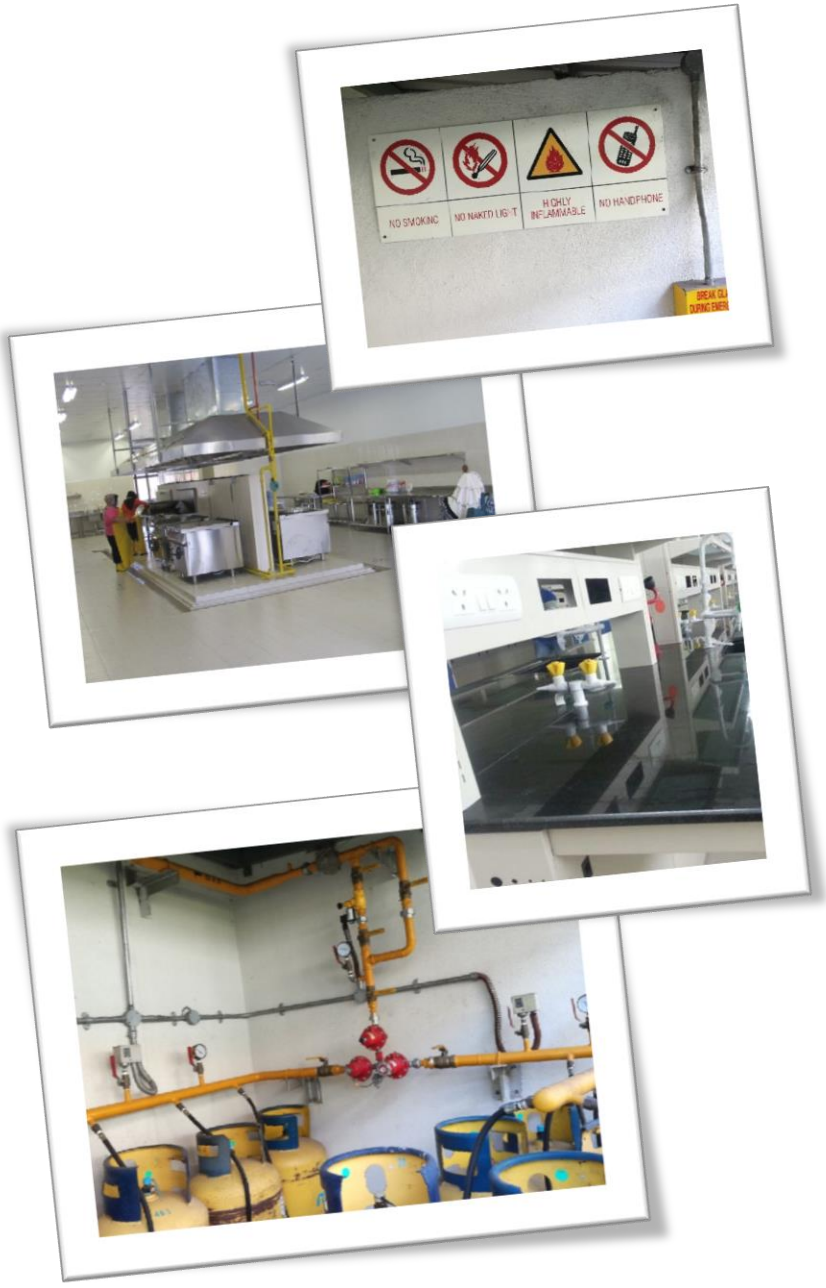
Cawangan Kejuruteraan
Mekanikal

JKR 20500-0053-18

STANDARD TECHNICAL SPECIFICATION

LIQUEFIED PETROLEUM GAS SYSTEM



SECTION 2.0

GENERAL SPECIFICATION

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SECTION 2.0 GENERAL SPECIFICATION

2.1. DEFINITIONS

In this Contract (as hereinafter defined) the following words and expressions shall have the meaning hereby assigned to them below except where the context otherwise requires:

'Authority' means organisation such as *Suruhanjaya Tenaga (ST), Jabatan Keselamatan dan Kesihatan Pekerjaan (JKKP)* and *SIRIM* that is officially responsible for the safety of the Liquefied Petroleum Gas (LPG) System installation or certification of equipment.

'Contractor' means the person or persons, sole proprietor, partnership, firm or company whose tender for the works has been accepted and who has or have signed this Contract and includes the Contractor's personal representatives, heir, successors, executors, administrators, servant and agent.

'Nominated Sub-Contractor' or 'Nominated Supplier' means all specialist, merchants, tradesmen and others executing any work or services, or supplying any materials or goods for which Prime Cost Sum (or P.C. Sums) are included in the Bills of Quantities or which the S.O. has given written instructions in regard to the expenditure of Provisional Sum and who may be nominated by the S.O. and employed by the Contractor as Sub-Contractors or Suppliers.

'Sub-Contractor' shall have the meaning of Contractor for direct contract.

'Superintending Officer (S.O.)' is an officer appointed by the Financial Controller to supervise and issue works instruction in accordance with Standard PWD Form 203 of the Agreement.

'Tenderer(s)' means the person(s) taking part in submitting a bid to the government for the mechanical works described in this Specification.

2.2. EXTENT OF CONTRACT

The work covered by this Specification is for the supply of all materials, appliances, labour, and necessary incidentals for the complete installation, testing and commissioning of Liquified Petroleum Gas (LPG) System as described further in the Specification. This Liquified Petroleum Gas (LPG) System must be complete in all aspect when handed over to the Jabatan Kerja Raya (JKR), and must be in strict accordance to this specification.

2.3. CONDITIONS OF CONTRACT

Tenderers shall read in conjunction with the Specification in the latest PWD Forms:

a. Form PWD 203
b. Form PWD 203N

The conditions and terms stated in these Forms constitute part of this Specification. Copies of these Forms are available for inspection at the Ibu Pejabat JKR, Jalan Sultan Salahuddin, Kuala Lumpur during normal office hours.

The successful tenderer will be required to enter into a sub-contract with the Contractor as Nominated Sub-Contractor in accordance with the Conditions of Contract in the latest Form PWD 203N and tenderer is to allow for complying with all the terms and conditions stated in the latest Form PWD 203 and Form PWD 203N.

2.4. TENDERS

Tenders for the above-mentioned shall be submitted on a lump sum basis for the supply, installation, testing, adjusting, balancing and commissioning of the complete plant as described further in this Specification, and the tender price shall include all charges for transport, handling, Government Custom Duties, Sales Tax and any other taxes where applicable, and all charges for the servicing and maintenance of the complete plant during the warranty period.

It is to be clearly understood that the successful tenderer shall pay all Government Custom Duties and any other taxes which may be payable on all materials for use in work to be performed under this Specification, and no tax exemption certificates will be supplied by the Jabatan Kerja Raya.

2.5. INSTRUCTION TO TENDERERS

The work to be tendered under this Specification includes the supply, delivery of all materials, appliances, labour and necessary incidentals for the complete installation, testing, painting, commissioning, operation and maintenance of the mechanical systems specified.

The tenderer shall tender strictly on the basis of the conditions and terms as laid out in the latest Form PWD 203 and Form PWD 203N. Jabatan Kerja Raya will not entertain any qualifications to the terms or any other conditions imposed by the tenderer.

Tenders must be made on the latest Form of Tender (PWD 203N), along with all relevant blanks in the Schedule of Technical Data for Equipment Offered, Schedule of Rates, Summary of Prices and all other Schedules annexed to this Specification duly filled up. Any tender which is incomplete or which does not include the whole of the works covered by this Specification will not be considered.

All drawings and specifications must be returned together with the tender to the office of Jabatan Kerja Raya at the time of tendering. Failure to observe this condition may result in the disqualification of the tender and forfeiture of the tender deposit.

The tenderer must be specific when completing the Schedule of Technical Data for Equipment Offered and shall only mention one make/manufacturer for each item offered by him. Phrases like "AS SPECIFIED" and "OR APPROVED EQUIVALENT" shall be deemed void.

The tender price entered into the Form of Tender shall be on a lump sum basis and shall include all charges for transport, handling, Government Custom Duties, Sales Tax and other taxes, where applicable and all charges for servicing and maintenance of the complete installation during the guarantee period. No tax exemption certificates will be supplied by the Jabatan Kerja Raya.

The Government shall not be bound to accept the lowest of any tender.

If the tenderer has any doubt as to the meaning of any portion of this Specification or Drawing(s), he shall, when submitting his tender, set out in a letter the interpretation on which he relies.

It shall be noted that where in this Specification, a manufacturer's name and material or equipment catalogue number is quoted followed by the phrase "or other approved equivalent" such reference is intended as a guide to the type of construction, performance, general appearance and quality standard of manufacture and shall in no way, exclude the offer of suitable alternative of similar standard and characteristics. The latter shall have to be approved by the S.O.

Should the tenderer consider there be any advantage to the Jabatan Kerja Raya by modification to the Specification, he may draw attention to such by an attached document stating the reduction of amount of his tender, if accepted by the Jabatan Kerja Raya. However, the total sum to be entered in the Form of Tender shall be such that it represents complete compliance with the Specification.

Tenderers shall furnish together with his tender, such details, technical literature, manuals, etc., as specifically requested or otherwise and all information which is necessary for the complete assessment of the tender.

Tenders which do not comply fully with the requirements of this clause will not be considered.

Tenderers shall state clearly in the tender, the section of the works they wish to sub-let. In each instance, the name/s of the proposed Sub-Contractors and details of their capacity and experience in carrying out such work must be provided.

The tenderer is to state in his tender the time required for delivery of the equipment to site and the time required for completion of the entire installation, both relative to the date of notification of the acceptance of tender.

2.6. DRAWINGS

Tender Drawings:

The drawings applicable to this installation are listed in the Schedule of Drawings and should be considered as diagrammatic and approximate only. The Specification and drawings are intended to be mutually explanatory and complete, but all work called for one, even if not by the other, shall be fully executed.

Working Drawings:

The successful tenderer shall, within thirty (30) days from the date of acceptance of tender, prepare and submit working drawings to the S.O. for approval. In preparing these working drawings, the tenderer shall acquaint himself fully with the building layout and constructional details by personal examination of the architectural, structural and electrical drawings (which are available for inspections at the S.O.'s office) and the completed work on site so as to understand fully the requirements as regards to the work to be erected and installed by him.

The drawing shall be fully dimensioned and show all the precise locations, arrangement and loading of the equipment. They shall also indicate location and details of all foundations, supports, chases, core holes, opening in partition walls, floors and roofs and any other information required for works or services to be provided by others.

Six (6) sets of approved drawings shall than be submitted for distribution to all parties concerned.

The Sub-Contractor shall maintain on site a complete set of the approved working drawings which shall be updated progressively to show accurately the works as executed to-date.

As-Built Drawings:

After completion of the installation work, and at least 3 weeks prior to the schedule date of practical completion, the as-built drawings shall be brought to completion and two sets of prints provided to the S.O. for comment and approval. Within one week of receiving the S.O.'s comments and requirements, the Sub-Contractor shall make all necessary amendments and resubmit one set of prints to the S.O. for final approval.

The Sub-Contractor shall furnish to the S.O. 1 set of original and 5 copies of as-built drawings. Two (2) copies of CD which comprises as-built drawing in AutoCAD and PDF format shall also be submitted.

2.7. REGULATIONS

All work to be performed under this Sub-Contract shall be in accordance with the best commercial practice, and shall comply with the regulations and by laws of the following authorities.

(a) Jabatan Kerja Raya
(b) Jabatan Keselamatan dan Kesihatan Pekerjaan
(c) Suruhanjaya Tenaga / *Energy Commission*
(d) Jabatan Perkhidmatan Bomba dan Penyelamat
(e) All other authorities having jurisdiction over the whole or part of the mechanical installation in the locality.

The Sub-Contractor shall obtain and fill in all notices when required by the above-mentioned authorities, and shall obtain all consents necessary for the various works to be executed by him and shall pay all fees in connection therewith.

The Sub-Contractor shall draw to the attention of the S.O. anything mentioned in this Specification which is inconsistent with the regulations of the above authorities and obtain further instructions from him before proceeding with any work.

2.8. RESPONSIBILITIES OF THE CONTRACTOR AND SUB-CONTRACTOR

(Sub-Contractor shall have the meaning of Contractor for direct contract)

i. The Contractor shall be responsible for:

(a) Ascertaining from the Sub-Contractor all particulars relating to his work in respect of sizes and positions in which chases, holes, mortices and similar items are required to be formed or left.

(b) Supplying all setting out information.

(c) Giving all necessary dimensions and taking responsibility for their accuracy.

(d) Providing all necessary visibility and lighting and making available temporary water and electrical power supplies for the Sub-Contractor's work including paying all fees and charges for water and electricity consumed.

(e) Permanent water and electrical power supply for the testing, adjusting, balancing and commissioning of mechanical installations will be made available on behalf of the Government. The Contractor shall however, pay all fees and charges for water and electrical power consumed up to and including the date of handing over.

(f) Affording free and full use of storage, sanitary and other welfare facilities and providing **SPACE ONLY** for the Sub-Contractor's site office, temporary workshops and accommodation for his employees and workmen.

(g) Affording free and full use of standing scaffolding while it remains so erected upon the site.

(h) Covering and protecting and taking full responsibility for damage to or loss of the Sub-Contractor's work including all the Sub-Contractor's materials, goods, plant and equipment properly delivered to the site for use or incorporation in the Sub-Contract works but excluding any plant, tools, equipment or other property belonging to or provided by the Sub-Contractor not for use or incorporation in the Sub-Contract works.

