

HA \_ \_

32.768 KHz

uA Current Consumption

SMD

CMOS

1.8 V

2.5 V

3.3 V

5.0 V

Min.

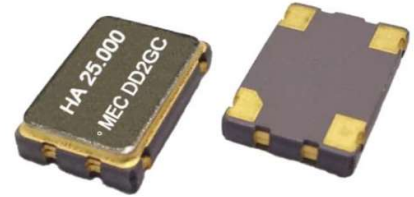
27.3 KHz

Max.

100.0 KHz

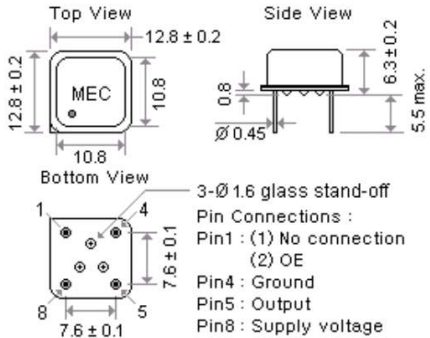
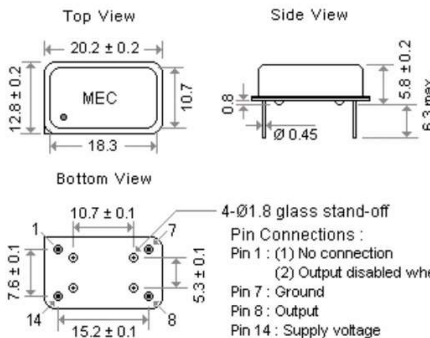
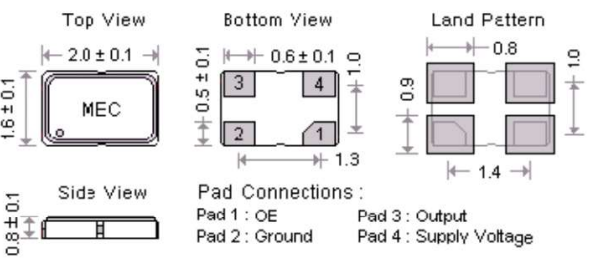
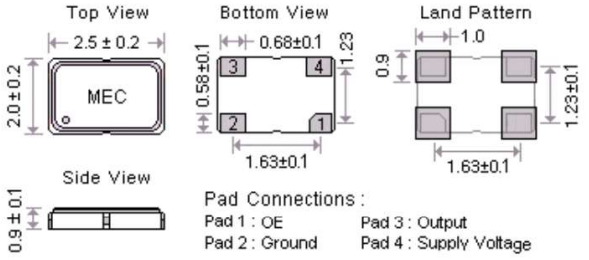
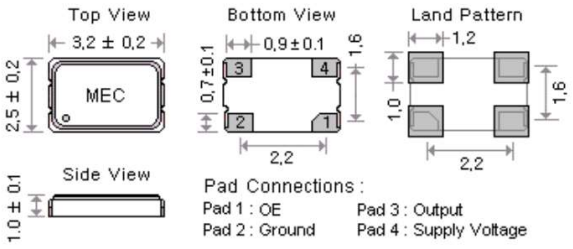
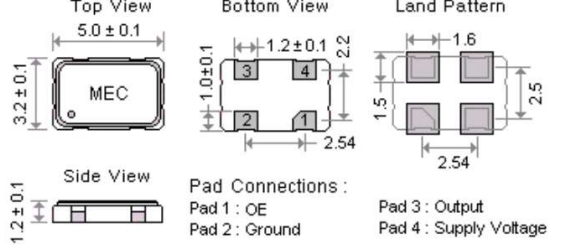
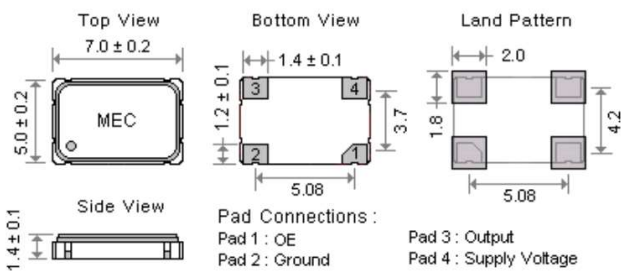
## Features

