a readily visible area. Stainless steel engraved plates shall be used. Adhesive nameplates or labels shall not be used unless otherwise approved.

All parts of an item of equipment, when sent loose, either together or separately from the major assembly, shall have a corrosion resistant metal tag firmly attached by wire or screws.

Nameplates shall show all information for the proper identification, servicing, maintenance and operation of equipment. Information shall include at least the following, where appropriate:

- Manufacturer's Name and Model No
- Equipment Serial No.
- Purchase Order No.
- Equipment Tag No.
- Lifting points
- Critical operating data and adjustments
- Pressure settings
- Gauge readings and identification
- Lubrication - type, quantity, frequency and fill levels
- Other special fluids including fill levels
- Direction of rotation and/or flow
- Warning notices
- Temperature limits
- Mass
- Date of Manufacture

#### **6.1.7. Jacking Bolts**

Jacking bolts and arrangements shall be installed on equipment where required to allow onsite alignment.

#### **6.1.8. Workshop Tests**

Equipment shall be run and tested for a minimum period of four hours, unless otherwise approved or specified.

After testing, equipment shall be thoroughly inspected for excessive wear or defective parts. Any parts found to be defective shall be replaced. Any repair work required shall not proceed without approval. Any out-of-balance of equipment shall be rectified. Equipment shall be re-run and re-tested for the above stated period unless otherwise stated.

Noise levels shall be tested in the works, if practical and if type test reports are unavailable. Type test reports will only be accepted if tests were carried out on equipment identical to that being supplied

and under similar operating conditions to the intended use. Exceeding the maximum allowable noise will be cause for rejection of the equipment.

Pressure containing parts shall be hydrostatically tested at 1.5 times design pressure for at least 30 minutes. Hydrostatic tests shall be performed with the equipment fully assembled, unless specified otherwise.

A test report shall be submitted including correction of defects.

#### **6.1.9. Preparation for Shipment**

Preparation prior to packing shall be in accordance with AS2400.2 and AS2400.5. Oil lubricated bearings shall be flushed with lubricant prior to shipping.

Enclosures such as gearboxes shall contain corrosion preventing products suitable for use during transportation.

Components that need to be disassembled for shipment shall be properly match marked. Items requiring precision alignment and location shall be provided with a minimum of two dowel pins or fitted bolts to ensure proper alignment in the field.

Flanged openings shall be covered with 10mm thick wooden discs of size equal to flange outside diameter. Each disc shall be bolted to the flange with three full diameter bolts and a washer on the wooden side.

Screwed pipe connections on lubrication or hydraulic equipment shall be plugged.

Bearings shall be protected against brinelling during transport by suitable chocking, support or disassembly.

Equipment shall, as far as possible, be furnished with all attachments and fully assembled prior to shipment.

### **6.2. Mechanical Installation**

#### **6.2.1. Unloading, Storage, and Handling**

Adequate covered or open off ground storage as appropriate shall be provided for all equipment and piping materials. The method of storage, i.e. bin, bag, rack or pallet shall be selected with regard to the items, type, nature and vulnerability to damage.

Storage shall be such that:

- Easy location and retrieval is possible.
- Items do not distort.
- No weight is placed on branches, brackets or other attachments.
- Water does not ingress equipment and form pools.
- Rust, pitting and protective coating deterioration is prevented.
- All rubber or synthetic rubber lined equipment and materials shall be protected from sunlight.

All equipment shall be thoroughly inspected immediately after unpacking. Any damage or apparent misalignment shall be reported immediately to the RGTES representative.

Any items which are opened for inspection on arrival at site shall be closed and resealed prior to being placed in storage.

All forms of corrosion protection that have deteriorated, missing, or that suffered damage in transit shall be replaced prior to the equipment being placed in storage. Protection shall not be removed unless damage to machined surfaces is suspected.

All electrical parts shall be protected from weather at all times.

When fragile parts or those with bearing or machined surfaces are being handled, care shall be taken to prevent damage by direct or indirect contact such as bumps, striking of a shaft with bearings on slings etc.

Slings shall be safely and properly located. Slings and rigging equipment shall be positioned so that machinery when lifted cannot be displaced.

### **6.2.2. Installation Procedures**

Equipment shall be inspected, prepared, offloaded, stored, installed, aligned, set, lubricated and tested in accordance with this Procedure, Drawings and the Manufacturer's Instruction Manuals. Any conflict in the above requirements shall be reported. Damaged equipment shall not be installed unless specifically directed otherwise.