(i) Clearing away and removing all rubbish and debris.

ii. The Sub-Contractor shall be responsible for:

(a) Unloading, getting in, storing and all handling and hoisting of his materials, plant and tools into required positions.

(b) Connection to temporary water and power supplies, made available by the Contractor for the execution of the work, supplying and running distribution pipes, hoses, cables, leads and electrical gear, etc., required but excluding paying for water and electrical power consumed.

(c) The provision of all fuel, gas, steam and other services required but excluding water and electrical power that may be required for the test run, testing and balancing and commissioning of installations.

(d) The provision, erection, maintenance and removal of all his temporary office, workshop and workmen's accommodation including paying all assessment and other charges.

(e) The provision of any special scaffolding, staging etc., required for the execution of the Sub-Contract works.

(f) Taking full responsibility for any loss or damage to his plant, tools, equipment and other property not for use or incorporation in the Sub-Contract works.

(g) The Sub-Contractor shall be responsible to provide all Industrialised Building System (IBS) related installation, information and requirement, such as space, opening, weight of equipment, anchorage, route, supports etc to the Contractor and carry out co-ordination work with relevant parties.

2.9. SCHEDULE OF WORK

The Sub-Contractor shall prepare in collaboration and to the approval of the Jabatan Kerja Raya a detailed schedule of work based on the time requirements of the Contract schedule. This schedule of work shall indicate clearly the sequence of operation required to complete the works of the Sub-Contract, and also the commencement and completion dates of each section of the work.

The Sub-Contractor shall see that his works progress according to this schedule of work, there shall be complete cooperation with all other trades in the matters of planning and execution of work.

Further variations of the schedule made with the agreement of the Contractor shall not relieve the Sub-Contractor of his liability to complete the contract and/or stages of work at the then agreed times.

2.10. WORKMANSHIP

The work described in this Specification shall be performed by workmen skilled in the installation, testing, commissioning and servicing of the aforesaid plant. All necessary work shall be executed in good workmanlike manner so as to present a neat and finished appearance.

The Jabatan Kerja Raya shall decide the finished piece of work is satisfactory, and if in its opinion any material or equipment has not been properly installed or finished, the successful tenderer, must replace the material or equipment wherever required, and must re-install the material or equipment in a manner entirely satisfactory and without additional cost to the Jabatan Kerja Raya.

2.11. OBVIOUS WORK

The Sub-Contractor shall provide all materials and necessary fittings and perform any work which is obviously necessary for the proper and efficient functioning of the complete installation even though such material or work may not be explicitly mentioned in the Specification.

2.12. MATERIALS

The Sub-Contractor shall supply and deliver to site all necessary fittings, equipment, materials, tools, plant and hoist to complete the installation apart from those specifically mentioned to be supplied by others.

All materials and equipment to be supplied under this Specification shall be new and unused and shall generally be of the best quality as regards to the design, manufacture and performance.

The Sub-Contractor shall submit to S.O. for approval samples such as fitting, pipes, valves, pressure gauge and other parts requested by S.O. that will be used in the project before any installation works begin at site.

2.13. SITE MEETINGS

Site meeting will be held as arranged by the S.O. or Contractor and the Sub-Contractor shall nominate a senior representative to attend these meetings to coordinate and check works in progress.

2.14. ACCESS TO SITE

The Sub-Contractor shall be allowed access to the building during normal working hours. At times other than these, he must make his own arrangements with the Contractor and he shall be held responsible for the building and its contents at all times when the Contractor is not in attendance.

2.15. SUPERVISION

The Sub-Contractor shall have in his direct employ at all time a skilled and efficient supervisor who is empowered to receive and carry out instructions. This supervisor must be thoroughly competent in supervising the works and shall be to the approval of the S.O.

2.16. OPERATING INSTRUCTIONS AND FAMILIARISATION

After completing the installation and before handing it over to the Jabatan Kerja Raya, the Sub-Contractor shall arrange to instruct, free of charge, one or more Jabatan Kerja Raya operators, in all aspects of correct operation and fault finding in case of breakdown during normal operation.

In conjunction with the above tuition, the Sub-Contractor shall supply six (6) printed sets of operating instructions which shall clearly indicate the sequence of operation for starting and stopping the entire plant and shall include the precautions to be taken. The operating instructions shall be completed with an "As completed wiring diagram and a schematic layout of the operating instructions" shall be supplied permanently mounted in a glazed frame to be hung up on to the plant room wall adjacent to the electrical switchboard.

2.17. REPAIR MANUALS AND SPARE PARTS

The Sub-Contractor shall supply six (6) complete sets of repair manuals and spare parts books for all the equipment comprising the complete installation installed by him.

In addition, the Sub-Contractor shall submit six (6), within one month of notification, a detailed and itemised list of equipment and spare parts which the manufacturer/s of the supplied equipment consider as essential to be kept in ready stock for the purpose of yearly service and maintenance. Each item shall be priced in the original contract submission.

2.18. TOOLS

The Sub-Contractor shall supply a complete set of tools and appliances contained in approved package. The set is to be adequate for the maintenance of the aforesaid plant.

2.19. TESTING, ADJUSTING, BALANCING AND COMMISSIONING (TABC)

On completing the installation work for the complete mechanical system, the Sub-Contractor shall carry out tests on all individual sections of the system to prove that the individual performance specified for all equipment can be produced and maintained. He shall also carry out tests on the plant as a whole to prove that the equipment has been properly adjusted and calibrated to produce the required guaranteed performance as called for according to Specifications of this tender.

The Sub-Contractor shall notify the S.O. when these tests are to be conducted so that a representative may be present to witness that the test are carried out satisfactorily.

2.19.1 Post Occupancy Testing and Commissioning

Further adjustments to the controls shall also be made whilst the building is occupied and the installation is in use during the defects liability period. No additional cost shall be charged in carrying out these adjustments.

2.20. MAINTENANCE AND GUARANTEE

The maintenance and guarantee period shall be twelve (12) months from the date of Certificate of Practical Completion (CPC). This guarantee shall include those provided by the manufacturer of the equipment installed and all materials and workmanship supplied by the Sub-Contractor.

The Sub-Contractor shall get a guarantee from supplier / manufacturer and give written warranty certificate to government.

During this period, the Sub-Contractor shall at his own expense, remedy and supply/replace all defective parts or items, inclusive of all consumable items so that the complete mechanical system is maintained in a first class running order. This maintenance shall include regular and systematic checking, cleaning and necessary adjustments to the equipment.

The Sub-Contractor shall also provide adjustments to the service as required by the Jabatan Kerja Raya in the event of a breakdown of the plant.

Replacement made during the maintenance and guarantee period may, at the discretion of the S.O. be subjected to a similar maintenance and guarantee period from the date of replacement.

2.21. HANDING OVER DOCUMENTS

Prior to the issuance of Certificate of Practical Completion, the Sub-Contractor shall submit all related project handing over documents in hard copy and softcopy format as the following:

a) Test report complete with fully verified Inspection checklist and Test Forms.
b) Defects list.
c) Operation and Maintenance Manual which includes
   - Manual / Standard Operating Procedures.
   - Preventive Maintenance Schedule and Manual.
   - Equipment / Product Engineering Data.
   - Asset and Inventory List.
   - Operation set point.
   - Pressure regulator set points.
   - Sub-Contractor and manufacturer contact details.
   - Gas Competent Person (GCP) certificate and contact details.
   - Approval To Install (ATI) – Kelulusan Untuk Memasang.
   - Approval To Operate (ATO) – Kelulusan Untuk Mengendali.
   - Private Gas License – Lesen Gas Persendirian.
   - All completed test report fully verified and endorsed for Pre-Delivery Stage, Delivery Stage, Installation Stage and Functional Performance Test Stage.
d) As-built drawing (softcopy-CAD file & PDF, hardcopy).
e) Schedule of Familiarisation Program to end users.

2.22. SERVICE CONTRACT

An annual figure is to be quoted where indicated hereunder for the complete maintenance (inclusive of repairs, replacements and the supply and installation of all consumable items) and service of the installation. Such annual figure will be valid and not subject to variation for a period of three (3) years from the end of the guarantee period.

This sum is NOT to be included in the total lump sum tendered for the project but is to be a separate quotation open for acceptance by the Jabatan Kerja Raya if they so desire.

The Sub-Contractor should note that the total maintenance costs for three years calculated on the basis of the figure quoted hereunder will be taken into account when considering tenders.

2.23. PROPRIETARY NAMES AND ALTERNATIVE OFFERS

Whenever proprietary names are mentioned in this Specification or in the Drawings they are indicative of the type and quality only. Articles of alternative manufacture may be considered provided they are equal in all respects as regards to the design, quality, appearance and finish.

Any alternative offer which differs from that specified in this Specification must be clearly stated and described by the tenderer in Section 7 in this Specification.

2.24. SCHEDULE OF PRICES

The tenderer shall complete the Schedule of Prices as set out in the tender document. All prices quoted shall be inclusive of Government Custom Import Duty and Sales Tax at current rate.

2.25. SCHEDULE OF RATES

The tenderer shall complete the Schedule of Rates as set out in the tender document. The price quoted shall include cost of materials, cutting, fixing in position, labour, supervision, profit and everything else necessary for the completion of the installations.

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SECTION 3.0

TECHNICAL SPECIFICATION

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SECTION 3.0 TECHNICAL SPECIFICATIONS

3.1 RESPONSIBILITIES OF THE SUB-CONTRACTOR

1. Submitting the name of gas competent person registered with Suruhanjaya Tenaga (ST) and qualified welder certified by SIRIM QAS / Suruhanjaya Tenaga (ST) / CIDB. A copy of valid certificate of competency shall be enclosed during submission of tender stage. Incomplete submission shall be rejected.

2. To ensure that all items supplied and installed for the system are approved by the Suruhanjaya Tenaga (ST) and Jabatan Kesihatan & Keselamatan Pekerjaan (JKKP) Malaysia (where applicable), the Sub-Contractor shall also be responsible to fill in all notices and requests required to obtain approvals from the agencies. The Sub-Contractor shall also pay all related fees in connection with the approvals.

3. The successful Sub-Contractor awarded with this tender, shall submit to the Superintending Officer (S.O.) representative a copy of the calculations and sufficient copies of detail working drawings duly endorsed by a gas competent person and approved by ST and/or JKKP. The tender drawings shall be not considered as working drawings. Nevertheless, the price to be offered by the tenderers shall be based in the tender drawings, apart from the scope of work and the Specification.

4. Prior to installation, the Sub-Contractor shall submit to the S.O. a copy of **Approval To Install (ATI) from ST.**

5. Prior to operation, the Sub-Contractor shall also submit to the S.O. a copy of **Approval To Operate (ATO) from ST.**

6. Prior to CPC, the Sub-Contractor shall obtain the “Private Gas License (*Lesen Gas Persendirian*)” from ST and submit to S.O.

7. To make good of hacking / coring of holes, which are not shown in the approved drawings.

8. Concealing all wiring conduits, including hacking of chases, holes etc. and making good damages.

9. Extending the electrical wiring from incoming isolator to the equipment.

3.2 GENERAL

The high and low pressure gas installation shall be in accordance with the manufacturer specification and shall comply with the Rules and Regulations of the Local Authorities and the relevant clauses of the Gas Supply Act 1993, Gas Supply Regulations 1997, British Standard 6400 & 6891, BS EN 1057, ANSI / ASME B31.8, ASTM A106, ASTM D2513, Malaysian Standards MS 1086, MS 830 & MS 930, National Fuel Gas Code Handbook 3rd Edition and Guidelines On Domestic Gas Piping System.

All necessary gas pipes shall be installed complete with the appropriate valves and regulators to the specified points as detailed in the tender drawings attached to this Specification.

The installation of gas pipes, valves and regulators shall conform generally with the following safety regulations:

i. The piping is to be free internally and externally of cutting burrs, loose scale, dirt, dust and other foreign matters before installation is completed.

ii. All pipe joints should be welded or brazed with material having a melting point of 540ºC (1000 ºF). Joints with valves or other devices which are removable for servicing are excluded from this recommendation. All the welding works shall be complied to the approved Welding Procedure Specification (WPS).

iii. Piping shall be located or protected as to avoid extreme temperature which might give rise to cracking of the pipe.

iv. Provision must be made to avoid damage to the piping by its expansion, vibration or by settlement of the building by which it is carried.

v. Where used, threaded connections are to be have tapered threads according to BS EN 10226. A jointing compound which is resistant to LPG and which remain plastic must be used, but should be applied only to the male threads.

vi. Suitable shut off valves shall be fitted to each appliance or burner. If this valve is closed, it shall shut off gas to that appliance only, and it may also serve as a control valve, but its design must be suitable for both functions. All shut-off valves shall be suitable for LPG service and designed for not less than the maximum pressure to which they may be subjected.

vii. The open ends of piping and/or fittings (with the exception of the terminal taps or valves in regular use) must always be made gas tight by means of a plug, welded or brazed in position. Welding or brazing materials must have a melting point of at least 540ºC (1000 ºF). Hammering over the ends of piping or plugging with wood as a means of sealing is not allowed.

viii. The use of gray cast iron valves, non-metallic materials, for bonnets or bodies of valves, fittings and accessories is prohibited.

ix. Piping shall be tested after assembly and proved free from leaks at not less than normal operating pressures (MS 930).

x. All materials used for valve seats, packings, gaskets, diaphragm etc., shall be resistant to the action of LPG.

xi. All gas piping shall be of seamless carbon steel pipe ASTM A106 of Schedule 40 or Schedule 80 for high temperature service aboveground. For underground gas piping, Schedule 80 pipe ASTM A106 shall be used.

xii. All works stipulated within the contract shall be supervised by gas competent person that appointed by the Sub-Contractor.