- Features an AT-Cut crystal for high frequency stability, while providing a low micro Amp (  $\mu\text{A}$  ) current consumption that would normally only be available from an X-Cut tuning fork crystal
- 32.768 KHz is popular for Real Time Clocks and other timing applications
- For even tighter frequency stability (  $\pm 5$  ppm over  $-40$  to  $85^\circ\text{C}$  ) and lower current consumption (  $1.2 \mu\text{A}$  at  $3.3\text{V}$  ) , please contact Mercury

General specifications of all available packages , at  $T_a=+25^\circ\text{C}$  ,  $CL=15\text{pF}$ 

| Type                                                            | "HA " series [ SMD Type ]                                          |                                  |                                  |           |                                                                                  |
|-----------------------------------------------------------------|--------------------------------------------------------------------|----------------------------------|----------------------------------|-----------|----------------------------------------------------------------------------------|
| Model                                                           | HA22                                                               | HA32                             | HA53                             |           | HA57                                                                             |
| Dimensions                                                      | 2.5 * 2.0 * 0.9 mm                                                 | 3.2 * 2.5 * 1.0 mm               | 5.0 * 3.2 * 1.2 mm               |           | 7.0 * 5.0 * 1.4 mm                                                               |
| Frequency Output Range                                          | 32.768 KHz ( standard )                                            |                                  |                                  |           |                                                                                  |
|                                                                 | 27.3 KHz ~ 100 KHz                                                 | 27.3 KHz ~ 100 KHz               | 27.3 KHz ~ 100 KHz               |           | 27.3 KHz ~ 52 KHz                                                                |
| Supply Voltage                                                  | 1.8 V ± 10%                                                        | 2.5 V ± 10%                      | 3.3 V ± 10%                      |           | 5.0 V ± 10%                                                                      |
|                                                                 | Voltage code is " 18 "                                             | Voltage code is " 25 "           | Voltage code is " 3 "            |           | Voltage code is " 5 "                                                            |
| Current Consumption<br>( 32.768 KHz , Load 15pF )               | 32 uA ( typ. )<br>50 uA ( max. )                                   | 32 uA ( typ. )<br>50 uA ( max. ) | 33 uA ( typ. )<br>50 uA ( max. ) |           | 36 uA ( typ. )<br>60 uA ( max. )                                                 |
| Output Logic " High " , " 1 "                                   | 1.62 V ( min. )                                                    | 2.25 V ( min. )                  | 2.97 V ( min. )                  |           | 4.5 V ( min. )                                                                   |
| Output Logic " Low " , " 0 "                                    | 0.18 V ( max. )                                                    | 0.25 V ( max. )                  | 0.33 V ( max. )                  |           | 0.5 V ( max. )                                                                   |
| Rise Time ( Tr ) / Fall Time ( Tf )<br>( 10 % ↔ 90 % waveform ) | 20 nsec ( max. )                                                   | 20 nsec ( max. )                 | 12 nsec ( max. )                 |           | 12 nsec ( max. )                                                                 |
| Frequency Stability Codes                                       | Frequency Stability over<br>Operating Temperature Range            | ± 25 ppm                         | ± 50 ppm                         | ± 100 ppm | If non-standard , please enter the<br>desired stability after the " C " or " I " |
|                                                                 | Commercial ( -10°C to +70°C )                                      | A                                | B                                | C         | For example :<br>" C20 " ±20 ppm over -10°C to +70°C ;                           |
|                                                                 | Industrial ( -40°C to +85°C )                                      | D                                | E                                | F         | " I30 " ± 30 ppm over -40°C to +85°C                                             |
| Output Load                                                     | 15 pF                                                              |                                  |                                  |           |                                                                                  |
| Start-up Time                                                   | 1.0 msec. ( typ. ) ; 5.0 msec. ( max. )                            |                                  |                                  |           |                                                                                  |
| Duty Cycle                                                      | 50% ± 5%                                                           |                                  |                                  |           |                                                                                  |
| Output Enable / Disable Function                                | 70% of V <sub>DD</sub> ( min. ) to enable output.                  |                                  |                                  |           |                                                                                  |
|                                                                 | 30% of V <sub>DD</sub> ( max. ) to disable output.                 |                                  |                                  |           |                                                                                  |
|                                                                 | Disable current : 3 uA ( max. ) for OE ≤ 0.3V                      |                                  |                                  |           |                                                                                  |
| Storage Temperature                                             | -55°C to + 125°C                                                   |                                  |                                  |           |                                                                                  |
| Aging at Ta=+25°C                                               | ± 3 ppm ( max. ) first year ; ± 2 ppm ( max. ) per year thereafter |                                  |                                  |           |                                                                                  |