The Contractor shall prepare and submit for approval a detailed Mechanical and Equipment Inspection and Test Plan (ITP) along with detailed commissioning plan for the works.

The Contractor shall not proceed with the works until all ITPs have been approved.

All personnel shall be fully instructed in and conversant with the installation procedures applicable for the equipment prior to commencement of work.

Assembly of equipment shall be carried out by competent trades personnel. Proposed lifting, installation and testing procedure details shall be submitted for prior approval including:

- Order of assembly and installation of equipment.
- Method of installation including lifting and handling of equipment, support facilities and protective measures.
- Equipment manufacturer's installation instructions.

### **6.2.3. Preparation of Equipment**

All temporary shaft locking devices shall be removed and shafts checked for free rotation in the appropriate direction by hand only.

All relevant equipment shall be checked for the presence of condensation in oil reservoirs at intervals not exceeding 30 days. Remedial action shall be in accordance with the requirements of the Manufacturer and/or as directed where necessary.

Shafts of relevant equipment shall be rotated in accordance with the Manufacturer's requirements or at intervals of 30 days. The status of oil reservoirs and shafts shall be reported in writing at intervals not exceeding 30 days.

Bearings shall be protected from ingress or moisture and dust.

Bolted joints shall be checked for tightness.

Parts shall be cleaned thoroughly prior to assembly by use of suitable solvents or in a manner which shall not be damaging to the equipment or painting system. After assembly, a film of grease or other approved coating shall be applied to machined surfaces to prevent corrosion.

Field alterations to steelwork or equipment to facilitate installation and dismantling of subassemblies shall not be permitted without approval; however temporary bracing or equipment may be used during installation, subject to approval.

Equipment shall be lifted using only those lifting lugs provided by the manufacturer. No temporary lugs or attachments shall be welded to equipment.

Large equipment will be delivered in such parts and subassemblies as is necessary for shipment. The extent to which equipment will require reassembly on site shall be advised at least 14 days prior to the delivery of equipment at site. However, any subsequent change in the extent of preassembly so advised shall not relieve the responsibility for performing all assembly or disassembly work required at site for installation.

Any error in fabrication which prevents the proper assembly and fitting of parts by the moderate use of drift pins shall be reported immediately to the RGES representative for approval of method of correction.

#### **6.2.4. Packing and Grouting**

Packing shims for equipment fitted with mounting feet shall cover the full bearing area of the respective foot.

Packing shims under base frames shall be the full width of the base frame member and 100mm long unless specified otherwise. One set of shims shall be provided at each hold down bolt.

The use of levelling nuts to level mechanical equipment mounted on concrete plinths with cast in hold down bolts is acceptable provided this does not conflict with the Manufacturer's requirements.

For equipment mounted on steelwork, the bearing areas shall be mechanically cleaned of paint (topcoats), rust and scale before placing packers. Grating shall be banded around each opening made for equipment installation.

For equipment mounted on concrete, the following procedures shall be adopted:

- All laitance shall be removed from the top of the concrete base and all loose material shall be removed by blowing and/or wet scabbling. All oil, grease, dirt and loose particles shall be removed from the concrete and the equipment bed plate and all bolt holes shall be thoroughly cleaned.
- A preliminary level shall be taken at each bearing point and remaining concrete shall be checked for height to ensure no interference with base frame will occur.
- Before any item of equipment is placed on a concrete plinth or footing, the equipment shall be levelled using levelling nuts or by placing of steel packers at each side of every holding down bolt, either by chipping or levelling concrete or by setting packers in a properly placed grout in accordance with the specification.
- For equipment mounted on a concrete base or footing, any error that prevents proper alignment shall be reported for approval of the correction method.

- The equipment shall be levelled to within 0.40mm/metre unless otherwise directed. In the case of pumps, the pump flanges shall be levelled and plumbed.
- Grouting or permanent fixing shall not be commenced until the setting and alignment has been approved.
- Grouting shall be carried out as soon as possible after approval.
- After thoroughly cleaning all load surfaces and tolerance tube pockets, the equipment shall be grouted in accordance with the specification.

The following shimming arrangements shall not be permitted:

- More than three shims at one location.
- More than one shim 3mm or thicker per location.
- Tapered shims.
- Shims thinner than 0.05mm.

Shims shall be cut from first class shimming material, free from indents and burrs. Shims shall be permanently and indelibly marked for location after fitting.