3.3 BULK STORAGE TANK (If applicable)

The system shall consist of, but not limited to bulk storage tank, fill up to the maximum allowable pressure with LPG (as indicated in the tender drawings), pipe works and fittings, valves, flanges, regulators, joints, corks, mounting, pressure gauges, pressure switch and other necessary items to complete the system, suitable and approved for LPG use.

The bulk storage tank shall be located as shown in the drawings. The capacity of the bulk storage tank shall be as specified in **Section 6 (Schedule of Design Requirements)**.

The bulk storage tank shall be designed, fabricated and tested in accordance with ASME Code, AS 1210, or other codes approved by the relevant authority.

The container shall also confirm and comply to the MS 830 (latest revision) for the application, design code and pressure, marking and, opening of containers, openings protection, appurtenances and any other relevant clause.

The safety distance from the bulk storage tank shall conform to MS 830 Fig.2 Column B - Location of aboveground containers for bulk storage at consumers' premise.

3.4 VAPORISER

The vaporiser shall be of the direct-fired, indirect-fired or atmospheric type. The Sub-Contractor shall size up the vaporizer capacity accordingly and detail calculation must be submitted with this tender. The vaporizer shall have at or near the vapor outlet, a safety relief valve to provide an effective rate of discharge as describe in MS 830. In general, the installation of the vaporizer shall comply with MS 830.

The vaporizer shall be designed and constructed in accordance with ASME Code, AS 1210 or other codes approved by the relevant authority.

The vaporizer may be connected to the liquid section or both the liquid and gas sections of the storage container; provided however that there shall be in each connection to the storage container a manually operated valve which shall be capable of completely shutting off all gas or liquid flow from the container to the vaporizer.

The vaporizer shall be provided with suitable automatic means to prevent liquid passing through the vaporizer to the LPG vapor discharge piping. The vaporizer shall not be equipped with fusible plugs and shall be provided with means for manually turning off the gas supply to the main burner and pilot.

3.5 CYLINDER, CYLINDER MANIFOLD AND PRESSURE REGULATOR

The LPG cylinder manifold shall rigidly support and arrange in two banks each consisting of cylinders as specified. The capacity of each cylinder shall be approximately 50 Kg of LPG. Storage containers for gas shall be capable of withstanding total pressure of 3.34 MPa exerted by the gas at the maximum temperature contemplated in use. Each container must be equipped with a discharge valve capable of discharging at the required rate.

The cylinder manifold shall be of seamless carbon steel piping. A suitable automatic change-over regulator with remote indicator shall be incorporated in the manifold header.

Connection to the manifold shall be of copper pigtails and shall be fitted with non-return valves. All joints between manifold headers and cylinder connectors shall be readily accessible.

The joints in manifold headers which do not have to be broken in normal use should be welded or brazed using materials which must have a melting point of at least 540ºC (1000 ºF).

The automatic change-over regulator shall be capable of reducing the cylinder pressure to a constant burner pressure of 11 inches w.c. (water column). It shall provide convenience of uninterrupted service on multiple cylinder installations. When gas is exhausted from the SUPPLY cylinders, the unit shall automatically switch to the RESERVE cylinders to maintain constant gas supply. The unit shall also provide visual indication at the regulator to show that the supply is exhausted.

Manifold headers, regulators and cylinder connectors shall be of suitable dimensions to supply the estimated gas off take without undue pressure drop.

Pressure regulator shall be reputable brand and approved type capable of handling the likely off take of the gas to the required pressure. The unit shall also provide visual indication at the regulator to show that the supply is exhausted. Regulators shall be constructed of bronze and have screwed ends and shall comply with BS EN 16129 and BS EN 10226.

(i) First Stage – Automatic changeover regulator

Outlet pressure setting	:	5 psig
Outlet Pressure	:	5 to 20 psig

(ii) At Second Stage Regulator

Outlet pressure setting	:	0.5 psig
Adjustment Range	:	0.3 – 0.7 psig

Pressure regulators are installed along the line to reduce the vapor pressure progressively from the tank operating pressure about 414 – 690 kPa (60-100 psig) to appliance operating pressure 300 mm w.c. (water column) or 0.5 psig. This pressure reduction is normally carried out in two stages (for better reliability and safety) such that the gas line pressure in the building is reduced to not more than 35 kPa (5 psig).

Second stage regulator/s shall be installed as indicated on the approved drawings complete with a shut-off ball valve as per requirement of the authority.

Pressure regulators shall be rigidly installed and provided with a vent line to the outside air with the discharge outlet not less than 1 meter horizontally away from any building opening below the level of such discharge outlet.

3.6 VALVES (ISOLATION SHUT-OFF AND EMERGENCY SHUT-OFF)

All isolation shut-off valve and emergency shut-off valve supplied and installed for the system are approved by the ST.

All valves shall be constructed of steel meeting the requirements of ASTM A182 and shall be leak-proof and follow API 6D, Class 150 for low pressure and Class 600 for high pressure LPG. In addition, such valves shall have renewable 'TEFLON' and valve disc and gland packing. All materials used, including valve seat discs, packing, seals and diaphragms shall be resistant to the action of LPG under service conditions. Any valve external to the container shall be of 'fire safe' type, i.e. one which incorporates secondary provisions to prevent leakage if the primary seal or seal has been damaged by heat.

3.6.1 Emergency Shut-off Valve

Emergency shut-off valve (ESV) shall be of reputable brand and approved type provided at each gas main riser. In case of an emergency of gas leak the individual gas main riser can be isolated by breaking the glass window of the ESV box and pulling the cable handle linked with the ESV. Each valve box shall be lockable and fitted with suitable glass fronted cover. The box shall be provided with vents at the top and bottom and large enough to allow adequate access for maintenance. The box shall be recess mounted. The valve box shall be fabricated from 16-gauge (1.626mm) G.I. sheet.

3.6.2 Isolation Shut-off Valve

Isolation shut-off valve should be installed at branch lines, before regulators and meters, at each riser point, at appliance points, to enable isolation of each section of the pipe for maintenance as well as during emergency. Isolation valves should be of quick-action type such as manually operated ball valves.

The isolation shut-off valves shall have clear indication for ON-OFF position.

Location of isolation shut-off valves shall be installed in readily accessible positions for ease to operate and must be within operation area and outside of gas storage area.

Suitable shut-off valves of approved type shall be fitted to each appliance or burner. They shall be of the same size as the pipe to which they are screw-jointed.

3.7 HYDROSTATIC SAFETY RELIEF VALVE ON LIQUID LINES

A hydrostatic safety relief valve shall be installed between each pair of shut-off valves on LPG piping to relieve hydrostatic pressure to atmosphere. It shall be so placed that, in the event of its operation, escaping LPG cannot impinge on containers fittings or other equipment nor on the ground.

The minimum setting of hydrostatic safety relief valve installed in piping shall be not less than 140% and not more than 200% of the container safety relief valve setting. For fittings rated 850 kPa (gauge) to 1000 kPa (gauge), the setting of such safety relief valve shall be not greater than 1750 kPa (gauge) and for fittings rated at 1750 kPa (gauge) to 2100 kPa (gauge), not greater than 3100 kPa (gauge). The discharge from such hydrostatic safety relief valve shall not terminate in any building.

A hydrostatic safety relief valve should not be installed in the pump discharge piping if the same protection can be provided by installing the hydrostatic safety relief valve in the suction piping.

3.8 FLEXIBLE HOSE

Provision shall be made, in design or by provision of flexible piping to compensate for stresses and vibration in the piping system. Flexible hose shall be as short as possible and in any case shall not exceed 1 m in length.

Flexible hose shall be fabricated of materials resistant to the action of LPG both as liquid and vapour. If wired braid is used for reinforcement it shall be of corrosion resistant material such as stainless steel. Where a hose is provided with an inbuilt earthing wire, this shall be of stainless steel.

Flexible hoses and connectors shall be complied to MS 830 and approved by the relevant authority.

3.9 PIPES AND INSTALLATION

Materials of pipes shall be seamless carbon steel pipe to standard ASTM A106 or API 5L Grade B, Schedule 40 and Schedule 80 and copper pipe to BS EN 1057. The jointing compound must be of a type which is resistant to LPG under the service conditions to which they are subjected. Fibre and similar material must not be used in pipe joints. In underground, or in inaccessible places, all joints shall be screwed, welded or brazed.

Tubing shall be steel, copper or polyethylene and shall comply respectively with the following or other approved equivalent specifications:

a) Steel Tubing: ASTM A539
b) Copper Tubing: BS EN 1057 or Type K or Type L of ASTM B88 or ASTM B280

All piping, tubing, fitting, valves and similar equipment (not subject to cylinder pressure) shall be suitable for LPG and shall be capable of withstanding a test pressure 1.5 times the maximum operating pressure to which they may be subjected to under normal use.

Bending, drilling, welding of pipes to create tees or bends are not allowed. All joints, bends, elbows and tees in steel or copper pipes shall be made strictly using the appropriate fittings. All changes in pipe direction requiring turns or offsets shall be free from flattening, buckling or thinning of tube wall at any point.

Piping and valves should be suitably dimensioned and installed in such a way the burners are supplied with required gas rate and pressure and any likely increase in the estimated gas off take should be allowed for.

Cast iron is not permitted to be used as piping and fittings material because of its brittle properties. PVC and natural rubber are also not allowed due their poor long-term resistance to gas attack.

The open ends of piping or fittings shall always be made gas tight by means of a plug, welded or brazed in position. Hammering over the ends of the pipes or plugging with wood as a means of sealing is strictly prohibited.

Piping shall be free internally and externally of cutting burrs, loose scales, dirt, dust or other foreign matter before and after installation and all pipe work has to be purged before the installation completed. Pipes with threads which are stripped, chipped, corroded or otherwise damage shall not be used.

Piping shall not be chase in / run along drains to avoid damage to the pipes by acids and other corrosive chemicals.

Piping in riser shall not be chase in walls but along surface.

Provision must be made to avoid damage to the piping by its expansion, contraction, vibration or by settlement of the building on which it is carried.

Piping shall be located and/or protected as to avoid extremes of temperature which might give rise to condensation or cracking of the gas insulation.

The insulation of piping shall in no way weaken significantly the building structure.

3.9.1 Underground Pipe

Underground pipes shall be wrapped with polyethylene tape.

Pipes need to be protected against aboveground loading by using protective sleeve.

When dissimilar metals are joined underground, an insulating coupling or fitting should be used. Piping should not be laid in contact with cinders.

The tracer wire should be installed around the non-metallic pipe surface and the wire ends should be led to aboveground, at every 50m interval, where the discontinuity can be detected easily.

Warning slab / warning tape should be located above the entire length of the underground gas piping. The purpose of warning marker and slab is to show that underground gas piping has been installed as required by the regulations.

Warning marker (concrete marker) should be installed at suitable intervals along the straight and curved runs, and whenever there is abrupt change in direction of the underground gas piping as required by the regulations.

3.10 JOINTS

All pipe joints shall be welded or brazed and shall be gas tight and leak proof. Welding or brazing material used must have a melting point of at least 540ºC (1000 ºF).

Only joints with valves or other devices which are removable for servicing may be jointed by threaded connections. Where used, threaded connections are to have tapered threads according to BS EN 10226.

A jointing compound which is resistant to LPG and which remain plastic must be used.

The open ends of piping and/or fittings (with the exception of terminal taps or valves) must always be made of gas tight by means of a plug, welded or brazed in position.

Joints in polyethylene pipe and tubing shall be made by heat fusion in accordance with the manufacturer instructions. Polyethylene fittings shall conform to ASTM D2683 or ASTM D3261.

3.11 SUPPORT

Piping shall be supported with pipe hooks, metal pipe straps, bands or hangers suitable for the size of piping of adequate strength and quality.

Piping shall be adequately supported with a free air space between the piping and the wall structure. The piping must be securely positioned to prevent them being moved from their original place. The interval between pipe support shall be in accordance to Table 1. Gas piping shall not be supported by other pipe services.

TABLE 1: Support of Piping

Steel pipe, nominal size of pipe (mm (in.))	**Maximum spacing of supports (m (ft))**
15 (½)	1.8 (6)
20 (¾) or 25 (1)	2.4 (8)
32 (1¼) or larger (horizontal)	3.0 (10)
32 (1¼) or larger (vertical)	Every floor level

Source: Department of Standard Malaysia. (2013). *MS 830: Storage, handling and transportation of liquefied petroleum gases (LPG) - (Third revision)*

3.12 FITTINGS

All fittings shall be forged or wrought-copper, bronze or brass made especially for solder type connections where possible or for flared nuts where this is more suitable.

Piping, fitting and valves shall be tested after assembly and prove free leaks at not less than normal operating pressures.

All materials used for valves seats, packing, gasket diaphragms etc. shall be resistant to the action of LPG.

3.13 GAS OUTLET

All table mounted cocks shall be of copper, bronze or brass secured on the table tops by recessed screws. Each 2-way gas cock shall be completed with 2 nozzles individually controlled by separate spring-loaded levers and shall be able to accommodate 8mm / 10mm diameter gas rubber tubing.

Connections from gas piping to the cocks shall be by flare nut from below table top.

3.14 PIPEWORK PURGING

After all installation is completed and before testing, the Sub-Contractor shall purge the whole of the pipework with inert gas – dry nitrogen.

3.15 EARTHING

Pipelines shall be bonded to the consumer's earth terminals. This bonding shall be made as near as possible to the point at which the pipeline enters the building from the plant/gas storage.

