



~Advanced Test System and Test Bench Engineering Professional~

**Tokyo Plant Co., Ltd.**



## HP-S-A type Constant speed brake lining tester

### » Overview

Capable of performing a lining friction performance test in accordance with the Japanese Industrial Standards (JIS-D-4311, 4411, etc.)

### » Technology of our products

This is the origin of the test procedure described in JIS D4311, and JIS D4411.

### » Applications

Brake or Clutch facings

### » Record

More than 70 years(The first one launched in 1954.)

※The first unit is for the Industrial Technology Research Institute

Accumulated sales volume: Over 200 units (No. 1 market share in Japan)

Spanning to Domestic, China, Taiwan, Indonesia, Thailand, Philipines, Malaysia, etc.

### » Customers

Akebono Brake Industry, Fuji Brake Industry, Ask Technica, Ministry of Economy, Trade and Industry Inspection Certificate, Nisshinbo, Aisin Seiki, Toyo Carbon, Nichias, NIPPON GOHSEI, Sumitomo Electric Industries, Tokai Materials, Tokai Carbon, Kudai Brake, Nissin Kogyo     Fuji Chemical Industry, Honda Motor, IHI, Nagoya Rubber Industries, Mitsui Kinzoku, Mitsubishi Motors Corporation, Tokai University     Starlite Industry, Tohoku Kako, Toyota Central R&D Labs, Atsugi Auto Parts, Toyota Motor Corporation, MK Kashiyaama, Ogura Clutch, Japan Brake, Tungaloy, Toray, Kubota, Osaka Gas, universities and research institutes, etc.

(More than 150)

# Configuration of product

Product & Solution

Controller



Type HP-S-A Main Unit



Required Utility

Voltage : 3-phase AC200V  
Capacity : 37kVA  
Coolant : 24L/min or, more  
Coolant Temp. : Below 25℃  
Supply Pressure :  
Primary 0.35~1MPa  
Secondary 0.15~0.345MPa  
Pneumatic : 0.4~0.7MPa

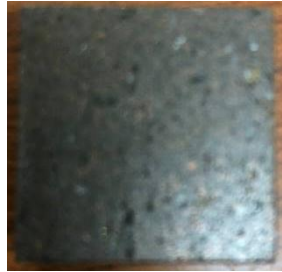
Calibration tool



Reference photos)

# Outline of product operation

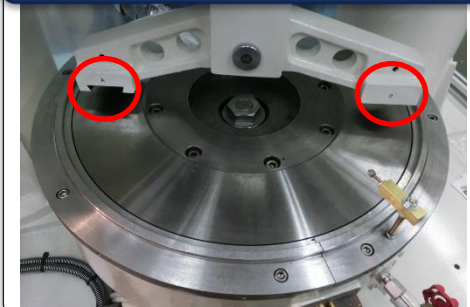
① Test Piece



② Fix to Holder



③ Attach to Loading Arm



④ Choosing Load



⑤ Test Start



⑥ Assess Wear Volume



## ① Test Piece



JIS D4411 protocol,  
test pieces (linings) are categorized as follows

| Class | Application                     |
|-------|---------------------------------|
| 1     | Parking brake only              |
| 2     | Drum brakes, for light duty use |
| 3     | Drum brakes, for heavy duty use |
| 4     | For disc brakes                 |

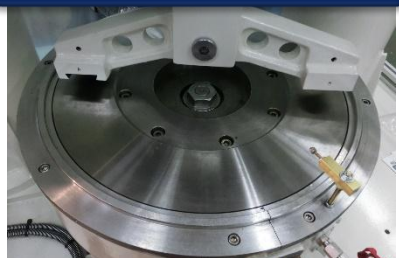
» Test piece (lining) \*Extracted from JIS D4411

- ✓The finish shall be good and shall have no cracks, scratches, unevenness, twists or other harmful flaws.
- ✓Two test specimens shall be taken from one product.
- ✓The size of the friction surface of the test specimen: 25×25mm / Tolerance : ±0.2mm
- ✓Thickness : adjust to 5~7mm, maximum allowable difference of 2 : Thickness 0.2mm or less.  
Those with a thickness of less than 5 mm shall be left as they are.