Outline Dimensions ( Unit : mm ) , Suggested pad Layout for SMDs

| [ H8 ; H_8 ]                                                                                                                                                                                                                                                                                                                                               | [ H14 ; H_14 ]                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>Top View: 12.8 ± 0.2, 10.8, 12.8 ± 0.2, 10.8</p> <p>Side View: 0.8, 6.3 ± 0.2, 5.5 max., Ø 0.45</p> <p>Bottom View: 1, 4, 3-Ø 1.6 glass stand-off, Pin Connections: Pin1: (1) No connection (2) OE, Pin4: Ground, Pin5: Output, Pin8: Supply voltage</p>              |  <p>Top View: 20.2 ± 0.2, 18.3, 12.8 ± 0.2, 10.7</p> <p>Side View: 0.8, 5.8 ± 0.2, 6.3 max., Ø 0.45</p> <p>Bottom View: 10.7 ± 0.1, 7.6 ± 0.1, 15.2 ± 0.1, 5.3 ± 0.1, 4-Ø 1.8 glass stand-off, Pin Connections: Pin 1: (1) No connection (2) Output disabled when low, Pin 7: Ground, Pin 8: Output, Pin 14: Supply voltage</p> |
| [ H21 ]                                                                                                                                                                                                                                                                                                                                                    | [ H22 ; H_22 ]                                                                                                                                                                                                                                                                                                                                                                                                    |
|  <p>Top View: 2.0 ± 0.1, 1.6 ± 0.1, MEC</p> <p>Bottom View: 0.6 ± 0.1, 1.0, 0.5 ± 0.1, 1.3, 3, 4, 2, 1</p> <p>Land Pattern: 0.8, 1.0, 0.9, 1.4</p> <p>Side View: 0.8 ± 0.1</p> <p>Pad Connections: Pad 1: OE, Pad 2: Ground, Pad 3: Output, Pad 4: Supply Voltage</p>     |  <p>Top View: 2.5 ± 0.2, 2.0 ± 0.2, MEC</p> <p>Bottom View: 0.68 ± 0.1, 1.23, 0.58 ± 0.1, 1.63 ± 0.1, 3, 4, 2, 1</p> <p>Land Pattern: 1.0, 1.23, 0.9, 1.63 ± 0.1</p> <p>Side View: 0.9 ± 0.1</p> <p>Pad Connections: Pad 1: OE, Pad 2: Ground, Pad 3: Output, Pad 4: Supply Voltage</p>                                         |
| [ H32 ; H_32 ]                                                                                                                                                                                                                                                                                                                                             | [ H53 ; H_53 ]                                                                                                                                                                                                                                                                                                                                                                                                    |
|  <p>Top View: 3.2 ± 0.2, 2.5 ± 0.2, MEC</p> <p>Bottom View: 0.9 ± 0.1, 1.6, 0.7 ± 0.1, 2.2, 3, 4, 2, 1</p> <p>Land Pattern: 1.2, 1.6, 1.0, 2.2</p> <p>Side View: 1.0 ± 0.1</p> <p>Pad Connections: Pad 1: OE, Pad 2: Ground, Pad 3: Output, Pad 4: Supply Voltage</p>    |  <p>Top View: 5.0 ± 0.1, 3.2 ± 0.1, MEC</p> <p>Bottom View: 1.2 ± 0.1, 2.2, 1.0 ± 0.1, 2.54, 3, 4, 2, 1</p> <p>Land Pattern: 1.6, 2.5, 1.5, 2.54</p> <p>Side View: 1.2 ± 0.1</p> <p>Pad Connections: Pad 1: OE, Pad 2: Ground, Pad 3: Output, Pad 4: Supply Voltage</p>                                                        |
| [ SWO ; H_57 ]                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                   |
|  <p>Top View: 7.0 ± 0.2, 5.0 ± 0.2, MEC</p> <p>Bottom View: 1.4 ± 0.1, 3.7, 1.2 ± 0.1, 5.08, 3, 4, 2, 1</p> <p>Land Pattern: 2.0, 4.2, 1.8, 5.08</p> <p>Side View: 1.4 ± 0.1</p> <p>Pad Connections: Pad 1: OE, Pad 2: Ground, Pad 3: Output, Pad 4: Supply Voltage</p> |                                                                                                                                                                                                                                                                                                                                                                                                                   |