Earthing and bonding of all electrical equipment shall comply with the requirements of MS IEC 60079-10 and MS IEC 60079-14.

Approved bonding conductor shall be used and the pipeline shall not be used for earthing the electrical equipment by themselves.

3.16 ELECTROSTATIC HAZARD PRECAUTIONS

An effective earthing point and/or bonding connection shall be provided at the storage site for discharging static electricity from bulk tank vehicles, prior to commencing the delivery operation.

Storage containers greater than 2,500 liters water capacity shall be electrically earthed as a protection against the accumulation of static electricity and should have electrical continuity with the earth required in item 14.4.5.1 (MS 830) or preferably it should be a common earth. The resistance to earth shall not exceed 1×10^5 Ω.

3.17 FIRE PROTECTION

The Sub-Contractor shall provide fire extinguisher of 9-kg ABC type dry powder which shall be installed in a conspicuous and readily accessible location as indicated in the drawing.

A storage of cylinders which may contain more than 500 kg of LPG shall be provided with not less than one garden system ready for immediate use, where the water supply is adequate.

3.18 LPG STORAGE SAFETY

A suitable site for the permanent placement of an LPG storage tank or manifold cylinders must be selected to ensure safety of the installation.

a. Location and Minimum Safety Distance

The decanting point shall be located outdoors and the following minimum safety distances from the decanting point shall be maintained:

i. To an opening into a building : 2 m
ii. To an ignition source : 10 m
iii. To buildings or to any flammable materials stored above ground on neighboring property : 5 m
iv. To streets and roads : 3 m
v. Dispensers for any type of fuel : 3 m

b. Manifold Cylinders Location:

A cylinder should be located at a distance of at least 5 m from flammable or combustible liquid storage, refuse chamber, electrical substation and other forms of combustible materials.

3.19 GAS METERING

Gas meters should be located at least 1 m from sources of ignition. Meter should be securely supported and should be protected against overpressure, backpressure and vacuum.

3.20 PAINTING

All equipment and pipework, conduits and other incidentals items shall be given one coat primer paint and two coats of finishing oil paint of colour golden yellow or according to colour code of BS 381C 309.

3.21 IDENTIFICATION AND SIGNAGE

i. Valve box to bear the name:

“INJAP PENGASING LPG”

ii. LPG store shall be provided with notice bearing the words:

“DILARANG MEROKOK, DILARANG MEMBAKAR, MUDAH TERBAKAR, DILARANG MENGGUNAKAN TELEFON BIMBIT ”

3.22 ELECTRICAL WORKS

The LPG Sub-Contractor shall carry out all electrical work associated with and / or necessary for the efficient functioning of the installation except where specified otherwise in this Specification. The work shall include the complete supply and installation of all the required materials and equipment.

All material used in electrical works, unless otherwise approved by the S.O., shall have SIRIM or ST approval.

3.23 GAS PANEL, GAS LEAK DETECTOR AND SIREN LIGHT

Gas Panel shall receive signal from pressure transmitter to display pressure reading of the incoming gas into building after the intermediate regulator.

The Gas Panel shall link with pressure transmitter and the main solenoid valve to cut off supply if the gas pressure supply is beyond/over design pressure. In case of gas leakage inside the area (Kitchen, Lab), the gas sensor will be activated.

When sensor activated, the gas leak detector will send a signal to the gas leak control panel which will treat it as leakage inside the lab/building. The panel will give signal to the solenoid valve to close immediately (safety issue) to make sure no more gas flow to the area. The panel will give another signal to the siren light (alarm, meaning there is leakage). The panel will give signal to fire alarm system which will deactivate the main solenoid valve of LPG of entire building (safety issue). The panel will give signal to Building Management System (*if applicable*) to notify to the operator (maintenance team) that there is a gas leakage.

The operator (maintenance team) has to check if there is leakage or any of outlet open and to close it immediately. When there is no more gas leakage inside the lab, the operator will reset the panel and the solenoid manually to activate the system and the gas flow inside the lab. In case of fire alarm triggered in the building, the main solenoid will be shut off (safety issue).

Solenoid Valve is an electrical control valve energised from control panel to shut off the gas in case there is leakage. It is a spring type solenoid which is normally closed. In case there is leakage, the gas panel send signal to solenoid to open. The panel will cut the power to solenoid and become again closed when there is no more leakage detected.

<u>Gas Leak Detector</u>

Fixed gas leakage detectors shall be provided to areas where the gas is used as indicated in the approved drawings. Gas leak detectors are installed at low level at 300 mm from finish floor level or near the gas fitting. Gas leak detector detects the LPG leakage and gives signal to detection control panel.

Siren Light

Once gas leak detector is activated, panel will give signal to siren light to alert the area about the LPG leakage (visual and audio). The fixing of the siren light is to be wall mounted or ceiling mounted as indicated in the approved drawings.

3.24 CATHODIC PROTECTION

The design and construction of the cathodic protection system shall be carried out by experienced corrosion specialists.

The size and number of anodes shall be designed by experienced corrosion specialist such that the anodes are capable for corrosion protection of the underground carbon steel piping before its next revalidation date.

Sacrificial anode type protection system with a minimum 15 years shall be provided. The cathodic protection shall be complimentary to the protective surface coating on the LPG underground piping and the sacrificial anode shall be either a Zinc or Magnesium anode. The minimum requirement of the system shall be:

- Pre-packed sacrificial anodes
- Reference electrode
- Monitoring panel with test points
- Cabling

The cathodic protection shall be as per applicable standards:

- NACE SP0169-2013

Cathodic protection criteria shall be:

i. A negative (cathodic) potential of at least 850mV with the cathodic protection system. The potential is measured with respect to a saturated copper/copper sulphate reference electrode containing the electrolyte.

ii. A minimum polarisation shift of (-)100 mV of cathodic polarisation.

iii. Cathodically protected section of the pipe line shall be electrically isolated by use of insulating joints.

References

- Australian Standard. *AS 1210: Pressure vessels.*
- American Petroleum Institute. *API 6D: Specification for Pipeline Valves.*
- American Petroleum Institute. *API 5L: Specification for Line Pipe.*
- American Society of Mechanical Engineers*. ASME B31.8: Gas Transmission and Distribution Piping Systems.*
- ASTM International. *ASTM A106: Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.*
- ASTM International. *ASTM A182: Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.*
- ASTM International. *ASTM A539: Standard Specification for Electric-Resistance-Welded Coiled Steel Tubing for Gas and Fuel Oil Lines.*
- ASTM International. *ASTM B88: Standard Specification for Seamless Copper Water Tube.*
- ASTM International. *ASTM B280: Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.*
- ASTM International. *ASTM D2513: Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings.*
- ASTM International. *ASTM D2683: Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.*
- ASTM International. *ASTM D3261: Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.*
- British Standards Institude. (2010). *BS EN 1057: Copper and Copper Alloys. Seamless, Round Copper Tubes for Water and Gas in Sanitary and Heating Applications.*
- British Standards Institude. (2016). *BS 6400: Specification for Installation, Exchange, Relocation, Maintenance and Removal of Gas Meters with a Maximum Capacity Not Exceeding 6 m3/h. Low Pressure (2nd Family Gases).*
- British Standards Institude. (2015). *BS 6891: Specification for The Installation and Maintenance of Low Pressure Gas Installation Pipework of Up To 35 mm (R1¼) on Premises.*

- British Standards Institute. (2004). *BS EN 10226: Pipe Threads where Pressure Tight Joints are Made on The Threads. Taper External Threads and Parallel Internal Threads. Dimensions, Tolerances and Designation.*

- British Standards Institute. (2013). *BS EN 16129: Pressure Regulators, Automatic Change-Over Devices, Having a Maximum Regulated Pressure of 4 Bar, with a Maximum Capacity of 150 kg/h, Associated Safety Devices and Adaptors for Butane, Propane, and their Mixtures.*

- International Electrotechnical Commission. (2015). *MS IEC 60079-10: Explosive Atmospheres, Part 10: Classification Areas – Explosive Gas Atmospheres.*

- International Electrotechnical Commission. (2013). *MS IEC 60079-14: Explosive Atmospheres, Part 14: Electrical Installations Design, Selection and Erection.*

- Department of Standard Malaysia. (2013). *MS 830*: *Storage, Handling and Transportation of Liquefied Petroleum Gases (LPG) - Code of Practice. (Third revision).*

- Department of Standard Malaysia. (2017). *MS 930*: *Installation of Fuel Gas Piping Systems and Appliances - Code of Practice. (Second Revision).*

- Department of Standard Malaysia. (2007). *MS 1086*: *Polyethylene (PE) Piping Systems for Gases Fuels Supply – Part 1: General (First Revision)*

END OF SECTION 3.0

SECTION 4.0

TESTING, ADJUSTING, BALANCING AND COMMISSIONING

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SECTION 4.0 TESTING, ADJUSTING, BALANCING AND COMMISSIONING

4.1 GENERAL

This section specifies the requirements for all testing, adjusting, balancing and commissioning (TABC) of the mechanical works to be carried out under the contract. The objectives of TABC are as follows:

i. To verify the delivered materials are as per approved specification and good physical condition.
ii. To verify the installation works are carried out in accordance to specification and good engineering practices.
iii. To verify the performance in terms of functionality, safety, maintainability and operational ability of the installed equipment to ensure the system meet the specified design intention through a series of tests and adjustments.
iv. To ensure all test result are systematically recorded and verified prior to system commissioning.
v. To ensure all the test comply with Gas Supply Act 1993 (Act 501), Gas Supply Regulations 1997, Suruhanjaya Tenaga (ST), Jabatan Kesihatan dan Keselamatan Pekerjaan (JKKP), MS 930:2010 and MS 830: 2013 or latest revision.

TABC works are divided into four stages as the following:

i. Pre-Delivery stage
ii. Delivery stage
iii. Installation stage
iv. Functional Performance Test stage

Sub-Contractor shall submit Inspection and Testing Plan (ITP) of TABC works to be carried out in accordance to this Specification to Superintending Officer (S.O.) for review and approval.

4.2 INSPECTION AND TESTING PLAN (ITP)

ITP shall consist of:

i. List of All TABC Requirement

All TABC works with specific scope and boundaries shall be clearly stated at every stage of TABC works and comply with the regulation of Suruhanjaya Tenaga (ST) and contract document. Sample of Inspection and Testing Plan minimum requirement is as per Table 1.

ii. TABC Work Program

TABC work program shall be integrated into main project schedules.

iii. Method Statements

TABC method statements shall consist of TABC procedures, responsibilities, necessary tools, measuring equipment with valid calibrated certification, consumable items and acceptance criteria. Type of test required is listed in Table 1.

Method statements and acceptance criteria for all equipment during installation stage, inspection and functional performance testing shall be endorsed by Gas Competent Person (GCP).

ITP shall be updated for any changes and resubmitted to the S.O. for approval.

Prior to the commencement of the TABC works as per approved ITP, the Sub-Contractor shall issue Request for Inspection and Testing (RFIT) to the S.O. During the TABC, the Sub-Contractor shall have his complete technical team available to aid the testing and to perform any adjustments as directed.

The TABC works shall be carried out under the direction of Gas Competent Person (GCP) and witnessed by S.O. No subsequent installation works shall proceed without S.O.'s approval of the test result.

Depending on the specific demands of individual installation, S.O. may require additional or substitute testing works in regard to any elements in the installation other than those indicated in this Specification.

Table 1: Sample of Inspection and Testing Plan (ITP)

Stage	Inspection and Test Name	Scope and Boundaries	Responsibility	Method Statement	Test Form No	Expected Date
Pre-Delivery Stage	Pressure and Leak Test	Gas Cylinder / Bulk Storage Tank	Manufacturer	To be submitted by Sub-Contractor	To be submitted by Sub-Contractor (i.e. LPG 01)	Date as per work program (January)
	Pressure regulating & Pneumatic / Leakage Test	Regulator	Manufacturer	To be submitted by Sub-Contractor	To be submitted by Sub-Contractor (i.e. LPG 02)	Date as per work program (January)
	Functional Test	Gas Leak Detector	Manufacturer	To be submitted by Sub-Contractor	To be submitted by Sub-Contractor (i.e. LPG 03)	Date as per work program (January)
Delivery Stage	Visual Inspection	Cylinder, Piping, Valve, Pressure Gauge and Regulator	Sub-Contractor	To be submitted by Sub-Contractor	To be submitted by Sub-Contractor (i.e. LPG 04)	Date as per work program (February)
	Measurement (size, capacity)		Sub-Contractor	To be submitted by Sub-Contractor	To be submitted by Sub-Contractor (i.e. LPG 05)	Date as per work program (February)
	Documentation- (Delivery Order, Factory Acceptance Test, etc.)		Sub-Contractor	To be submitted by Sub-Contractor	To be submitted by Sub-Contractor (i.e. LPG 06)	Date as per work program (February)

Installation Stage	Flushing/Purging Work	LPG Pipe	Sub-Contractor	To be submitted by Sub-Contractor	To be submitted by Sub-Contractor (i.e. LPG 07)	Date as per work program (April)
	Sectional Pressure Test	LPG Pipe	Sub-Contractor	To be submitted by Sub-Contractor	To be submitted by Sub-Contractor (i.e. LPG 08)	Date as per work program (April)
	Leak Test	Pipe and Fittings	Sub-Contractor	To be submitted by Sub-Contractor	To be submitted by Sub-Contractor (i.e. LPG 09)	Date as per work program (April)
	Support and hanger load test	Equipment & Pipeworks	Sub-Contractor	To be submitted by Sub-Contractor	To be submitted by Sub-Contractor (i.e. LPG 10)	Date as per work program (April)
	Location & Orientation of Equipment	Gas Cylinder / Storage Tank	Sub-Contractor	To be submitted by Sub-Contractor	To be submitted by Sub-Contractor (i.e. LPG 11)	Date as per work program (April)
Functional Performance Stage	Regulator & Change Over Test	Regulator, Leak Detector, Alarm, Auto Shut-off Valve & Gauges	Sub-Contractor	To be submitted by Sub-Contractor	To be submitted by Sub-Contractor (i.e. LPG 12)	Date as per work program (July)
	Pressure Gauge Functional Performance Test			To be submitted by Sub-Contractor	To be submitted by Sub-Contractor (i.e. LPG 13)	Date as per work program (July)
	Gas Leak Detection, Alarm & Auto Shut-off Valve Functional Performance Test			To be submitted by Sub-Contractor	To be submitted by Sub-Contractor (i.e. LPG 14)	Date as per work program (July)

4.2.1 Pre-Delivery Stage

Pre-delivery inspection and performance test shall be conducted before site delivery. These tests shall be witnessed by the government's representative if deemed necessary by the S.O. All travelling, food and accommodation cost of government representatives related to witnessed performance test shall be included in the contract.