## ② Fix to Holder



## ③ Attach to Loading Arm



Test Piece is attached to the mounting holder and loading arm of the friction testing machine, then test is ready.

## Test Conditions

JIS D4411 protocol

| Friction Characteristics of Class 4                 |                  |             |             |             |             |             |
|-----------------------------------------------------|------------------|-------------|-------------|-------------|-------------|-------------|
| Item                                                | Test temperature |             |             |             |             |             |
|                                                     | 100℃             | 150℃        | 200℃        | 250℃        | 300℃        | 350℃        |
| Coefficient of friction                             | 0.25~0.65        | 0.25~0.70   | 0.25~0.70   | 0.25~0.70   | 0.25~0.70   | 0.25~0.70   |
| Tolerance on designated coefficient of friction     | ±0.08            | ±0.10       | ±0.12       | ±0.12       | ±0.14       | ±0.14       |
| Wear rate (10 <sup>-7</sup> cm <sup>3</sup> /N · m) | 0.5 or less      | 0.7 or less | 1.0 or less | 1.5 or less | 2.5 or less | 3.5 or less |

※The test temperature shall be the temperature of the friction surface of the discs on the test instruments.

※The range of friction coefficients includes tolerances.

※The tolerances for the specified coefficient of friction will depend on the agreement between the relevant parties.

✓Temperature tolerance: ±10℃

✓Relative velocity: Constant within 6~8m/s

✓Pressure : 1±0.02MPa

✓Abrading direction: As actual usage of lining

## Test Procedure

JIS D4411 JIS D4411 protocol (HP-S-A allows us to setup)

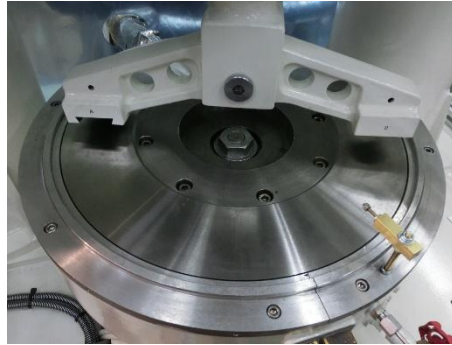
Attach two test specimens to the test apparatus and execute the following procedure

- 1 : Grind the test specimens together below 100°C until at least 95% of the friction surface is covered in advance. Then measure the thickness of the specimen with a micrometer after cooling the specimen to room temperature.  
Measurements are made at five locations for each specimen, and take the average value.
  - 2 : Rotate the disc 5,000 times at 100°C and measure the frictional force during the rotation, or divide the 5,000 times into 10-20 equal parts and measure the frictional force every 250 to 500 revolutions. After that, measure the thickness of the specimen according to the same way as (1).
  - 3 : Conduct the same test as in 2 above at 150°C, 200°C, 250°C, 300°C, and 350°C, depending on the type of test piece. Note that it is limited to the maximum test temperature specified for each type.
  - 4 : After the measurements have been taken to the highest test temperature, for every 50°C drop, rotate the disc 1500 times at that temperature, and the frictional force between them is measured.  
Note that up to 500 revolutions are allowed during the temperature drop
- ※The disc temperature is increased by less than 1500 out of 5000 disc revolutions to reach each test temperature.
- ※If the respective test temperatures are not reached in less than 1500 times, an auxiliary heating device may be used.

Friction Disk



Assembled to the Unit



JIS D4411 protocol

- ✓The distance between the center of test specimen and the center of rotation axis shall be 150mm.
- ✓The materials for disk shall be FC 250 of JIS G 5501 and the surface shall be finished by using the abrasive paper equivalent to No. 320 of JIS R 6252.  
Also the frictional surface shall be of pearlite structure.

○Operating tips

It is recommended to polish the disk with the abrasive paper once per a month before test.  
Replace it when excessively thin, or fluctuating data is observed.

※Discs are consumables.

## Temperature Sensor



JIS D4411 protocol

- ✓A silver plate (8×8×0.6mm) with a thermocouple welded to it is pressed against the friction surface with a force of 0.1-0.2N  
(Made of phenolic resin and mild steel)
- ✓Its location shall be 50~100mm from the center of test specimen in rotational direction at center line of frictional width of disk.

