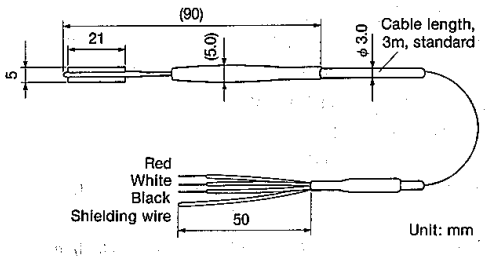
# KCW Weldable Waterproof Strain Gage
# INSTRUCTION MANUAL

## 1. External appearance

This strain gage is so constructed that a foil strain gage housed in a stainless steel tube is completely shielded by epoxy resin filled in.

The strain gage is installed to a measuring object by spot welding.




## 2. Handling precautions

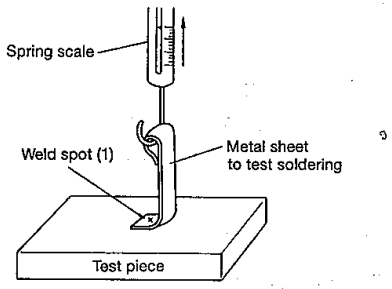
- This strain gage is installable chiefly to ferrous materials because it is installed through spot-welding. It cannot be installed to aluminum and copper materials.
- Produce spot welds at even intervals as much as possible. Also, avoid a spot on another, or sparking and deterioration of weld strength will occur.
- A small number of spot welds will deteriorate the strain gage sensitivity and strain limit.
- Produce spot welds as much near as possible to the tube.
- Absolutely avoid the electrode tip on any gage part other than the flange.
- If the measuring object or the electrode tip is dirty, a shower of sparks will occur while welding, to cause damage to the electrode. Take care to avoid it. Also, wear glasses to protect the eyes from sparks.
- The important factors in producing quality spot welds are: quality preparation of the surface of the measuring object, a proper output of the spot welder and a proper electrode pressure applied. Recommended is KYOWA GW-3C spot welder.

## 3. Installation

### 3.1 Welding requirements

| | |
|---|---|
| Welding energy: | Approx. 10W•s |
| Electrode pressure: | Approx. 10N (Ref. value: Approx.1kgf) |
| Diameter of electrode tip: | Approx. ø0.8mm |
| Weld strength*: | Over 15N (Ref. value: Over 1.5kgf) |

*** How to measure weld strength:** Using the accessory metal sheet, measure the strength in the manner illustrated by the figure. **Where a spring scale is not available:** Using pinchers, etc., forcibly pull the metal sheet. If holes are made on the sheet while the spot welds remain on the test sheet, it is the proof of weld strength good enough for strain measurement.

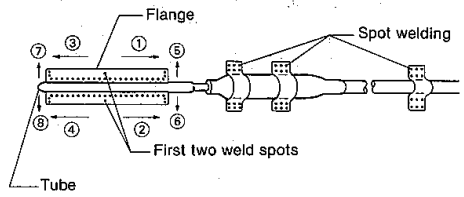



### 3.2 Surface preparation

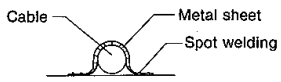
a. Remove rust, dust, fat and other foreign matters from the measuring area of the measuring object.
b. To remove rust from the measuring area, use #100 or thereabout sandpaper, then smooth the area using #320 or thereabout sandpaper.
c. With the measuring area which is not much rough, just polishing the surface with #320 or thereabout sandpaper will do.
d. Using methyl ethyl ketone or acetone, thoroughly remove stain and fat, etc., from the measuring area. If necessary, also remove fat from the gage surface using methyl ethyl ketone or acetone.
e. Once fat has been removed from the measuring object and gage, avoid touching them.

### 3.3 Spot welding the gage

a. Set the strain gage in place.
b. Fix the connector and cable by spot welding the accessory metal sheets.
c. To spot weld the strain gage, first fix the flange by welding two spots at its center.
d. Next, spot weld the flange towards the flange ends in order of ① to ④ at intervals of 0.9 to 1.0mm.
e. Further spot weld the ends of the flange in order of ⑤ to ⑧.




Welded spot intervals: 0.9 to 1.0mm

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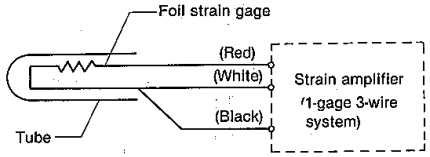
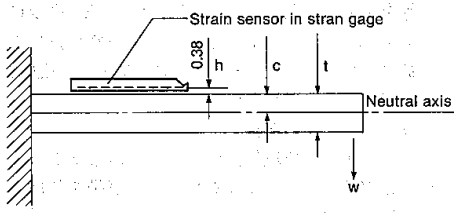
## 4. Connection

Connect the strain gage with a strain amplifier depending on the 1-gage 3-wire system. The white and black wires of the cable are common to the both.




## 5. Measurement precautions

**5.1** Unlike other general strain gages, this strain gage is so constructed that the strain sensor is apart from the surface of a measuring object. This makes the gage factor prohibit some difference between a bending strain and a tensile strain. Suppose that the thickness of a measuring object is t, the distance from the neutral axis to the surface is c, and the distance from the surface to the strain sensor is h, the gage sensitivity against a bending strain is (h+c)/c times larger than that against a tensile strain.




**5.2** The gage factor of this strain gage is denoted by the gage factor with a tensile strain. To measure a bending strain, it is therefore necessary to correct the gage factor using the equation below.

$$K_B = K_P \cdot \frac{0.38 + c}{c}$$

where $K_B$: Gage factor with a bending strain
$K_P$: Gage factor stated on the package
c: Distance from the neutral axis to the surface

## 6. Specifications

| | |
|---|---|
| Model name: | KCW-5-120-G10-11 |
| Tube material: | SUS304 |
| Flange material: | SUS304 (size: 5x21mm; 0.1mm thick) |
| Cable: | ø3, 3-conductor shielded cross-link poly-ethylene cable, 3m long as standard |
| Gage length: | 5mm |
| Gage resistance: | 120Ω±0.5%(1-gage 3-wire system) |
| Gage factor: | Approx. 2.2 (as stated on the package) |
| Operating temp. range: | –20 to 100°C |
| Compensated temp. range: | 0 to 100°C (±3 x $10^{-6}$ strain/°C)<br>20 to 80°C (±1.8 x $10^{-6}$ strain/°C) |
| Applicable coefficient of linear expansion: | 11.7 x $10^{-6}$/°C |
| Minimum radius of curvature: | 20mm |
| Strain limit: | 9000 x $10^{-6}$ strain |
| Fatigue life: | 1 x $10^{6}$ times (loaded strain:±1000 x $10^{-6}$ strain ) |
| Waterproofness: | Water pressure resistance: 9.8MPa (Ref. value: 100kgf/cm²), 100 hours |
| Stability: | ±100 x $10^{-6}$ strain or better/500 hours(80°C, over 90%RH)<br>±40 x $10^{-6}$ strain or better/500 hours (under immersion) |
| Installation method: | Spot welding |

### ■ Accessories

Metal sheets: (Material: NiCr, size 100 x 3 x 0.05mm)..... 4
Metal sheets for soldering test:
(Material: Inconel 600, size 30 x 4 x 0.1mm).....2
Instruction manual .....1

KYOWA
KYOWA ELECTRONIC INSTRUMENTS CO., LTD.
Overseas Department:
Address: 1-22-14, Toranomon, Minato-ku, Tokyo 105-0001 Phone: 03-3502-3553 Fax: 03-3502-3678