A factory test shall be defined as any test of equipment such as Gas Cylinder, Pressure Regulator, Emergency Shut-off Valves and all other related necessary equipment required as stated in the contract, conducted at manufacturer's plant or at an independent and accredited test facility approved by the S.O.

Performance test method statement, test standard and acceptance criteria shall comply to MS 830 / MS 930 and submitted to S.O. for record. The manufacturer shall conduct the test, pass all acceptance criteria and produce a signed test report. All test report shall be submitted to S.O.

Manufacturer shall be responsible for any reworks and adjustment of the equipment if the test results fail to comply with the approved acceptance criteria.

Rejection of Equipment

The Government shall reserve the rights to reject any item of the equipment that fail to comply with the Specification of this contract.

4.2.2 Delivery Stage

All incoming material and equipment to site shall be verified by visual inspection, documentation and measurement that delivered items are comply with technical specification, as per approved materials and good physical conditions. Materials delivered to site shall be free from defects and adequately protected against site conditions.

List of verification and inspection during delivery stage as per Table 2:

Table 2: Verification and Inspection

Inspection / Test Name	Description
Visual Inspection	• Good physical conditions • Free from defects • Adequately protected
Measurement	• Size, capacity, quantity and dimension • Orientation of equipment and plant layout
Documentation *Where required, the documentation shall be verified and endorsed by GCP and /or S.O.	• Delivery Order • Factory Acceptance Test • Quality Assurance • Technical Data • *Permit Mesin Tekanan* (for cylinder diameter above 4 inches)

Rejection of Material

The Government shall reserve the rights to reject any material that fail to comply with the Specification of this contract.

4.2.3 Installation Stage

The Sub-Contractor shall submit to the S.O. a copy of Approval To Install (ATI) from Suruhanjaya Tenaga (ST) and Jabatan Keselamatan dan Kesihatan Pekerja (JKKP), before installation work start.

Visual Inspection

List of visual inspection and testing during installation as per Table 3:

Table 3: Visual Inspection of LPG

Inspection / Test Name	System/Component	Objectives
Visual Inspection	Gas Cylinder	Verify that all gas cylinder store room components are installed as per approved working drawings, approved material list, installation method statement and free from installation defects. Verify inlet pipe, capacity, quantity and tank compartment.
	Gas Cylinder Manifold	Verify quantity, size and material of manifold and non-return valve according to approved drawing. Joining of manifold shall be done by certified welder.
	Pressure Regulator	Verify the alignment, mounting, range of pressure, air vent pipe size and to discharge at high level to atmosphere.
	Emergency shut-off valve	Verify the location and orientation.
	LPG Piping & Hose	Verify types of pipe/hose, protection and colour coding.
	Piping bracket	Verify types of support, location and spacing.
	Pressure gauge	Verify the quantity, location, operating range and functionality.
	Hanger and supports	Verify hanger and supports as per approved drawing and technical specification.
	Pipe sleeves	Verify all the pipe sleeves with the right size and material (non-metallic).
	Fire seal	Verify seal thru any floor, wall or partitions using non-combustible or fire-resistant sealant material.
	LPG Storage	Verify safety and ventilation for installation of gas cylinder and gas manifold.
	Safety for LPG Storage	Verify no source of ignition (electrical supply, lamp, etc.) If required, it shall be installed with explosion-proof or equivalent. Verify firefighting equipment (Fire Extinguisher).
	Tagging, Labelling and Signage	Verify all equipment to be tagged and labelled, and safety signage installed.

Rejection of Installation Work

The Government shall reserve the rights to reject any installation work that fail to comply with the Specification of this contract.

4.2.4 Functional Performance Test Stage

(a) The Sub-Contractor to carry out testing procedure in accordance to Suruhanjaya Tenaga (ST) / Jabatan Keselamatan dan Kesihatan Pekerjaan (JKKP) requirement.

(b) The Sub-Contractor shall notify the S.O. in advanced the date of the test to be conducted.

(c) Test medium shall be inert gas (Nitrogen) or air (refer to Table 4). Oxygen shall not be used for any leak test / pressure test. Where possible pipe joints including welds shall be left uninsulated and exposed for visual inspection during the test. Prior to testing, the interior of the pipe shall be cleared of all foreign material. Pressure shall be measured with calibrated pressure chart recorder or equivalent to read in increments of not greater than 0.5 kPa (0.1 psi). The source of pressure shall be isolated before tests are made.

(d) All parts of the installation subjected to test pressure of 1.5 times of the pressure corresponding to the maximum assessed pressure of the product being carried. During the pressure testing, the tested section must be periodically checked with the interval of 10 minutes to observe the pressure and presence of leakage. The pressure retention time shall be 60 minutes continuously without any drop in reading in accordance to MS 930.

(e) Special provision shall be made by disconnecting the safety relief devices or other lower pressure valves or isolated by blanks, blind flanges or caps where the test pressure shall be limited to the operating pressure of the device.

(f) Open flames shall never be used for checking leakage and the fittings tightness of installations. Defective pipes or fittings shall be replaced and not repaired.

(g) Prior to acceptance and initial operation, all piping installations shall be inspected, tested and approved by GCP to ensure that the materials, design, fabrication and installation comply with the technical and safety requirements of the Gas Supply Regulations and applicable standards and guidelines.

(h) Inspection shall consist of visual examination during or after fabrication, assembly or test as appropriate.

(i) Corrosion protective coating shall be subjected to Holiday Test (test of the continuity of protective coating). Coating defects or damage that may impair effective corrosion control shall be repaired prior to installation in the ditch as specified by the relevant codes such as MS 830 or National Association of Corrosion Engineers (NACE) Recommended Practice.

(j) Soapy water solution test may be used to locate leaks if all joints are accessible during the test. The test pressure and duration for various sections of LPG piping systems are summarised in the Table 4.

The Sub-Contractor GCP shall test in accordance to the procedure and standard requirement of Suruhanjaya Tenaga (ST).

A test result shall be endorsed by Gas Competent Person (GCP) upon successful testing of the system and shall be submitted to JKR.

4.3 TESTING EQUIPMENT

All sensors and gauges use for measurement of pressure and gas detector shall be calibrated and all calibration certificates shall be submitted to S.O. prior to testing works for validation.

The Sub-Contractor shall provide all necessary testing, calibrating instruments and labor required for the TABC of the complete LPG system installed under the contract.

The Sub-Contractor shall also allow for any necessary replacement of parts in order to achieve the conditions specified in the specification and drawings.

Required equipment for testing shall be but not limited to as per Table 4.

Table 4: LPG PIPES SYSTEM PRESSURE/LEAK TEST REQUIREMENTS

Scope	Maximum operating pressure [kPa (psi)]	Type Of Test		Test pressure [kPa (psi)]	Test duration (min)		Equipment			
		Test	Medium		Above ground	Buried	Pressure Gauge	Pressure Chart Recorder[a]	Soap Solution[b]	Gas Detector
From Tank Manifold To 1st Stage Regulator	Up to 1725 (250)	Pneumatic / Leak	Nitrogen	1900 (275)	60	-	√	√	√	-
		Leak (During commisioning)	LPG	Operating pressure	-		-	-	√	√
From 1st Stage Regulator To 2nd Stage Regulator	Above 140 (20)	Pneumatic / Leak	Nitrogen	345 (50)	60	1440	√	√	√	-
			Air							
		Leak (During commisioning)	LPG	Operating pressure	-	-	√	-	√	√
After 2nd Stage Regulator	Up to 7 (1)	Pneumatic / Leak - Appliances disconnect	Nitrogen	140 (20)	30	1440	√	√	√	-
			Air							
		Leak (During commisioning)	LPG	Operating pressure	-	-	√	-	√	√

[a] Pressure chart recorders should be used when under ground piping system are involved.
[b] Soapy water solution should be used when a gas detector is not available.

Source: Department of Standard Malaysia. (2017). *MS 930: Installation of fuel gas piping systems and appliances - Code of practice (Second revision)*

4.4 OPERATION LICENSE

The Sub-Contractor shall obtain Approval To Operate (ATO) and Private Gas License Certificate that are issued by Suruhanjaya Tenaga (ST) upon successful testing of the system and shall be given to the S.O.

4.5 COMMISSIONING

Commissioning includes achieving, verifying, and documenting that the performance of facilities, systems, and assemblies meets the design requirements and criteria.

All completed test forms and test summary shall be submitted to S.O. Having satisfied that all appropriate tests have been conducted and the performance of the installation meet the design requirements.

The Sub-Contractor shall submit to the S.O. a copy of Approval To Operate (ATO) and Private Gas license from Suruhanjaya Tenaga (ST) and Jabatan Keselamatan dan Kesihatan Pekerjaan (JKKP), if any.

4.5.1 Handing Over Documents

Prior to the issuance of Certificate of Practical Completion, Sub-Contractor shall submit all related project handing over documents as the following:

a) Defects list
b) Operation and maintenance manual which includes:
   - Manual/standard operating procedures.
   - Preventive maintenance schedule.
   - Equipment / product engineering data.
   - Operation set point.
   - Pressure regulator set points.
   - Sub-Contractor and manufacturer contact details.
   - Gas Competent Person (GCP) certificate and contact details.
   - Asset and Inventory list.
   - Approval To Install (ATI) – Kelulusan Untuk Memasang.
   - Approval To Operate (ATO) – Kelulusan Untuk Mengendali.
   - Private Gas License – Lesen Gas Persendirian.
   - All completed test report fully verified and endorsed for Pre-Delivery Stage, Delivery Stage, Installation Stage and Functional Performance Test Stage.
c) As-built drawings (softcopy & hardcopy).
d) Schedule of Familiarisation Program to end users.

4.5.2 Familiarisation Program

In-class and practical familiarisation program shall be conducted to the personnel nominated by S.O. within one (1) month before the issuance of Certificate of Practical Completion. Program shall focus on:

- Overview of system and design concept
- Operation instruction & competency requirement and appointment of Gas Responsible Person
- Maintenance procedures, Planned Preventive Maintenance (PPM)
- Critical operating parameters monitoring
- Emergency response & safety procedures
- Suruhanjaya Tenaga (ST) and Jabatan Keselamatan dan Kesihatan Pekerjaan (JKKP) requirements and procedures.

Sub-Contractor shall submit program modules and materials to S.O. for approval prior to commencement of training. Particulars of trainee shall be recorded and send to S.O. for records.

---------- END OF SECTION 4.0 ----------

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SECTION 5.0

SPECIFICATION FOR COMPREHENSIVE SERVICE & MAINTENANCE

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SECTION 5.0 SPECIFICATION FOR COMPREHENSIVE SERVICE & MAINTENANCE

5.1 GENERAL

The work covered by this section is for the supply of all appliances, materials and labour for the service and maintenance of the Liquefied Petroleum Gas (LPG) System and Ancillary Equipment.

All work to be performed under this Specification shall be in accordance with the commercial practice and must be in strict accordance with this Specification.

5.2 WORKMANSHIP AND MATERIALS

The work described in this Specification shall be performed by workmen skilled in the service, maintenance and repair of LPG System and Ancillary Equipment and shall be executed in accordance with the best commercial practice.

All materials to be supplied in connection with work under this Specification shall be new and unused, and shall generally be of the best quality as regard to manufacture and performance.

5.3 SUPERVISION

The Sub-Contractor shall have a gas competent person in charge of the service, maintenance and repair work to be carried out under this Specification.

5.4 SCOPE OF WORK

All machinery and equipment comprising the complete LPG System and Ancillary Equipment shall be serviced and maintained.

The Sub-Contractor is to provide and execute service and maintenance program for a period of one (1) year in accordance to the latest version of MS 830 & MS 930.

The service and maintenance of the complete LPG System and Ancillary Equipment shall be in strict accordance with the Servicing and Maintenance Schedule as set out in clause 5.5 below.

The Sub-Contractor shall advise the Superintending Officer (S.O.) of any defects in any part or parts of the complete LPG System and Ancillary Equipment observed during routine inspection and service, and shall repair or replace parts of such defects if required to do so by the S.O.

5.5 SERVICE AND MAINTENANCE SCHEDULE

The Sub-Contractor shall inspect and service the LPG System and Ancillary Equipment at least once in three months except where otherwise directed by the S.O.