#### 6.2.5. Shaft Alignment

The permissible amount of shaft misalignment will vary with the type of equipment. Misalignment shall not exceed the manufacturer's recommendation or the following; whichever is more stringent:

COUPLING CRITERIA	MAXIMUM PARALLEL OFFSET	ALLOWABLE MAXIMUM ANGULARITY
Up to 150kW/3600 RPM	0.100mm (TIR)	0.333mm/m
Above 150kW/3600 RPM	0.050mm (TIR)	0.083mm/m
Rigid Couplings	0.025mm (TIR)	0.083mm/m

(TIR Total Indicator Readings)

The reverse indicator method of shaft alignment shall be used in the following cases unless the Manufacturer specifies otherwise:

- Units above 3600RPM.
- Units with a spacer coupling 200mm or longer in length, or 200mm or larger in diameter.
- Pumps or drivers with sleeve bearings.

Rigid alignment brackets shall be used and it shall be demonstrated that readings are repeatable.

For items requiring the reverse indicator method of alignment, a graphical plot of final shaft position shall be placed in the equipment files.

The following potential movements shall be allowed for during alignment of driver and driven equipment:

- Thermal expansion or contraction.
- Hydraulic loading.
- Gears with rising pinions.
- Motor rotors seeking a magnetic centre.

Electric motors shall be moved rather than the driven equipment. Equipment items with the largest diameter nozzle shall be aligned to the respective pipe.

Shims under gear cases shall not be used without written approval.

The dowelling of equipment where required shall be carried out as soon as possible after approval of alignment.

After the final shaft alignment has been accepted, pipe connections shall be made up and shaft alignment shall be monitored. For machinery with common pipe such as pairs of pumps, both shaft alignments shall be monitored during pipe-up operations. Shaft alignment shall not change by more than 0.050mm TIR while piping is made up.

Bolting up of connecting piping flanges under stress caused by misalignment, and springing of flanges together shall not be permitted.

Piping shall be supported independently of the equipment casings.

Piping shall be installed in accordance with the piping specification, P&IDs, and the drawings.

The following procedures shall be followed to make up piping with spring hangers:

- Following normal hydro testing, remove the stops or pins shall be removed from the spring supports and properly stored.
- The spring support shall be used to move the piping into proper alignment with the equipment flange. The piping shall be adequately supported by the spring support and no binding on guides, restraints etc. is permitted.
- The setting on the spring support at this time shall be noted. The spring support should be within its working range.
- The equipment flange shall be made up whilst monitoring of equipment movement is being undertaken to assure that undue force is not carried by the equipment.
- The coupling shall be aligned.

After bolting up of footings, couplings and pipes, equipment shall be rotated by hand to ensure that neither binding nor case distortion has occurred.

#### **6.2.6. Bearings and Plummer Blocks**

At the first no load run, bearings shall be checked externally for brinelling using an approved hand held vibration meter. Details of any damaged or suspected faulty bearings shall be reported for decision concerning rectification.

The free and installed clearances of every spherical roller and other taper sleeve mounted bearing shall be checked and reported in accordance with Manufacturer's instructions.

Pulley bearing housings shall be installed to within 0.25 degrees of level over their width and squareness to the shaft within their length so that the seals are not adversely affected.

Bearings shall be checked to ensure that:

- Bearings are free to rotate and are centrally positioned within the housing.
- One bearing per pulley is fixed in its housing by fixing rings and that the other is free and centrally positioned in the housing.

- Seals are located with the correct clearances.

#### **6.2.7. Drives and Transmissions**

Drive components shall be accurately aligned and installed in accordance with this Specification and Manufacturer's recommendation.

Drives shall be turned by hand to check freedom of rotation.

The direction of rotation of motors shall be checked for compliance with the equipment Manufacturer's requirements before drives are coupled. The direction of motors shall be rechecked, with belts or couplings disconnected, whenever electrical connections are disturbed.

The final alignment of all drives and couplings shall be checked and recorded. Where applicable, the alignments shall be performed after fitting and hydrostatic testing of the suction and discharge pipe work. The guards shall be fitted after final alignment.

Fluid couplings shall be filled in accordance with the manufacturer's instructions for correct torque and slip.

#### **6.2.8. Chain or Belt Driven Equipment**

Shafts shall be levelled by use of a spirit level on bare shafts, across the teeth of multiple width sprockets or across the outer faces of sheaves.

A straight edge shall be applied to the finished surfaces on the sides of sprockets or sheaves.