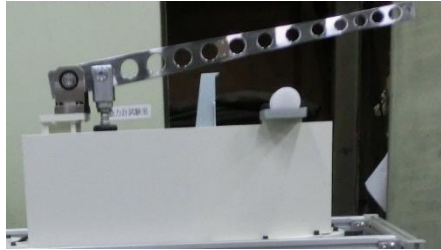
## Assembled to the Unit



※This method is stipulated by JIS and cannot be changed.

If a change is to be made, a committee will be set up with the Japanese Standards Association and experts to discuss the change, then the committee will decide on the best course of action. It will take a long time to change the JIS standard itself.

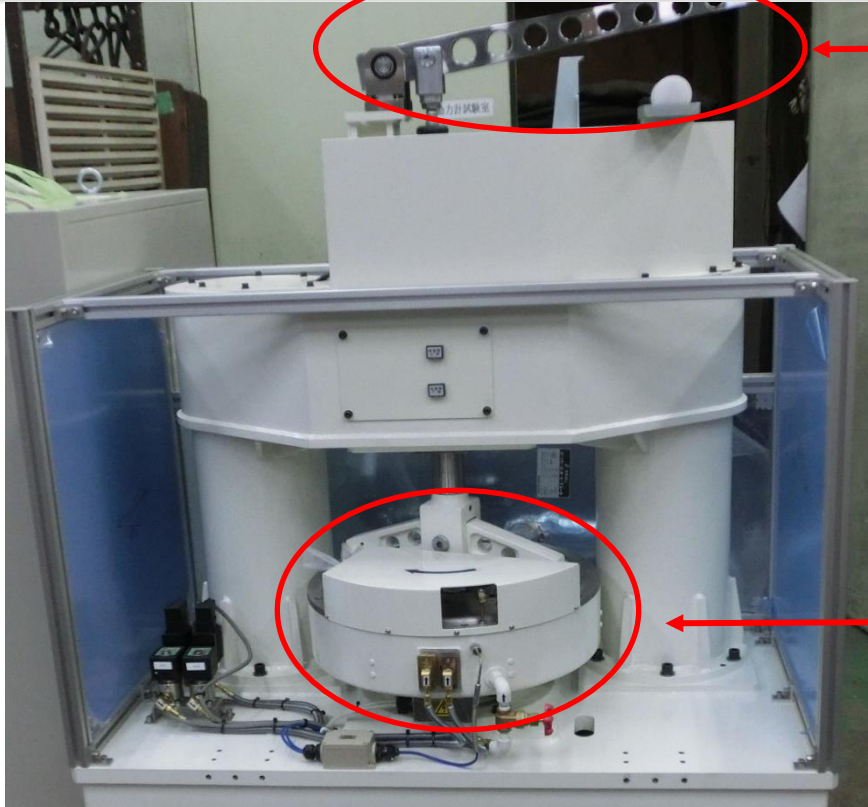
## Set Up Specific Load



JIS D4411 protocol

- ✓The pressing pressure of the test specimen shall be  $1 \pm 0.02 \text{ MPa}$ .  
Attach the weight shown in the photo to the upper part of the main unit with the weight hanger arm, and set the pressing load.
- ✓Note that this load setting cannot be automated.  
(Because the variable value of the pressing load during the test is not specified in the JIS.)