At each such periodic inspection and service LPG System and Ancillary Equipment, the work details below shall be performed by the Sub-Contractor.

a. Inspect and check the routine operation of the automatic changeover controls, gas panel, gas leak detector panel, gas meter and any other related equipment.

b. Check leaks / damage / corrosion and dirt for all gas piping, valves, regulator, connectors, gauges, pigtails and any other related equipment. (Rectify as necessary)

c. Inspect all LPG cylinder, all mounting and brackets.

The Sub-Contractor shall also provide emergency repair service at any time if required to do so by the S.O.

5.6 CONSUMABLE MATERIALS

The Sub-Contractor shall supply the following consumable materials such as cotton waste, soap detergent and other cleaning materials required for cleaning purposes.

The costs of these consumable materials shall not be charged separately by the Sub-Contractor, but shall be included in the fixed monthly rate quoted by the Sub-Contractor for the service and maintenance of the complete LPG System and Ancillary Equipment.

5.7 REPAIRS

The Sub-Contractor shall repair defects in the complete LPG System and Ancillary Equipment on the instructions of the S.O. The costs of such repair shall be included in the fixed monthly rate quoted by the Sub-Contractor for the service and maintenance of the complete LPG System and Ancillary Equipment.

All repairs on the complete LPG System and Ancillary Equipment shall be guaranteed by the Sub-Contractor against defects in workmanship and materials for a period of one year to take effect from date of completion of the repairs. During guarantee period, the Sub-Contractor shall rectify defects in repairs carried out by him with no additional charge to the Government.

5.8 SERVICE AND MAINTENANCE RECORDS

The Sub-Contractor shall provide a service and maintenance record book for the complete LPG System and Ancillary Equipment being serviced and maintained.

This record book shall be kept in the plant room / gas storage room. Details of all service, maintenance and repairs carried out on the complete system shall be recorded by the Sub-Contractor into this book for checking purposes and endorsed by GCP.

The address and telephone number of the Sub-Contractor's service station shall also be included in this record book to facilitate emergency service calls.

The Sub-Contractor shall also keep an accurate detailed record in duplicate of all service, maintenance and repair work carried out on the complete system. This record shall be in the form of a Maintenance/Repair Sheet, and shall be countersigned by the end user / building owner each time the system is serviced, maintained and repaired by the Sub-Contractor. The record shall also be endorsed by GCP.

5.9 RATES FOR SERVICE AND MAINTENANCE AFTER DEFECT LIABILITY PERIOD (DLP)

The Sub-Contractor shall quote the rates and prices for the service and maintenance of the complete LPG System and Ancillary Equipment for this contract. These rates quoted by the Sub-Contractor at the time of tenders, shall hold good for the period of three (3) years commencing from the expiry of the defect liability period.

The Sub-Contractor maybe required to enter into a contract for the above periods with the Government on the Standard Form of Contract for service and maintenance of LPG System and Ancillary Equipment, a copy of which may be inspected at the office of the **Pengarah Kanan, Cawangan Kejuruteraan Mekanikal, Ibu Pejabat JKR, Kuala Lumpur.**

5.10 SCHEDULE OF RATES FOR THE COMPREHENSIVE SERVICE & MAINTENANCE

FOR SERVICE AND MAINTENANCE OF THE COMPLETE LIQUEFIED PETROLEUM GAS (LPG) AND ANCILLARY EQUIPMENT

The tenderer is to note that the prices quoted will be binding in the event that the Government decides to accept them immediately after the end of DLP. These prices should not be subjected to variation for the period of three years after the end of DLP.

RATES BASED ON CONTRACT PERIOD OF THREE YEARS ONLY (After the end of DLP)

For service and maintenance of the complete Liquefied Petroleum Gas (LPG) System and Ancillary Equipment at the above premises in strict accordance with the Tender Specifications and for supply of all consumable materials listed in Section 5 of the service and maintenance as and whenever required and to provide emergency repair service at any time as required.	Charge Per Year

Tandatangan Petender : _____

Nama Petender : _____

Nama dan Alamat Syarikat: _____
(Dengan Cop)

_____

Tarikh : _____

Tandatangan Saksi : _____

Nama Saksi : _____

Nama dan Alamat Syarikat: _____
(Dengan Cop)

_____

Tarikh : _____

---------- END OF SECTION 5.0 ----------

SECTION 6.0

SCHEDULE OF DESIGN REQUIREMENTS

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SECTION 6.0 SCHEDULE OF DESIGN REQUIREMENTS

6.1 SCOPE OF WORKS

The Sub-Contractor shall supply labor, materials, equipment and services for the complete Liquefied Petroleum Gas (LPG) System and Ancillary Equipment.

The works to be performed under this contract are listed hereunder but not necessarily be limited to the following scope of work:

6.1.1. Supply, deliver, install, test, adjust, balance and commission of the following system and ancillary equipment for this contract.

6.1.2. Service and maintain the above-mentioned for a period of one year from the date of its handing over to the Jabatan Kerja Raya in good operating condition.

6.1.3 Submit working drawings, as-built drawings, test results, operation and maintenance manuals of the services and the installed equipment.

6.1.4 Guarantee and monthly service of the complete installed system for a period of twelve (12) months after handing over to the Jabatan Kerja Raya, in good operating condition.

6.1.5 Familiarisation Program as per clause 4.5.2.

6.1.6 Deviation:

Any deviation from the specifications shall not be made without prior consent of the Superintending Officer (S.O.).

6.2 SYSTEM DESIGN REQUIREMENTS

The works to be carried out under LPG System and Ancillary Equipment as per specification and tender drawing shall comprise but not limited to the supply, delivery to site, installation, testing, adjusting, balancing and commissioning, and maintenance of the following equipment and principal services, including all associated minor works and items:

6.2.1 LPG (Cylinder) System

ITEM	DESCRIPTION	UNIT	QTY.
1.	Gas Cylinder (50kg)	nos	
2.	Aboveground Seamless Carbon Steel ASTM A106 Schedule 40 / Schedule 80 pipe inclusive of hanger, non-metallic pipe sleeves, brackets, neoprene pad and other related accessories All pipe shall be coated with one (1) layer primer and two (2) layers oil base finishing.	lot	
3.	Underground Seamless Carbon Steel ASTM A106 Schedule 80 pipe c/w excavation of pipe trench, sand bedding, filled-up soil, tracer wire, warning tape, non-metallic pipe sleeves and safety marker as per drawing. All pipes shall be coated with one (1) layer primer and two (2) layers oil base finishing and wrapped with polyethylene tape.	lot	
4.	Concealed Seamless Carbon Steel ASTM A106 Schedule 40 / Schedule 80 pipe c/w concrete cover minimum of 38mm, non-metallic pipe sleeves. All pipes shall be coated with one (1) layer primer and two (2) layers oil base finishing and wrapped with polyethylene tape.	lot	
5.	Valves including Safety Relief Valve c/w vent pipe on Container / Pipeline, Isolation Valve, Non-return Valve, Ball Valve, Pressure Gauge (Low/Medium/High) and other accessories required to meet authority approval.	lot	
6.	Emergency Shut-Off Valve assembly c/w manual pull cable and box	lot	
7.	1st stage, 2nd stage pressure regulator and accessories	lot	
8.	Automatic Change Over Regulator and accessories	lot	
9.	Gas Meter (if applicable)	nos	
10.	Gas Leak Detection System c/w gas panel, gas leak detector, auto solenoid valve, siren light, wiring and other related equipment / accessories for functional of the system.	lot	
11.	Dry Powder Fire Extinguisher of minimum 9 kg	nos	
12.	All electrical works, components, wiring and control panels shall be flameproof.	lot	
13.	Cathodic Protection System (Sacrificial Anodes) – if applicable	lot	
14.	Complete Signage and gas marker / arrow mark gas flow	lot	
15.	Pipe Earthing	lot	

6.2.2 LPG (Bulk Storage) System

ITEM	DESCRIPTION	UNIT	QTY.
1.	Bulk Storage Tank capacity	litre	
2.	Aboveground Seamless Carbon Steel ASTM A106 Schedule 40 / Schedule 80 pipe inclusive of hanger, non-metallic pipe sleeves, brackets, neoprene pad and other related accessories. All pipe shall be coated with one (1) layer primer and two (2) layers oil base finishing.	lot	
3.	Underground Seamless Carbon Steel ASTM A106 Schedule 80 pipe c/w excavation of pipe trench, sand bedding, filled-up soil, tracer wire, warning tape, non- metallic pipe sleeves and safety marker as per drawing. All pipes shall be coated with one (1) layer primer and two (2) layers oil base finishing and wrapped with polyethylene tape.	lot	
4.	Concealed Seamless Carbon Steel ASTM A106 Schedule 40 / Schedule 80 pipe c/w concrete cover minimum of 38mm, non-metallic pipe sleeves. All pipes shall be coated with one (1) layer primer and two (2) layers oil base finishing and wrapped with polyethylene tape.	lot	
5.	Valves including Safety Relief Valve c/w vent pipe on Container/Pipeline, Isolation Valve, Non-return Valve, Check Valve, Ball Valve, Emergency Shut-off Valve, Excess Flow Check Valves for liquid and vapour, Vapour Balance, Drain and Pressure Gauge (Low/Medium/High), Temperature Gauge, Pop Action Valves, Fixed Level Gauges, Emergency Isolation Valve, Pressure Transmitter and other accessories required to meet authority approval.	lot	
6.	Electric Indirect-Fired Explosion Proof Dry Vaporiser (minimum 160kg/hr).	nos	
7.	Liquid Level Gauge (Roto and Ullage c/w Dip Tube)	lot	
8.	1st stage, 2nd stage pressure regulator and accessories	lot	
9.	Gas Meter (if applicable)	nos	
10.	Gas Leak Detection System c/w gas panel, gas leak detector, auto solenoid valve, siren light, wiring and other related equipment/accessories for functional of the system.	lot	
11.	Dry Powder Fire Extinguisher of minimum 9 kg	nos	
12.	All electrical works, components, wiring and control panels shall be flameproof.	lot	
13.	Cathodic Protection System (Sacrificial Anodes) – if applicable	lot	

6.2.2 LPG (Bulk Storage) System (cont'd)

ITEM	DESCRIPTION	UNIT	QTY.
14.	Complete signage and gas marker / arrow mark gas flow	lot	
15.	Pipe Earthing	lot	

---------- END OF SECTION 6.0 ----------

SECTION 7.0

SCHEDULE OF TECHNICAL DATA OFFERED

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SECTION 7.0 SCHEDULE OF TECHNICAL DATA OFFERED

LIQUIFIED PETROLEUM GAS (LPG) SYSTEM

The tenderer must complete the Schedule of Technical Data as set out below. All information asked for must be given (answer) correctly and supported by copies of manufacturer's equipment being offered. Only one BRAND/ MODEL may be entered for each item. Failure to follow these published technical data for the instructions may cause his tender to be rejected.

After the award of the tender, any item found to be inferior quality than the specification or does not meet the requirement in the tender document, not withstanding the tenderer's reserve the right to reject it. The rejected item shall be replaced and the tenderer shall not be entitled to any claim for cost arising therefore. Sample where possible, shall be submitted for approval of the S.O. prior to the installation.

1. REGULATOR

		JKR Requirement	Tenderer's Offer
i) First Stage Regulator			
a. Make	:		
b. Model	:		
c. Type	:		
d. Inlet Pressure	:		
e. Outlet Pressure	:		
f. Is Built-in Relief Valve provided as specified	:	Yes	
g. Is Vent provided as specified	:	Yes	
h. Other Features	:		
ii) Second / Intermediate Stage Regulator			
a. Make	:		
b. Model	:		
c. Type	:		
d. Inlet Pressure	:		
e. Outlet Pressure	:		
f. Is Built-in Relief Valve provided as specified	:	Yes	
g. Is Vent provided as specified	:	Yes	
h. Other Features	:		

2. PIPING

i) High Pressure Liquid Line (Aboveground)

a. Class of Pipe :
b. Make of Pipe :
c. Nominal Pipe Size (mm) :
d. Material of Pipe :
e. Cerificate of Safety Compliance :
f. Method of Pipe Jointing :
g. Anchoring Bracket Material :
h. Paint Brand/ Make :
i. Other Features :
j. Material of pipe sleeves :

ii) High Pressure Liquid Line (Underground)

a. Class of Pipe :
b. Make of Pipe :
c. Nominal Pipe Size (mm) :
d. Material of Pipe :
e. Cerificate of Safety Compliance :
f. Method of Pipe Jointing :
g. Anchoring Bracket Material :
h. Paint Brand/ Make :
i. Other Features :
j. Material of pipe sleeves :

iii) Aboveground (Medium & Low Pressure Gas Line - Schedule 40/Schedule 80)

a. Class of Pipe :
b. Make of Pipe :
c. Nominal Pipe Size (mm) :
d. Material of Pipe :
e. Method of Pipe Jointing :
f. Anchoring Bracket Material :
g. Paint Brand/ Make :
h. Other Features :

3. VALVES

i) Emergency Shut-Off Valve

a. Make :
b. Model :
c. Type :
d. Valve size :
e. Other Features :

ii) Ball Valve

a. Make :
b. Model :
c. Type :
d. Test Pressure :
e. Nominal Running Pressure :
   i) High Pressure :
   ii) Medium Pressure :
   iii) Low Pressure :
f. Pressure Rating :
   i) High Pressure :
   ii) Medium Pressure :
   iii) Low Pressure :
g. Other Features :

3. VALVES (cont'd)

iii) Non-return Valve

a.	Make	:	
b.	Model	:	
c.	Type	:	
d.	Test Pressure	:	
e.	Nominal Running Pressure	:	
f.	Pressure Rating	:	
h.	Other Features	:	

iv) Pressure Relief Valve

a.	Make	:	
b.	Model	:	
c.	Type	:	
d.	Test Pressure	:	
e.	Nominal Running Pressure	:	
f.	Pressure Rating	:	
h.	Other Features	:	