Equipment of this type shall be set +0.13mm. The sprockets of sheaves shall be checked to ensure they are properly keyed and set screwed on shafts after alignment.

- Stored belts shall be under cover and preferably hung in loose coils.
- Matched sets shall be used.
- Pulley grooves shall be degreased before fitting belts.
- Belts and chains shall be tensioned in accordance with the equipment Manufacturer's instructions.
- Before fitting belts or chains, the rotational direction of the motor shall be checked and changed if necessary.
- After belts or chains have been fitted and tensioned, the drive shall be checked for freedom of rotation by hand.

#### **6.2.9. Coupling Hubs**

Shaft extensions shall be cleaned to parent metal prior to coupling hub installation.

Before mounting a straight fit coupling, the coupling hub bore and shaft diameter shall be measured with a micrometre to determine if the coupling hub will have the proper installed interference.

Tapered coupling hubs shall be installed with an interference fit of approximately 0.025mm per 25mm of nominal shaft diameter unless otherwise specified. Heating of coupling hubs shall be in a hot oil bath. Bath temperature shall be 700C above shaft temperature to ensure proper draw up on the taper.



#### **6.2.10. Fasteners and Bolted Connections**

New corrosion resistant and commercial grade fasteners shall be supplied complying with all applicable standards.

Unless stated otherwise in equipment Manufacturer's instructions, high strength type bolts, nuts and washers to AS1252 shall be used for mounting conveyor pulley assemblies and vibrating equipment such as feeders, screens and agitators.

The minimum diameter bolt or screw thread shall be 16mm.

All bolts and stud bolts shall project at least three full thread lengths past the outer face of each tightened nut but not more than 10mm. The nominal height of nuts shall not be less than the bolt diameter.

Chemical anchor bolts shall be preferred to wedge type masonry anchor bolts.

Wedge type masonry bolts shall only be used after written approval has been given.

Where masonry anchor bolts are approved, they shall be galvanized 'Dynabolts' or approved equivalent, having a minimum thread diameter of 12mm.

High strength bolts shall be installed in accordance with the nominated standard and the equipment Manufacturer's recommendations.

Threaded section of adjusting screws likely to require regular adjustment shall not be painted. An approved corrosion inhibiting protective coating shall be applied to threaded sections which are not corrosion resistant.

Where appropriate, the threads of fasteners shall be lightly greased or coated with an antiseize compound before assembly.

On all equipment, vibration proof lock washers shall be used unless specified otherwise.

Bolt connections shall be made by using calibrated wrenches or by the 'turn-of-nut' method. Bolts shall be accurately torque to specified levels.

Screw threads shall be correctly toleranced. Bolts with stripped threads, short bolts or other inadequate fastenings shall be replaced.

Unless specified otherwise, holes for fitted bolts shall be reamed within the tolerance range for an H7/k6 transition fit in accordance with Table 1 in AS1654.

Misalignment of flanges in chutes or plate shall be corrected by plug welding and redrilling. Elongation of holes is not permitted unless approved.

Bolt holes shall be drilled or punched. Gas burning of holes is not permitted.

Holding down bolts or anchor bolts shall not be altered by cutting and welding or heating and bending.

#### **6.2.11. Welding and Cutting**

All cutting shall comply with the requirements of AS1674. A fire watch shall be maintained when cutting over rubber lined tanks, conveyor belts and the like. Protective mats shall be used to prevent hot material contacting rubber. Hot work permits shall be obtained as required.

Steel wire ropes shall not be cut with a cutting torch.

Welding shall comply with AS1554, Part 1 Category SP. Unless stated otherwise on the Drawings, welds shall be 6mm (minimum) continuous fillet or full strength butt weld, as appropriate.

Where intermittent welding is approved, the gap intervals shall be sealed with welds of a minimum size of 3mm.

Welding shall only be performed by welders who hold relevant certificates issued in accordance with AS1796 for the type of welding being carried out.

All welding procedures shall be submitted for approval prior to commencing work, unless noted otherwise.

Evidence of certification of welders and welding supervisors shall be supplied prior to commencement on site.

The welder's earth connection shall be placed as close as possible to the work to be welded. Welding currents shall not pass through bearing assemblies. Liability will apply for the costs of replacement of bearings and gears damaged by direct or stray currents.

A suitable baking oven shall be supplied for pre-drying welding electrodes used in welding special classes of steel or for low hydrogen electrodes.

Lifting lugs, alignment pads and all similar temporary attachments shall be of the same material as the parent metal and the same welding materials and procedures shall be used.