## Part Number Format and Examples

|          | [ 1 ]          | [ 2 ]       | - | [ 3 ]               | [ 4 ]       | - | [ 5 ]            |
|----------|----------------|-------------|---|---------------------|-------------|---|------------------|
|          | Supply Voltage | Holder Type |   | Frequency Stability | OE Function |   | Center Frequency |
| Examples | (1) 3          | SWO         | - | D                   | T           | - | 25.000           |
|          | (2) 3          | HY32        | - | K50                 | T           | - | 24.000           |
|          | (3) 18         | HA32        | - | B                   | T           | - | 32.768K          |
|          | (4) 3          | HJ22        | - | E                   | T           | - | 49.152           |

Ex (1) : 3SWO - DT - 25.000 [ 3.3V , H seires 7050 type ,  $\pm 25\text{ppm}$  from  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  , OE Function , 25.000MHz ]

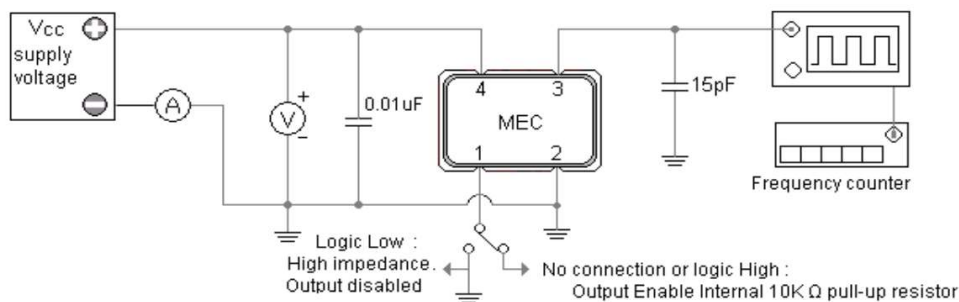
Ex (2) : 3HY32 - K50T - 24.000 [ 3.3V , HY seires 3225 type ,  $\pm 50\text{ppm}$  from  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$  , OE Function , 24.000MHz ]

Ex (3) : 18HA32 - BT - 32.768K [ 1.8V , HA seires 3225 type ,  $\pm 50\text{ppm}$  from  $-10^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$  , OE Function , 32.768KHz ]

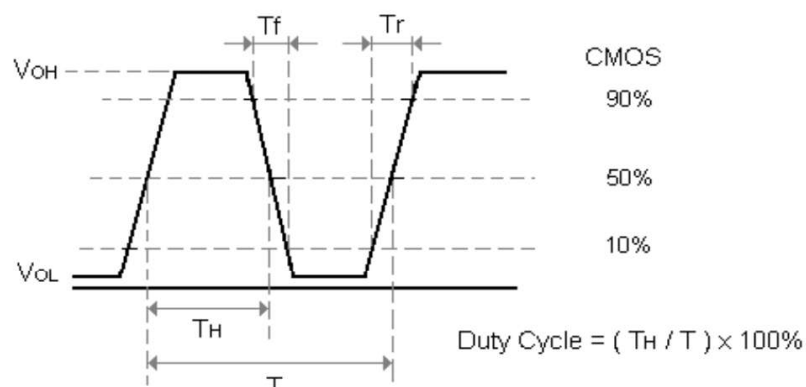
Ex (4) : 3HJ22 - ET - 49.152 [ 3.3V , HJ seires 2520 type ,  $\pm 50\text{ppm}$  from  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  , OE Function , 49.152 MHz ]