3. VALVES (cont'd)

v) Main Solenoid Valve

a.	Make	:	
b.	Model	:	
c.	Type	:	
d.	Test Pressure	:	
e.	Nominal Running Pressure	:	
f.	Pressure Rating	:	
g.	Dimension	:	
h.	Threaded Connections	:	
i.	Power Supply	:	
j.	Max Working Pressure	:	
k.	Material	:	

vi) Auto Solenoid Valve (If Applicable)

a.	Make	:	
b.	Model	:	
c.	Type	:	
d.	Test Pressure	:	
e.	Nominal Running Pressure	:	
f.	Pressure Rating	:	
g.	Dimension	:	
h.	Threaded Connections	:	
i.	Power Supply	:	
j.	Max Working Pressure	:	
k.	Material	:	

4. PRESSURE GAUGE

i) High Pressure Gauge

a. Make :
b. Type :
c. Model :
d. Pressure Range offered :
e. Material of Body :
f. Standard Compliance :
g. Other Features :

ii) Medium Pressure Gauge

a. Make :
b. Type :
c. Model :
d. Pressure Range offered :
e. Material of Body :
f. Standard Compliance :
g. Other Features :

iii) Low Pressure Gauge

a. Make :
b. Type :
c. Model :
d. Pressure Range offered :
e. Material of Body :
f. Standard Compliance :
g. Other Features :

5. WRAPPING TAPE

a. Make :
b. Type :
c. Material : PE

6. PIPE SLEEVE

a. Make :
b. Material : Non Metallic
c. Other Features :

7. DRY CHEMICAL PORTABLE FIRE EXTINGUISHER (9kg c/w STORAGE CABINET)

a. Make :
b. Model/ code no. :
c. Country of origin :
d. Conforming standard :
e. Capacity (kg) :
f. Total weight c/w cylinder :
g. Agent Concentration :
h. Other Features :

8. GAS LEAK DETECTOR

a. Make :
b. Type :
c. Model :
d. Enclosure Material :
e. Size :
f. Weight :
g. Sensor Type :
h. Operating Temperature :
i. Approval (ST) :

9. GAS YARD CONTROL PANEL (CONTROL MAIN SOLENOID VALVE) - If Applicable

a. Make :
b. Product :
c. Model :
d. Channel :
e. Dimension :
f. Weight :
g. Enclosure Material :
h. Ingress protection :
i. Power :
j. Battery back up :

10. GAS LEAK CONTROL PANEL (CONTROL SOLENOID VALVE)

a. Make :
b. Product :
c. Model :
d. Channel :
e. Dimension :
f. Weight :
g. Enclosure Material :
h. Ingress protection :
i. Power :
j. Battery back up :

11. GAS METER (If Applicable)

a.	Make	:	
b.	Product	:	
c.	Model	:	
d.	Operating Principle	:	
e.	Gas Type	:	
f.	Cyclic volume	:	
g.	Maximum Working Pressure	:	
h.	Flow Range	:	
i.	Accuracy	:	
j.	Approval	:	
k.	Metrology (unit)	:	
l.	Totaliser	:	
m.	Materials	:	

12. CATHODIC PROTECTION SYSTEM

a.	Sacrificial Anode (Material)	:	
b.	Life Sacrificial Anode	:	
c.	Make Anode	:	
d.	Make Electrode	:	
e.	Make Monitoring Panel	:	
f.	Test points	:	
g.	Standard Compliance	:	
h.	Make Cable	:	
i.	Name of Specialist/Company	:	
j.	Make Backfill	:	

13. TRACER WIRE (For Underground Non Metallic Pipe)

a. Make :
b. Type :
c. Material :
d. Size :

14. GAS COMPETENT PERSON (GCP)

a. Name of GCP :
b. Competent Certificate No. :
(copy of valid Certificate from Suruhanjaya Tenaga (ST) must be enclosed)
c. Cert. Expiry Date :

15. WELDER

a. Name of Welder :
b. Welder Certificate No. :
(copy of valid Certificate from SIRIM QAS or Authorised Body must be enclosed)
c. Cert. Expiry Date :

16. LPG CYLINDER

a.	Manufacturer	:		
b.	Type	:		
c.	Overall dimension	:		
d.	Filled Weight	:	50 kg	
e.	Volume of Cylinder (liter)	:		
f.	Quantity	:		
g.	JKKP Certificate	:	YES	
h.	Other Features	:		

17. BULK STORAGE TANK (IF APPLICABLE)

a.	Manufacturer	:		
b.	Pressure Vessel Code	:		
c.	Water Capacity (Kilolitres)	:		
d.	Design Pressure	:		
e.	Design Temperature	:		
f.	Tare Weight	:		
g.	Class of Vessel	:		
h.	Operating Pressure	:		
i.	Operating Temperature	:		
j.	Maximum Safe Working Pressure	:		
k.	Hydrostatic Test Pressure	:		
l.	Overall Dimensions	:		
m.	Shell Thickness	:		
n.	Country of Manufacture	:		
o.	Pressured Vessel JKKP Certificate / Approval	:	YES	
p.	Other Features	:		

18. VALVES (IF APPLICABLE)

i) Hydrostatic Relief Valve

a. Make :
b. Model :
c. Type :
d. Test Pressure :
e. Nominal Running Pressure :
f. Pressure Rating :
g. Other Features :

ii) Excess Flow Valve

a. Make :
b. Model :
c. Type :
d. Test Pressure :
e. Nominal Running Pressure :
f. Pressure Rating :
g. Other Features :

19. THERMOMETER (IF APPLICABLE)

a. Make :
b. Type :
c. Model :
d. Temperature Range offered :
e. Other Features :

20. LIQUID LEVEL GAUGE (IF APPLICABLE)

a.	Make	:	
b.	Type	:	
c.	Model	:	
d.	Range offered	:	
e.	Other Features	:	

21. STRAINER (IF APPLICABLE)

a.	Make	:	
b.	Type	:	
c.	Model	:	
d.	Dimension	:	
e.	Other Features	:	

22. PRESSURE TRANSMITTER (IF APPLICABLE)

a.	Make	:		
b.	Type	:		
c.	Model	:		
d.	Pressure Range offered	:		
e.	Capacity	:		
f.	Material of Body	:		
g.	Standard Compliance	:		
h.	Other Features	:		
i.	Approved for use in hazardous areas	:	YES	
j.	Output signal	:		
k.	Voltage Supply	:		

23. LIST OF CATALOGUE SUPPLIED

NO	DESCRIPTIONS

SECTION 8.0

SCHEDULE OF PRICE

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SECTION 8.0 SCHEDULE OF PRICE

8.1 LIQUEFIED PETROLEUM GAS (LPG) SYSTEM

The tenderer shall complete this Schedule of Prices. The Government is under no obligation to accept the lowest tender and reserves the right to accept any tenders in part or full and to vary the quantities stated with no variation to the rates.

The prices entered in this schedule shall be for the supply, installation, testing, adjusting, balancing and commissioning of the complete Liquefied Petroleum Gas (LPG) System and ancillary equipment in accordance with the requirements of the Specification and drawing together with one year (12 months) maintenance and guarantee period as specified.

Where work is specified or incident to the contract and no corresponding payment item has been allowed for, the cost of such work shall be deemed to be included under the relevant items of work listed in the summary below.

For cases where there are discrepancies in quantities in the tender document, the higher quantity shall take precedent and applicable for the purpose tender pricing and the Sub-Contractor shall clearly indicate in his tender submission.

The tender price breakdown may be used as a basis of making progress payment. However, the Superintending Officer (S.O.) or his representative reserves the rights to vary the price breakdown by making the necessary adjustment if in his opinion the breakdown given by the tenderer is unreasonable, when making such payment. Being a lump sum contract the full tender sum, after making adjustments for any variation to the works, shall be paid upon completion of all works specified.

The price of any variation to the works shall not necessarily be based on the corresponding price breakdown, if deemed reasonable it may be used, otherwise it shall be on agreed rates.

The breakdown of prices is for major components in the Schedule of Prices and it is not exhaustive. It is the contractor's responsibility to price out for all scope of works as per tender drawings & specification even though is not specifically indicated in the Schedule of Prices.

8.2 GENERAL ITEMS

Item	Description of Equipment/ Work	Unit	Qty.	Unit Price (RM)	Price (RM)
1.	Preliminaries:				
	a. Insurances	lot			
	b. Performance bond	lot			
	c. Submission fees to Suruhanjaya Tenaga (ST) dan Jabatan Keselamatan dan Kesihatan Pekerjaan (JKKP)	lot			
2.	Documents:				
	a. Contract Document (6/12)	nos			
	b. Working Drawing (6 copies)	nos			
	c. As-Built Drawing inclusive of endorsement by Gas Competent Person (6 copies)	nos			
	d. Operation and Maintenance Manual (6 copies)	nos			
	e. Two (2) copies of Hand Over Document and As Built Drawing in **CD format**	nos			
3.	Monthly Progress Report Inclusive of Digital Image Photos.	Lot			
4.	Cost for Industrialised Building System (IBS) related works and coordination.	lot			
5.	Painting of the complete system inclusive 1 coat primer paint and 2 coats finishing oil paint (Yellow), identification, name plates, etc. as per drawing and specification.	lot			
6.	Mobilisation and demobilisation	lot			
7.	All Civil Works necessary for complete installation of the above system include coring, cutting, digging, drilling, cart away debris, etc. and making good to S.O. satisfaction.	lot			
8.	One Year (12 Monthly Services) Maintenance during Defect Liability Period (DLP) as per schedule offered by S.O. in accordance to MS 830 and renewal fees to Suruhanjaya Tenaga (ST) and BOMBA.	nos	12		

8.2 GENERAL ITEMS (cont'd)

Item	Description of Equipment/ Work	Unit	Qty.	Unit Price (RM)	Price (RM)
9.	System familiarisation program as specified in tender document.	lot			
10.	Other necessary work not included above but necessary to complete the Liquefied Petroleum Gas System (Please Give Detail): a. ……. …….				
	b. ……. …….				
	c. ……. …….				
	Total to be carried to SUMMARY OF PRICES of Section 8.5				

8.3 LPG SYSTEM INSTALLATION

It is the responsibility of the Sub-Contractor to appoint a gas provider to supply and deliver LPG for the initial load required to commission the complete LPG system. The unit price (RM/kg) of the initial load of LPG shall be included in the Bill of Quantity.

The Sub-Contractor is required to design, supply, install and carry out all necessary test and commissioning to ensure a complete and safe operation of the system. The tender drawing is only the indicative layout of the proposed system and as a guide to Sub-Contractor to price the tender.

8.3.1 LPG Cylinder Storage

Item	Description of Equipment/Works	Unit	Qty.	Unit Price (RM)	Price (RM)
1.	To supply, deliver and install LPG cylinder (50kg).	nos			
2.	To supply deliver and install LPG cylinder fittings c/w flexible hose, isolation valves, quick coupling, non-return valve, 1/4" NPT carbon steel socket and other fittings for complete installation of LPG gas cylinder system as per drawing and specification.	lot			
3.	To supply, deliver and install header manifold, c/w pressure gauge connection sockets to each cylinder, isolation valves and union joints as per drawing and specification.	lot			
4.	To supply deliver and install main pipe c/w automatic change over device, relief valve, main isolation valve, 1st stage regulator, pressure gauge, connection sockets to each cylinder, isolation valves, solenoid valve and union joints as per drawing.	lot			
5.	To supply deliver and install main emergency shut-off valve c/w IP64 solenoid (if applicable) for electrical emergency shut-off.	lot			
6.	To supply deliver and install gas leak detection system c/w gas detector, wiring, conduit, control panel, valves, siren light, fitting and all accessories (if applicable).	lot			
7.	To supply deliver and install dry powder portable fire extinguisher (9kg).	nos			
	Total to be carried to SUMMARY OF PRICES of Section 8.5				

8.3.2 LPG Pipeworks – LPG Cylinder

Item	Description of Equipment/Works	Unit	Qty.	Unit Price (RM)	Price (RM)
1.	To supply, deliver and install Schedule 40 / Schedule 80 / copper / Medium Density Polyethylene (MDPE) pipe inclusive of hanger and support, neoprene pad and all other necessary accessories as per drawing and specification:				
	i. Aboveground Seamless Carbon Steel ASTM A106 Schedule 40 / Schedule 80 pipe inclusive of hanger, non-metallic pipe sleeves, brackets, neoprene pad and other related accessories. All pipe shall be coated with one (1) layer primer and two (2) layers oil base finishing.	lot			
	ii. Underground Seamless Carbon Steel ASTM A106 Schedule 80 pipe / MDPE pipe c/w excavation of pipe trench, sand bedding, filled-up soil, tracer wire, warning tape, non- metallic pipe sleeves and safety marker as per drawing. All pipes shall be coated with one (1) layer primer and two (2) layers oil base finishing and wrapped with polyethylene tape.	lot			
	iii. Concealed Seamless Carbon Steel ASTM A106 Schedule 40 / Schedule 80 pipe c/w concrete cover minimum 38mm, non-metallic pipe sleeves. All pipes shall be coated with one (1) layer primer and two (2) layers oil base finishing and wrapped with polyethylene tape.	lot			

8.3.2 LPG Pipeworks – LPG Cylinder (cont'd)

Item	Description of Equipment/Works	Unit	Qty.	Unit Price (RM)	Price (RM)
2.	To supply, deliver and install emergency shut-off valves at riser installation c/w isolation valves, manual pull station and S.S. cable as per drawing and specification.	lot			
3.	To supply, deliver and install of gas meter as per drawing and specification (if applicable).	nos			
4.	To supply, deliver and install 2nd stage regulator c/w air vents, isolation valves, union joints, pressure gauges before and after regulator, hanger and brackets as per drawing and specification.	lot			
5.	To supply, deliver and install gas leak detection system c/w gas detector, wiring, conduit, control panel, valves, siren light, input & output fire trip module, fitting and all accessories as per drawing and specification.	lot			
6.	To supply, deliver and install earthing system.	lot			
7.	To supply, deliver and install cathodic protection system (if applicable).	Lot			
	Total to be carried to SUMMARY OF PRICES of Section 8.5				

8.3.3 LPG System with Bulk Storage Tank (If Applicable)

The gas provider will enter into a supply agreement with the end user for the rate of the bulk supply of liquefied petroleum gas to be stated in this document. Rate shall be in accordance to government price.