Welds across the tension flanges of structural beams shall not be permitted without approval.

Where specified, welded components shall be stress relieved. No further welding shall be permitted after stress relieving.

#### **6.2.12. Site Welding**

Where site welding is to be employed, the work shall be planned in sections which permit a maximum amount of welding to be completed on the ground, to limit, as far as possible, the amount of overhead welding.

Fire and personnel protection precautions shall be made when welding or cutting and grinding near and/or over rubber belts and linings. Belts and rubber lining shall be covered with an approved non-flammable cover. Protection against spatter, flames and heat shall conform to the site safety requirements.

Welds shall be free of slag, undercutting, porosity, pitting, high spots, pockets or pinholes, and on internal surfaces to be rubber lined shall be ground smooth and flush. The edges of all attachments (e.g. brackets, clips etc) shall be seal welded completely to prevent corrosion between attachments and the base material.

#### **6.2.13. Guards**

Where guards are to be provided, they shall be designed in accordance with this standard and AS 4024.3611.

#### **6.2.14. Corrosion Protection and Making Good**

Unless stated otherwise on the drawings or specified elsewhere, equipment supplied free issue will not require to be repainted.

Reasonable precautions shall be taken to prevent damage to painted surfaces. Damage shall be made good in accordance with the specified requirements.

In the event of damage taking place, full preparation, repaint and touch up shall be undertaken in accordance with Engineering Site Standard - GPC-CSS-007 Protective Coatings.

'Free issue' equipment will be supplied with final paint finish, but allowance shall be made for damage to be repaired in accordance with the specified requirements.

#### **6.2.15. Lubrication**

Prior to testing, oil lubricated equipment shall be drained, flushed and refilled with oil to the equipment Manufacturer's specifications (refer RGTCT Fixed Plant Lubrication Guide).

Where necessary, air shall be bled from lubrication lines, and seals purged.

Grease lubricated bearings shall be externally inspected for cleanliness, seal condition and adequate greasing. Bearings suspected to be contaminated with moisture or dust shall be flushed and re-greased.

Grease shall be of the correct grade and quantity as recommended by the manufacturer.

#### **6.2.16. Site Located Equipment and Site Run Piping**

Where it is required to site run or locate equipment or piping, such equipment or piping shall be supported from structures or foundations not subject to vibration.

Supports shall not be fixed or welded to machinery or equipment unless approved. Supports shall be spaced to prevent excessive deflection under all operating conditions and designed to prevent the generation of noise due to vibration.

Supports shall be placed to support pipes with a 100mm clearance from horizontal and vertical surfaces where there is any possibility of material spillage occurring.

#### **6.2.17. Record Sheets**

Completed record sheets shall be submitted for all equipment which is fitted or located by a tolerance dimension for acceptance of the work done.

#### **6.2.18. Conveyor Idlers**

Idler support assemblies shall be bolted firmly to the stringer assemblies such that they are within 1 in 3000 of dead square and 1 in 1000 of dead level unless otherwise specified. Preassembled idler assemblies shall be checked to ensure they are within these tolerances before mounting.

Where practical, the PROK Conveyliner or other approved method shall be used for idler alignment.

Idler rollers shall be placed in the support frames and where shown on the Drawings, and restrained from movement with retainer clips.

Misalignment in the vertical plane between any three adjacent idler assemblies shall be less than 1 mm.

Weigh scale frames, idlers and control panels shall be installed in accordance with the Manufacturer's Instructions and the Drawings. Care shall be taken to identify the weigh (as distinct from the weighing) idler assemblies. Both sets of idlers shall be installed with vertical misalignment between the idler assemblies limited to 0.1 mm, unless otherwise shown on the Drawings.

Belt training idlers on troughing and return sides shall be installed as called for on drawings. The assemblies shall be installed with the training rollers on the lead side.

#### **6.2.19. Conveyor Belts**

Belts shall be installed on the conveyors and prepared for splicing. Unless stated otherwise, splices shall be made by hot vulcanising.

Preparation for splicing shall include the following procedures:

- The take-up pulley shall be locked in the nominated splicing position, or the screw take-up slackened, as applicable.
- The belt shall be threaded onto the conveyor with the top cover outermost.
- Slack shall be pulled out and the ends to be joined shall be clamped off.
- Idlers in the splice area shall be removed (and later replaced and aligned).
- Assistance to the splicing crew in positioning splicing equipment shall be provided.
- After splicing the area shall be cleaned and excess belting shall be removed to the designated area.
- The take-up pulley shall be released and the take-up weight lowered steadily, or screw take-up adjusted, as applicable to tension the belt.
- During installation of belts, belt reels shall not be supported on the conveyor, structure, take-up tower or plant steelwork.