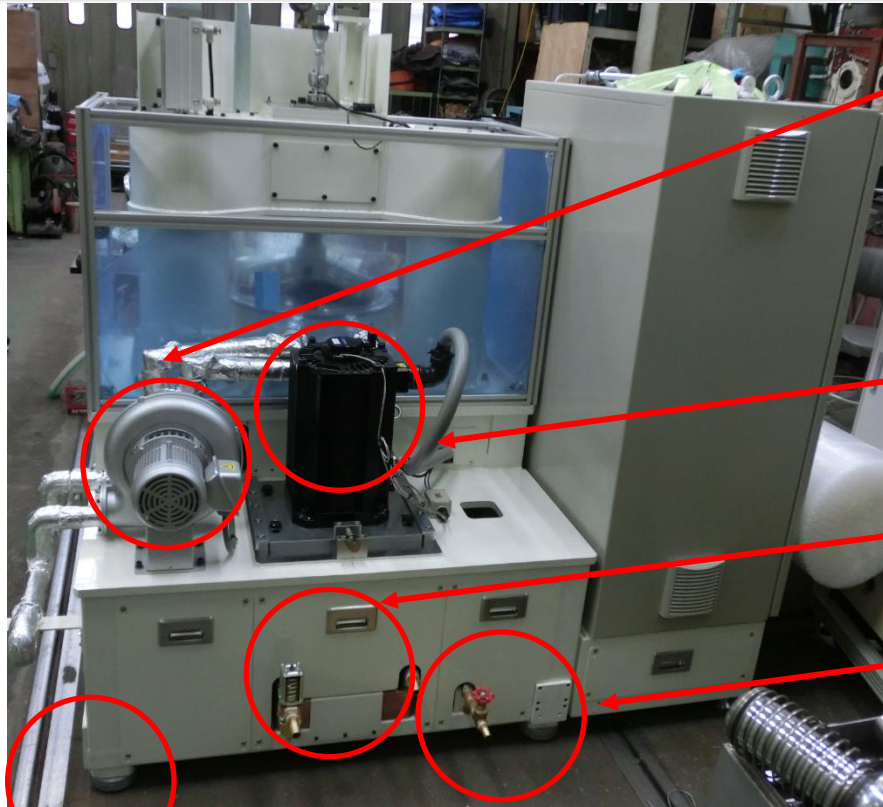
## Configuration



Loading Arm

Drive Motor, Coolant Reservoir,  
and Coolant line , and its supply

## Configuration



Blower

Disk Drive Motor

Oil Cooler

Drainage

Instant installation with level pads

## Controller



PLC and inverter for drive motor in the Cabinet

## Example of Status GUI



HP-S 定速摩擦試験機

12:12:12

運転画面

運転準備 アラームON

発生中アラームモニタ

計測データ現在値

|         |            |
|---------|------------|
| 摩擦板周回数  | 1234 回     |
| 摩擦板回転速度 | 1234 min-1 |
| 摩擦板温度   | 123.4 °C   |
| 押し付け荷重  | 12345 N    |
| 摩擦力     | 1234.5 N   |

操作スイッチ

開始 停止 アラームリセット カウンタクリア

リカバリ 摩擦試験

DB2000 切り替え

実行NO.1 実行NO.2 実行NO.3 実行NO.4

摩擦試験モード 擦り合わせモード

擦り合わせ周回停止 擦り合わせ時間停止

警報 上限しきい値

|         |            |
|---------|------------|
| 摩擦力     | 1234 N     |
| 摩擦板回転速度 | 1234 min-1 |
| 摩擦板表面温度 | 1234 °C    |

摩擦試験 運転データ設定値

|         |          |
|---------|----------|
| 摩擦板周回数  | 12345 回  |
| 摩擦板周速度  | 12.3 m/s |
| 摩擦板表面温度 | 1234 °C  |

擦り合わせ 運転データ設定値

|         |          |
|---------|----------|
| 摩擦板周回数  | 1234 回   |
| 摩擦板周回時間 | 1234 sec |

設定 警報履歴

冷却水ノズル 1.0mm 冷却水ノズル 1.5mm

## Constant Speed Friction Test Machine

Since aiming to perform tests in accordance with D4311 and D4411, so customer requests for bespoke modifications cannot be accommodated.

Constant Speed Friction Test Machine is a designated equipment for JIS D4311, D4411 exclusively.

For example, possible features,

- ✓Static Friction Load Testing
- ✓Configuring load values other than those specified in JIS
- ✓Configuring circumferential velocity other than those specified in JIS
- ✓Optional Variable Setting of transient load value
- ✓Optional Variable Setting of transient speed value
- ✓High temperature region above 350°C
- ✓Runs from minimum to maximum temperature without measuring the wear rate at each step

Also, Depending on the quality and finish of the test piece, the following problems may occur.

- ✓Oscillation
- ✓brake squeal
- ✓Below specified temperature
- ✓Excessive or little wear

**We will participate in your project from the planning phase onward.**

We provide seamless support throughout every stage — from creating requirement specifications and design documents, to product design, manufacturing, commissioning, and delivery. Rest assured, we also provide prompt and reliable after-sales service following delivery.