|     |                                                                                                                              |                                                                                                                                                                                                                                           |
|-----|------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [1] | Supply voltage " 10 " for +1.0V ; " 12 " for +1.2V ; " 18 " for +1.8V ; " 25 " for +2.5V ; " 3 " for +3.3V ; " 5 " for +5.0V |                                                                                                                                                                                                                                           |
| [2] | Holder Type                                                                                                                  |                                                                                                                                                                                                                                           |
| [3] | $-10^{\circ}\text{C} \sim 70^{\circ}\text{C}$                                                                                | " A " $\pm 25\text{ppm}$ ; " B " $\pm 50\text{ppm}$ ; " C " $\pm 100\text{ppm}$ ;<br>If non-standard please enter the desired stability after " C " , example " C15 " : represents $\pm 15\text{ppm}$ over $-10$ to $+70^{\circ}\text{C}$ |
|     | $-40^{\circ}\text{C} \sim 85^{\circ}\text{C}$                                                                                | " D " $\pm 25\text{ppm}$ ; " E " $\pm 50\text{ppm}$ ; " F " $\pm 100\text{ppm}$ ;<br>If non-standard please enter the desired stability after " I " , example " I30 " : represents $\pm 30\text{ppm}$ over $-40$ to $+85^{\circ}\text{C}$ |
| [4] | " T " for OE Function , Leave this space blank if no connection on pad 1.                                                    |                                                                                                                                                                                                                                           |
| [5] | Frequency in MHz                                                                                                             |                                                                                                                                                                                                                                           |

## Test Circuit &amp; Test Waveform

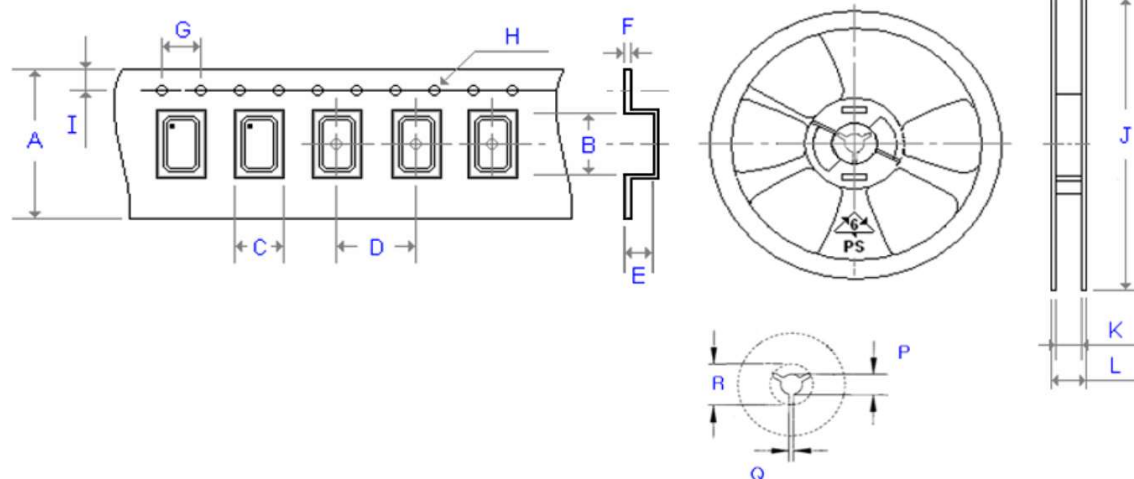
H ; H<sub>-</sub> - series CMOS Test Circuit