Belts shall be protected against oil spillage and when cutting or welding equipment is in use.

Unless specified otherwise belts shall be tracked to run in accordance with the requirements of AS 1333 and AS 1332.

#### **6.2.20. Conveyor Pulleys and Drives**

Head and tail pulley assemblies shall be installed to within a tolerance of 1 in 2000 for level and 1 in 3000 for squareness to the conveyor axis.

Care shall be taken to ensure that lagged surfaces are not damaged. Any damage shall be reported.

Pulleys shall not be rolled across any surfaces. Pulleys shall be protected when cutting or welding equipment is being used.

Conveyor drives shall be installed in accordance with this Specification and the Manufacturer's instructions. Torque arms will be provided with the drives.

#### **6.2.21. Chutes and Skirts**

Conveyor transfer chutes shall be installed as shown on the Drawings. Where chutes have allowances for site fitting including loose or tack welded flanges or connections, the chutes shall be trimmed where necessary and the welds complete.

Moving parts shall be tested for smooth and free operation.

Conveyor skirts and skirt supports shall be installed in accordance with the Drawings. Tail skirt sections shall be to suit the conveyor belt line.

Skirt rubber shall be installed in continuous lengths after correctly tracking conveyor belts. Skirts shall be adjusted to minimise spillage of material and to ensure the belt is not damaged.

Belt scrapers and return belt ploughs shall be installed and adjusted only after the conveyor belt has been spliced and tensioned.

The take-up mass shall be as specified on the drawings.

Conveyor pull-wire and under speed switch support brackets shall be installed in accordance with the Drawings.

#### **6.2.22. Pumps**

Unless otherwise specified, pumps will be received as completely assembled units with pump, drive and motor mounted on a steel base frame.

Pumps shall not be grouted in until after suction and discharge lines are connected.

Suction and discharge flanges shall be protected with thin steel covers or equivalent during pipe work fabrication and fitting.

Where instructed, slip blinds shall be installed at pump suction flanges to prevent foreign material entering the pump through the suction line.

Blind flanges shall be marked with securely fixed metal tags.

Blind flanges shall be removed for testing.

Pump drives shall be checked and aligned after piping is installed.

Where applicable and prior to start up, gland adjustments shall be carried out in accordance with the Manufacturer's instructions and gland water flow rate and pressure checked.

#### **6.2.23. Tanks and Sumps**

Supplied tanks will have protective covers over all nozzle connections.

Supplied tanks will be complete with lifting lugs. Nozzle necks or flanges shall not be used for lifting or slinging.

Protective covers shall be left in place until piping or other equipment is ready to be installed.

Welding shall not be permitted onto tanks which have been internally finished painted unless otherwise approved.

Where instructed, slip blinds shall be installed at tank discharge nozzles to prevent foreign material entering pipe work.

Blind flanges shall be clearly marked with securely fixed metal tags.

Blind flanges shall be removed for testing.

The coatings and/or lining of tanks, sumps and agitators shall be protected at all times to prevent damage from welding slag, cutting, grinding and drilling swarf, and spillage of solvents.

Where access inside of tanks is necessary, take every precaution to prevent damage to internal coatings and linings. Any damage to coatings or linings shall be notified for approval of correction method.

Work in confined or enclosed spaces shall comply with the site safety instructions in force.

Damaged rubber linings shall be repaired in accordance with the relevant requirements of BS CP 3003 Part 1. The repaired area shall be spark tested to ensure complete coverage.

Prior to filing, the tank or sump shall be cleaned of any foreign materials, e.g., swarf, welding electrodes.

#### **6.2.24. Cranes, Monorails, and Hoists**

Cranes, monorail hoists and monorails shall be installed in accordance with the manufacturer's instructions and the requirements of AS 1418. Testing must be conducted in accordance with the statutory requirements, and approval received before use of cranes and hoists.

Monorail beams and crane rails shall be inspected for level and alignment and proper installation of all end stops and travel limit devices. Defects shall be reported immediately.

Cranes and monorails shall have SWL labels affixed in accordance with AS 1418.

Electric hoists and monorail beams shall be tested in accordance with the manufacturer's instructions and the requirements of AS 1418 in the presence of the Machinery Inspector, or as otherwise approved or directed.