### Planning



Please let us know your requirements, specifications, and requests. We can provide a variety of proposals based on your budget and testing needs.

We will also align with the customer's project goals to ensure successful achievement. A non-disclosure agreement will be concluded if necessary.

### Contract



After the product manufacturing specifications, service requirements, definitions, and project amount are finalized, the contracting process will begin.

We will work closely with the customer to ensure that the project is executed in accordance with the agreed schedule.

### Design, production



We will proceed with product manufacturing under strict delivery and safety control, ensuring compliance with the customer's defined requirements, functionality, and quality standards.

Also, conducting Pre-commissioning at our test bench.

### Delivery Civil work



After packing, we deliver the products with the utmost care to ensure that they remain secure and intact during transportation.

We also carry out civil engineering work such as installation, piping, and wiring as requested by the customer.

### Commissioning Acceptance



System configuration is carried out, followed by reproducible testing and final adjustments at the customer's test bench.

### After service

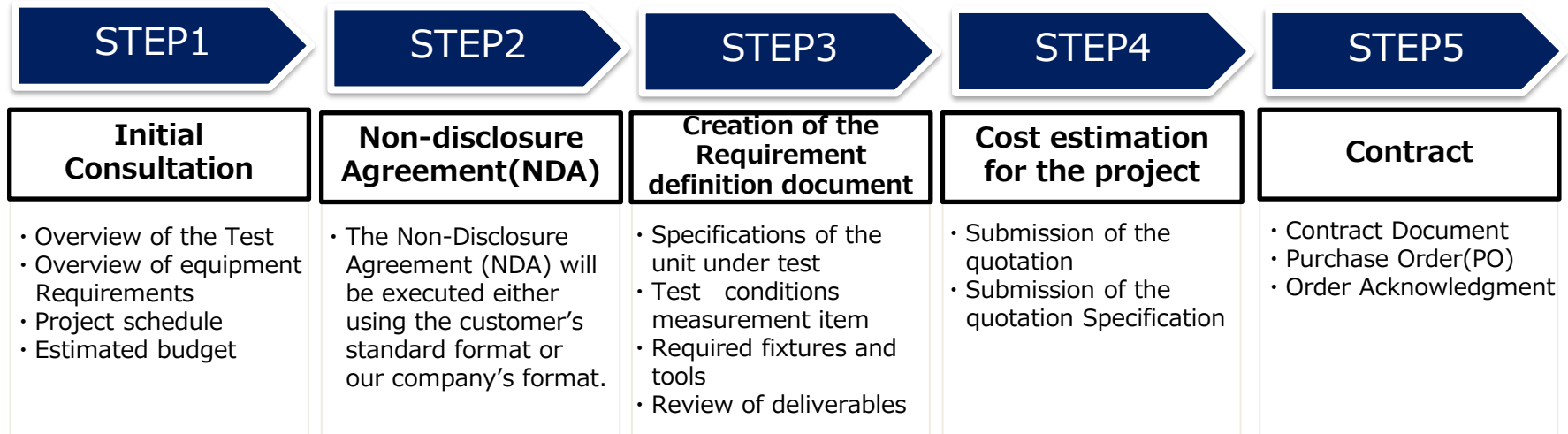


We provide long-term support even after product delivery.