Item	Description of Equipment/Works	Unit	Qty.	Unit Price (RM)	Price (RM)
1.	To supply, deliver and install LPG bulk storage tank that come with appurtenances, fittings, etc.	nos			
2.	To supply & infill LPG to bulk storage tank.	litre			
3.	To supply, deliver and install oil separator.	nos			
4.	To supply, deliver and install electric indirect-fired explosion proof dry vaporiser.	nos			
5.	To supply, deliver and install first stage regulator c/w with valves, piping and fittings.	lot			
6.	To supply, deliver and install valves & fitting:				
	i. Filler Valve	lot			
	ii. Hydrostatic Relief Valve	lot			
	iii. Carbon Steel Ball Valve	lot			
	iv. Check Valve	lot			
	v. Excess Flow Valve	lot			
	vi. Spring Return Ball Valve	lot			
	vii. Diaphragm Relief Valve c/w 1 meter High Vent Pipe	lot			
	viii. Emergency Shut-Off Valve assembly c/w manual pull handle	lot			
	ix. Pressure Relief Valve c/w with 2 meter High Vent Pipe and Rain Cap	lot			
	x. Strainer	lot			

8.3.3 LPG System with Bulk Storage Tank (If Applicable) (cont'd)

Item	Description of Equipment/Works	Unit	Qty.	Unit Price (RM)	Price (RM)
7.	To supply, deliver and install gauges:				
	i. Low Pressure Gauge	lot			
	ii. Medium Pressure Gauge	lot			
	iii. High Pressure Gauge	lot			
8.	To supply, deliver and install second/intermediate stage regulator c/w with valves, piping and fittings.	lot			
9.	To supply, deliver and install solenoid valves.	lot			
10.	To supply, deliver and install pressure transmitter.	nos			
11.	To supply, deliver and install gas meter (if applicable).	nos			
12.	To supply, deliver and install gas leak detection system c/w gas detector, wiring, conduit, control panel, valves, siren light, input & output fire trip module, fitting and all accessories as per drawing and specification.	nos			
13.	To supply, deliver and install pipe sleeve.	lot			
14.	To supply, deliver and install dry powder portable fire extinguisher (9kg).	nos			
15.	To provide all electrical works/wiring/Isolator/equipment to nearest electrical supply by Electrical Contractor.	lot			
16.	To supply and install LPG manual pull station and other related equipment as per Suruhanjaya Tenaga requirements and as per indicated in the drawing and specification requirements.	lot			
17.	To supply, deliver and install cathodic protection system (if applicable).	lot			

8.3.3 LPG System with Bulk Storage Tank (If Applicable) (cont'd)

Item	Description of Equipment/Works	Unit	Qty.	Unit Price (RM)	Price (RM)
18.	Signage and gas marker/ arrow mark gas flow.	lot			
19.	LPG pipe riser protection with (hot dipped galvanised iron).	lot			
20.	Weatherproof and flameproof gas yard control panel to house intermediate/2nd stage regulators, pressure transmitter, main solenoid valve, pressure display, etc.	lot			
21.	Anti-corrosive tape (PE Tape).	lot			
22.	Record book for service and maintenance (hard cover).	nos			
23.	Sample material:	lot			
	a. Pipe				
	b. Valves				
	c. Fittings				
	d. Pipe fixture				
24.	Other works necessary for completion of the above system:				
	a._____ _____				
	b._____ _____				
	c. _____ _____				
	Total to be carried to SUMMARY OF PRICES of Section 8.5				

8.3.4 LPG Pipeworks – Bulk Storage (If Applicable)

Item	Description of Equipment/Works	Unit	Qty.	Unit Price (RM)	Price (RM)
1.	To supply, deliver and install Schedule 40 / Schedule 80 / copper / MDPE pipe inclusive of hanger and support, neoprene pad and all other necessary accessories as per drawing and specification:				
	i. Aboveground Seamless Carbon Steel ASTM A106 Schedule 40 / Schedule 80 pipe inclusive of hanger, non-metallic pipe sleeves, brackets, neoprene pad and other related accessories. All pipe shall be coated with one (1) layer primer and two (2) layers oil base finishing.	lot			
	ii. Underground Seamless Carbon Steel ASTM A106 Schedule 80 pipe / MDPE pipe c/w excavation of pipe trench, sand bedding, filled-up soil, tracer wire, warning tape, non- metallic pipe sleeves and safety marker as per drawing. All pipes shall be coated with one (1) layer primer and two (2) layers oil base finishing and wrapped with polyethylene tape.	lot			
	iii. Concealed Seamless Carbon Steel ASTM A106 Schedule 40 / Schedule 80 pipe c/w concrete cover min 38mm, non-metallic pipe sleeves. All pipes shall be coated with one (1) layer primer and two (2) layers oil base finishing and wrapped with polyethylene tape.	lot			
2.	Emergency shut-off valves at riser installation c/w isolation valves, manual pull station and S.S. cable.	lot			

8.3.4 LPG Pipeworks – Bulk Storage (If Applicable) (cont'd)

Item	Description of Equipment/Works	Unit	Qty.	Unit Price (RM)	Price (RM)
3.	Installation of gas meter (if applicable).	nos			
4.	Installation of 2nd stage regulator c/w air vents, isolation valves, union joints, pressure gauges before and after regulator, hanger and brackets as per drawing.	lot			
5.	To supply, deliver and install earthing system.	lot			
	Total to be carried to SUMMARY OF PRICES of Section 8.5				

8.4 SCHEDULE OF TESTING, ADJUSTING, BALANCING AND COMMISSIONING

No	Description	Price (RM)
1.	Testing, adjusting, balancing and commissioning of mechanical works at Pre-Delivery Stage: a. LPG Cylinder / Bulk Storage Tank b. Pressure Regulator	
2.	Testing, adjusting, balancing and commissioning of mechanical works at Delivery Stage: a. Visual Inspection b. Documentation c. Measurement / Quantity	
3.	Testing, adjusting, balancing and commissioning of mechanical works at Installation Stage: a. Visual Inspection b. Pressure Test c. Pipe Flushing and Leak Test (using Inert gas) d. Manifold / Regulator Test	
4.	Testing, adjusting, balancing and commissioning of mechanical works at Functional Performance Stage: a. Regulator & Change Over Test b. Pressure Gauge Functional Performance Test c. Initial charge of LPG	
5.	Post Occupancy Evaluation as per specification: Adjustments to the system controls such as (Re-balancing, re-tuning, re-checking and re-adjustment, etc).	
	Total to be carried to SUMMARY OF PRICES of Section 8.5	

8.5 SUMMARY OF PRICES

The total tender sum for the Supply, Delivery, Installation, Testing and Commissioning inclusive of one year (1 year) servicing and maintenance for the Liquefied Petroleum Gas (LPG) system and ancillary work is as follows:

Item	Description / Item	Price (RM)
8.2	General Items	
8.3	LPG System Installation	
8.3.1	LPG Cylinder Storage	
8.3.2	LPG Pipeworks– LPG Cylinder	
8.3.3	LPG System with Bulk Storage Tank (If applicable)	
8.3.4	LPG Pipeworks– Bulk Storage (If applicable)	
8.4	Schedule of Testing, Adjusting, Balancing and Commissioning	
TOTAL TO BE CARRIED IN THE FORM OF TENDER		

TOTAL (to be carried to Form Tender)

(**RINGGIT MALAYSIA**

_____

_____)

Tandatangan Petender : _____

Nama Petender : _____

Nama Dan Alamat Syarikat : _____
(Dengan Cop)

_____

Tarikh : _____

Tandatangan Saksi : _____

Nama Dan Alamat : _____
(Dengan Cop)

_____

Tarikh : _____

8.6 SCHEDULE OF DELIVERY, INSTALLATION & COMMISSIONING

The tenderer shall submit the following information ascertaining his capability to complete the work by the stipulated date:

No.	Item	Weeks
1	Delivery period of equipment from award of tender	
2	Installation period required	
3	Testing, Adjusting, Balancing and commissioning of the system	
	Total weeks as indicated in the Form of Tender	

Notes: The whole work shall be completed before the date of completion of the Main Contractor (-- Date --)

Tandatangan Petender : _____

Nama Petender : _____

Nama Dan Alamat Syarikat : _____
(Dengan Cop)

_____

Tarikh : _____

Tandatangan Saksi : _____

Nama Dan Alamat : _____
(Dengan Cop)

_____

Tarikh : _____

---------- END OF SECTION 8.0 ----------

SECTION 9.0

SCHEDULE OF UNIT RATES

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SECTION 9.0 SCHEDULE OF UNIT RATES

The rate entered hereinafter shall be used for any variation in the quantities of work carried out and shall be applicable to both additional and deleted work. Unit rates shall include overhead and profit and shall cover supply, installation with supports or mountings, painting, labelling and testing, adjusting, balancing and commissioning (TABC). Pipework installed per meter run including joints, hangers and painting or laid underground including excavation, bedding benefit and compaction.

1. Pipework (Aboveground)

Nominal	Price (RM / Meter)			
Size (mm)	MS 1086 (ISO 4437)	ASTM A106 or MS 863	ASTM A106 or MS 863	EN 1057 or ASTM B42
	MDPE (PN 12.5)	Carbon Steel SCHEDULE 40	Carbon Steel SCHEDULE 80	Copper
15				
20				
25				
32				
40				
50				
65				
80				
100				
125				
150				
200				

2. Pipework (Underground)

Nominal	Price (RM / Meter)			
Size (mm)	MS 1086 (ISO 4437)	ASTM A106 or MS 863	ASTM A106 or MS 863	EN 1057 or ASTM B42
	MDPE (PN 12.5)	Carbon Steel SCHEDULE 40	Carbon Steel SCHEDULE 80	Copper
15				
20				
25				
32				
40				
50				
65				
80				
100				
125				
150				
200				

3. Fitting: ASTM A106 or MS 863 **Carbon Steel SCHEDULE 40**

Nominal Size (mm)	Price (RM)			
	Elbow	Tee	Cross	Socket Union
15				
20				
25				
32				
40				
50				
80				
100				

4. Fitting: ASTM A106 or MS 863 **Carbon Steel SCHEDULE 80**

Nominal Size (mm)	Price (RM)			
	Elbow	Tee	Cross	Socket Union
15				
20				
25				
32				
40				
50				
80				
100				

5. Fitting: MS 1086 ISO 4437 **MDPE (PN 12.5)**

Nominal Size (mm)	Price (RM)			
	Elbow	Tee	Cross	Socket Union
15				
20				
25				
32				
40				
50				
80				
100				

6. Fitting: ASTM A106 or MS 863 **Copper**

Nominal Size (mm)	Price (RM)			
	Elbow	Tee	Cross	Socket Union
15				
20				
25				
32				
40				
50				
80				
100				

7. Liquified Petroleum Gas System

No.	Item	Unit	Price Per Unit (RM)
1.	First Stage Regulator	set	
2.	Automatic Change Over Regulator	set	
3.	Second Stage Regulator	set	
4.	Stainless Steel Ball Valve	nos	
5.	Non-Return Valve	nos	
7.	Pressure Relief Valve	nos	
8.	Emergency Shut Off Valve	nos	
9.	High Pressure Gauge	nos	
10.	Medium Pressure Gauge	nos	
11.	Low Pressure Gauge	nos	
12.	Pipe Sleeve	nos	
13.	Anti-Corrosive Tape	meter	
14.	Main Auto Solenoid Valve	nos	
15.	Auto Solenoid Valve	nos	
16.	Pressure Transmitter	set	
17.	Gas Leak Detector	set	
18.	Gas Panel	set	
19.	Gas Meter	nos	
20.	Isolator- Flameproof	nos	

No.	Item	Unit	Price Per Unit (RM)
21.	Emergency Shut-off Valve - manual pull cable c/w box	set	
22.	LPG Bulk Storage Tank come with appurtenances	set	
23.	LPG Cylinder (50kg)	nos	
24.	Flexible Hose	nos	
25.	Cathodic Protection System	set	

All prices listed in the above Schedule of Rates are inclusive of all existing Government duties and taxes.

Tandatangan Petender : _____

Nama Petender : _____

Nama dan Alamat Syarikat: _____
(Dengan Cop)

_____

Tarikh : _____

---------- END OF SECTION 9 ----------

CAWANGAN KEJURUTERAAN MEKANIKAL
IBU PEJABAT JKR MALAYSIA
TINGKAT 24 - 28, MENARA KERJA RAYA,
NO. 6, JALAN SULTAN SALAHUDDIN
50480 KUALA LUMPUR

03-2618 8888
03-2618 9510