Test weights shall be applied and tests as required by the Inspector conducted to demonstrate safe and effective operation of the hoists, and travel operations of the equipment.

Completed acceptance and approval certificates for the tests performed shall be submitted.

#### **6.2.25. Agitators**

Agitators shall be installed in accordance with the Manufacturer's instructions.

Both agitator and tank shall be protected during installation of the agitator to ensure coating systems are not damaged.

If the agitator is supplied, disassembled, the manufacturer's instructions shall be followed during assembly, taking care to correctly tension bolts and align shafts, bases and the like.

#### **6.2.26. Vibratory Screens**

Screens shall be installed in accordance with the manufacturer's instructions and drawings supplied. The screen body shall be set onto the spring mounts and packed such that it is level across its width and correctly inclined and that it does not interfere with adjacent steelwork or chutes. Clearances shall be as shown on the Drawings.

Hold down bolts shall be tensioned correctly to the manufacturer's specification.

Inlet, discharge and underflow chutes shall be installed as shown on the Drawings.

Seals and dust covers, if applicable, shall be clip on type unless otherwise approved.

The drive shall be turned by hand prior to operation to ensure its freedom of rotation.

After 12 hours of operation, all hold down bolts, cloth tension bolts and deck support bolts shall be checked to ensure their integrity.

#### **6.2.27. Air Compressors**

Air compressors will be supplied as fully assembled units, skid mounted or similar.

The unit shall be installed and levelled in accordance with the Manufacturer's installation instructions, and this Specification.

Alignment of drives shall be checked and the direction of motor rotation verified as correct before operation.

#### **6.2.28. Fans and Blowers**

Unless specified otherwise fans or blowers will be supplied mounted on a base frame with drive motor.

The fan or blower shall be installed and levelled in accordance with the Manufacturer's instructions.

Vibration isolators shall be fitted in accordance with the Drawings.

The unit shall be rotated by hand to ensure freedom of movement. Ducting shall be aligned and bolted up with an approved flexible gasket material.

#### **6.2.29. Hydraulic Equipment**

Hydraulic equipment shall be installed in accordance with the drawings, GPC Engineering Site Standard - GPC-MSS-109 Hydraulic Equipment and the Manufacturer's instructions.

Experienced competent hydraulic pipe fitters shall perform all hydraulic pipe fitting work.

Pipe shall be annealed carbon steel or stainless steel seamless unless noted otherwise. All fittings shall be of a standard readily available type.

Pipe work shall be adequately supported so as to prevent movement or damage produced by pressure surges.

Immediately before charging the system, all pipes and fittings shall be thoroughly flushed with a suitable solution, and reservoirs shall be cleaned of any foreign materials.

### **6.2.30. Fluid Couplings**

When installed, each fluid coupling shall be filled with oil recommended by the manufacturer. The approved oil shall be suitable for the particular duty and ambient temperature conditions.

Under no circumstances shall two or more oils be mixed in the coupling.

The amount of oil used shall be adjusted in accordance with manufacturer's instructions before and during start up, to produce the required torque capacity.

### **6.2.31. Conveyor Structure**

All conveyor idler support structure shall be installed to the following tolerances:

- Level:  $\pm 3$  mm from the design levels.
- Line:  $\pm 3$  mm from the design line.

For low level conveyor structure, measurements shall be taken at the ends of each conveyor module or at six metre intervals, whichever is the smaller.

For conveyor gantry sections, measurements shall be taken at six metre intervals along the gantry and at the ends of the gantry.

## **6.3. Tie In Procedure**

This Tie-In Procedure covers all works to be carried out in areas where new construction activities are to join existing GPC facilities and systems.

During construction stages the contractor shall submit to the GPC Engineering Representative a detailed schedule outlining all Tie-In activities. GPC shall provide a project specific tie in procedure.

## **6.4. Inspection, Testing, and Commissioning**

Equipment shall be checked to ensure safe and satisfactory operation on completion of the assembly and installation in accordance with the relevant specifications.

Testing shall be performed only after approval of the installation.

Unless specified otherwise, testing will be as detailed in the Manufacturer's instructions.

All tests shall be performed and conducted in accordance with the specified requirements, and shall only be undertaken after submission of all proposed activities to the Engineer.

The proposed testing program shall be submitted in advance to allow all tests to be witnessed by the Owner or Engineer.

The Contractor will record all results.

The safety/danger tag system shall be used for all testing.

It shall be expected that all testing shall be undertaken in such a way as to prevent the injury of personnel or the damage of private equipment.