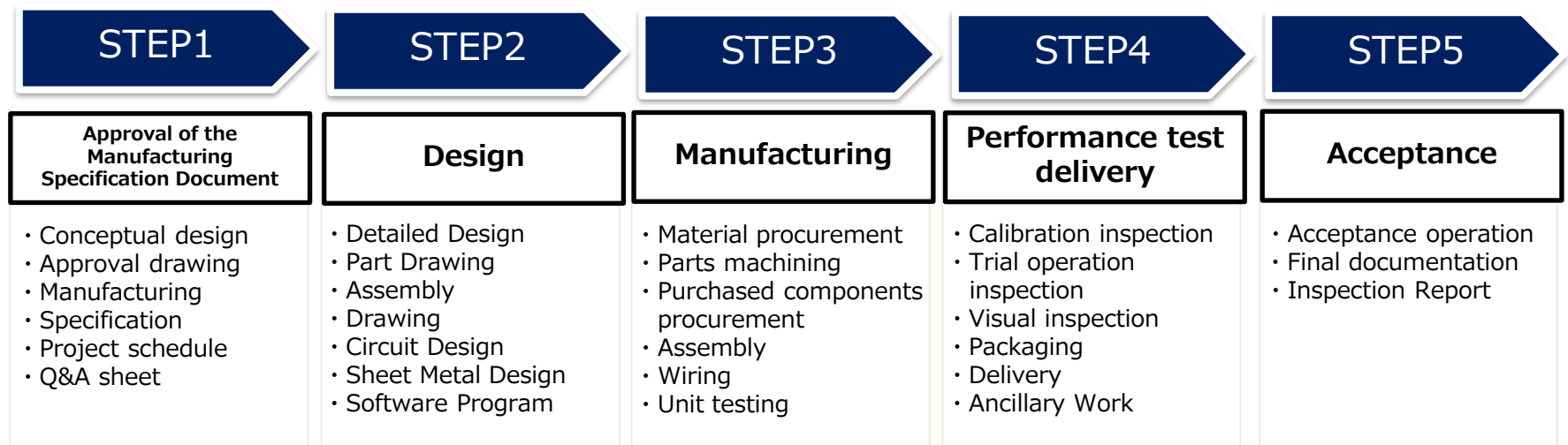
We offer prompt assistance anywhere as needed.

In addition, we propose product upgrades and maintenance planning to ensure continued optimal performance.

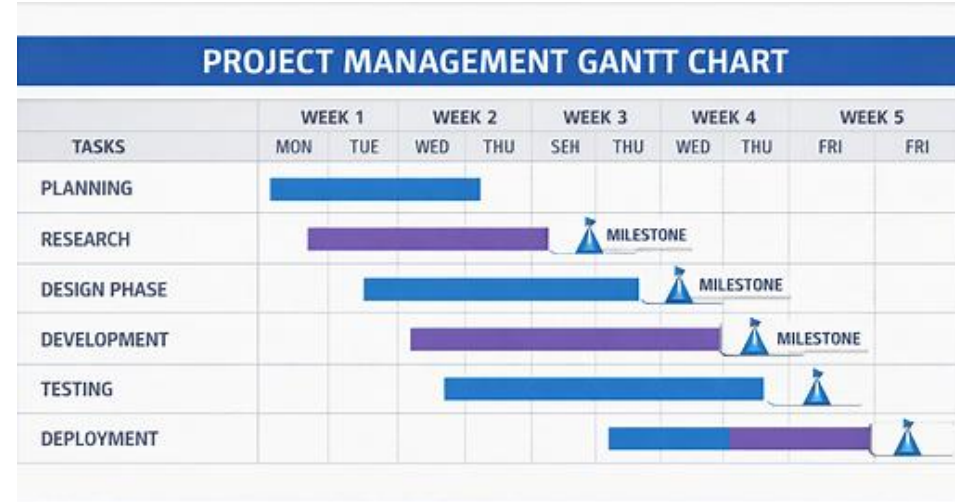
### » Process from initial inquiry to contract finalization



### » Process from project initiation to completion



### » Project execution framework



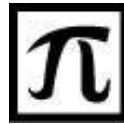
#### ✓Project Leader and Assigned Members

We assign a Project Leader (responsible person) and project members according to the project's scale and type—whether it is a new installation, repair work, or on-site inspection.

#### ✓Project Management

With clearly defined requirements and a firm commitment to achieving QCD (Quality, Cost, Delivery), we approach every project with the same passion as our customers and work sincerely toward its success.





**Since 1948**



**Contact Information**

**Tokyo Plant Co., Ltd. – Sales Department**

**515-5 Miyazawa-cho, Akishima, Tokyo 196-0024, Japan**

**TEL: +81-42-546-6500 FAX : +81-42-546-6600**

**URL : [www.tokyo-plant.co.jp](http://www.tokyo-plant.co.jp)**

**E-mail: [sales@tokyo-plant.co.jp](mailto:sales@tokyo-plant.co.jp)**