## CMOS Output Waveform



# Emboss Taping and Reel Specifications

## [ Crystal Oscillator Units ]



Carrier Type Dimensions ( unit : mm ) ±0.3mm

|       | A     | B     | C     | D     | E    | F    | G    | H      | I    | pcs / reel |
|-------|-------|-------|-------|-------|------|------|------|--------|------|------------|
| H21   | 8.00  | 2.30  | 1.90  | 4.00  | 0.90 | 0.25 | 4.00 | Ø 1.50 | 1.75 | 3000       |
| H_22  | 8.00  | 2.80  | 2.25  | 4.00  | 1.10 | 0.30 | 4.00 | Ø 1.50 | 1.75 | 3000       |
| H_32  | 8.00  | 3.40  | 2.70  | 4.00  | 1.40 | 0.25 | 4.00 | Ø 1.50 | 1.75 | 3000       |
| H_53  | 12.00 | 5.30  | 3.60  | 8.00  | 1.40 | 0.30 | 4.00 | Ø 1.50 | 1.75 | 1000       |
| H_57  | 16.00 | 7.30  | 5.30  | 8.00  | 1.90 | 0.32 | 4.00 | Ø 1.50 | 1.75 | 1000       |
| SWO   | 16.00 | 7.20  | 5.40  | 8.00  | 1.80 | 0.32 | 4.00 | Ø 1.50 | 1.75 | 1000       |
| H_226 | 8.00  | 2.80  | 2.25  | 4.00  | 1.10 | 0.30 | 4.00 | Ø 1.50 | 1.75 | 3000       |
| H_326 | 8.00  | 3.40  | 2.70  | 4.00  | 1.40 | 0.25 | 4.00 | Ø 1.50 | 1.75 | 3000       |
| H_536 | 12.00 | 5.30  | 3.60  | 8.00  | 1.40 | 0.30 | 4.00 | Ø 1.50 | 1.75 | 1000       |
| H_576 | 16.00 | 7.30  | 5.30  | 8.00  | 1.90 | 0.32 | 4.00 | Ø 1.50 | 1.75 | 1000       |
| H_328 | 8.00  | 3.40  | 2.70  | 4.00  | 1.40 | 0.25 | 4.00 | Ø 1.50 | 1.75 | 3000       |
| H_538 | 12.00 | 5.40  | 3.60  | 8.00  | 1.70 | 0.30 | 4.00 | Ø 1.50 | 1.75 | 1000       |
| H_578 | 16.00 | 7.30  | 5.30  | 8.00  | 1.90 | 0.32 | 4.00 | Ø 1.50 | 1.75 | 1000       |
| H_43  | 24.00 | 11.80 | 10.00 | 16.00 | 5.00 | 0.30 | 4.00 | Ø 1.50 | 1.75 | 500        |

Reel Dimensions ( unit : mm ) ±2mm

|       | J      | K     | L     | P     | Q    | R     | pcs / reel |
|-------|--------|-------|-------|-------|------|-------|------------|
| H21   | 180.00 | 9.00  | 12.00 | 13.00 | 2.50 | 20.20 | 3000       |
| H_22  | 180.00 | 8.40  | 11.40 | 13.00 | 2.50 | 20.20 | 3000       |
| H_32  | 180.00 | 9.00  | 12.00 | 13.00 | 2.50 | 20.20 | 3000       |
| H_53  | 180.00 | 13.00 | 16.00 | 13.00 | 2.50 | 20.20 | 1000       |
| H_57  | 180.00 | 17.20 | 19.30 | 13.00 | 2.50 | 20.20 | 1000       |
| SWO   | 180.00 | 17.20 | 19.30 | 13.00 | 2.50 | 20.20 | 1000       |
| H_226 | 180.00 | 8.40  | 11.40 | 13.00 | 2.50 | 20.20 | 3000       |
| H_326 | 180.00 | 9.00  | 12.00 | 13.00 | 2.50 | 20.20 | 3000       |
| H_536 | 180.00 | 13.00 | 16.00 | 13.00 | 2.50 | 20.20 | 1000       |
| H_576 | 180.00 | 17.20 | 19.30 | 13.00 | 2.50 | 20.20 | 1000       |
| H_328 | 180.00 | 8.00  | 12.00 | 13.00 | 2.50 | 20.20 | 3000       |
| H_538 | 180.00 | 13.00 | 16.00 | 13.00 | 2.50 | 20.20 | 1000       |
| H_578 | 180.00 | 17.20 | 19.30 | 13.00 | 2.50 | 20.20 | 1000       |
| H_43  | 330.00 | 24.50 | 29.10 | 13.00 | 2.50 | 20.20 | 500        |