Bearing temperatures shall be measured using a surface temperature thermometer at 30 minute intervals during the running tests for all drives with motors larger than 5 kW.



When specified, power consumption measurements shall be taken using an ammeter at hourly intervals during running tests.

Defects indicated by the test results shall be rectified and the test repeated. The method of rectification shall first be approved.

#### **6.4.1. Piping Inspection and Testing**

Piping and instrumentation shall be checked to ensure correct installation. Piping and instrumentation diagrams, services drawings and flow sheets shall be progressively marked up as the installation is checked as correct.

Grease lines and flexible pressure hoses shall be checked to ensure freedom from chaffing or fouling of structures while operating.

All piping shall be installed, cleaned and tested in accordance with the relevant specification.

#### **6.4.2. Hydrostatic Testing**

Tanks, sumps, launders and distribution boxes shall be checked for leaks by filling with water and recording any level change over a period of not less than one hour.

Hydrostatic tests shall be performed with pipe work connected and nozzles blanked off.

Tests shall be conducted progressively to use the minimum quantity of water possible.

#### **6.4.3. Water Batching Tests**

Prior to water batching tests, start-up strainers shall be installed in pump suction lines.

Each pump shall be run with water for a short period against a head similar to that expected in the duty. During this initial run, the pump shall be observed for excessive noise, vibration and leaks.

When the pump satisfactorily meets the requirements above, the pump shall be run continuously with water for a period of two hours during which the following shall be measured:

- Bearing temperature.
- Power consumption of electric motors.
- Seal operation.

#### **6.4.4. Agitators and Mixers**

Agitators and mixers shall be run for a period of two hours during which power consumption and bearing temperatures shall be measured. Tanks shall be full of water during the tests.

#### **6.4.5. Vibratory Screens**

Screens shall be run for a period of two hours during which time the power consumption and bearing temperatures shall be measured.

#### **6.4.6. Compressors**

Compressors shall be run for a period of six (6) hours during which time oil temperatures shall be monitored.

If the oil temperature exceeds the Manufacturer's recommendations the unit shall be shut down and the results reported for approval of any corrective action to be undertaken.

Valves and drains shall be operated as required to maintain a flow from the compressor.

During tests, safety devices and valves shall be checked for correct operation. The method proposed for testing safety valves shall be submitted for approval prior to start-up of the compressor.

#### **6.4.7. Fans**

Fans shall be run continuously, for not less than four (4) hours during which time the bearing temperatures and vibration levels shall be recorded, together with current drawn.

Dampers shall be set per the Manufacturer's recommendations and fixed in position by a suitable means, to be approved, unless noted otherwise.

#### **6.4.8. Hydraulic Equipment**

The system shall be run for a period of not less than two hours during which time fluid, and bearing temperatures shall be recorded, any noise or abnormal vibration shall be noted, and reported for approval of repair method.

The system shall be in full working order, and shall conform both to the circuit diagram, and approved operational specification. (Refer to GPC Standard MSS-109).

Approval shall be obtained before operation of any pump or motor.

Care shall be taken to ensure that no damage to equipment or injury to personnel can occur when testing or operating cylinders, actuators or other such equipment.

The system shall be operated initially at reduced pressure and shall be slowly brought up to the specified working pressure. Pumps shall be run to the manufacturer's recommendations.

The system and pipe work shall be flushed prior to filling and properly vented to remove all air from the system.

Air bleed valve design shall ensure safe and complete release of air and shall provide a positive seal.

Cylinder, actuator and motor speeds shall meet the operational specification.

Relief, unloading sequence and any other control valve or pressure switch, shall operate at the settings specified on the approved circuit diagram.

No alteration shall be made to the circuit, pressure settings or operational specification, without first obtaining written approval from the Engineer.

Commissioning of hydraulic systems shall always be carried out with the responsible company officer in attendance. Approval to apply pressure to systems, to operate machinery or to operate controls, shall always be obtained beforehand from the Engineer.

Systems shall be free from surges and fluid shock conditions, and shall be approved prior to acceptance.

Shock conditions shall be rectified where these are unacceptable.

#### **6.4.9. Conveyors**

Each conveyor shall be tested under local control and necessary adjustments made to ensure it is in a safe and operating condition.

Conveyors shall be run empty for a period of not less than four hours after alignment of components and training of the belt.

The following records shall be made: starting time, stopping time, noise levels, bearing temperatures, and motor amp reading as applicable.