



## 1. Quartz Crystals... What?

The quartz crystal is a single crystal of silicon dioxide and used in important electronic components of digital equipment such as mobile communications, optic communications, video equipment and PCs as a precise source of electrical signal.

## 2. Quartz Crystals... Why?

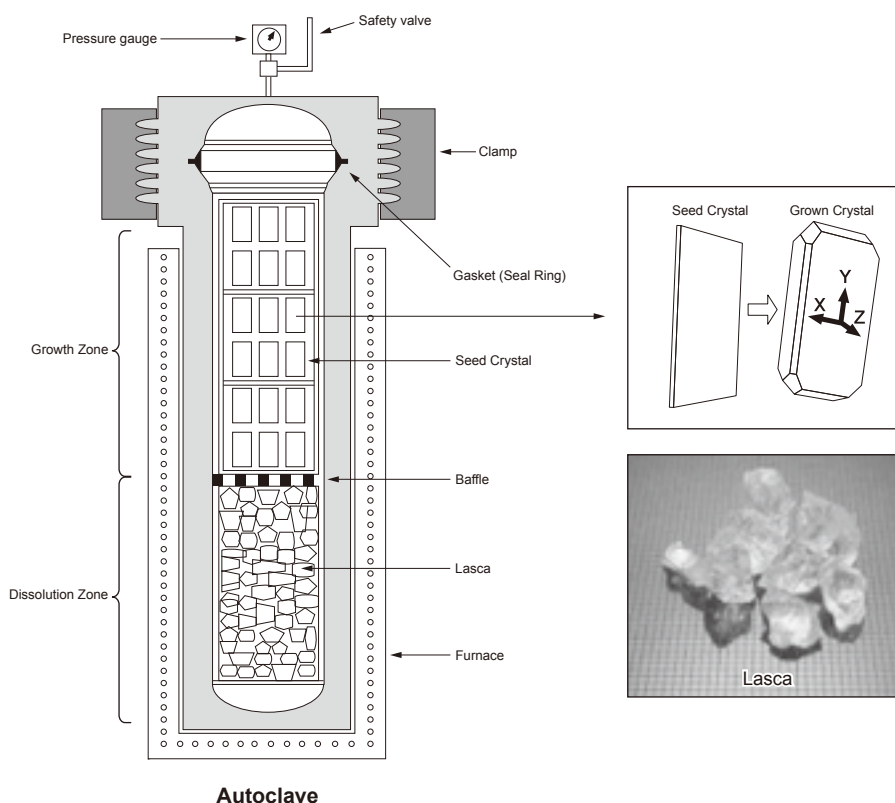
The quartz crystal has a character when the compression is applied to the direction of the crystal axis (x axis), the electric change generates on the quartz crystal plate, and on the contrary, when the electricity is applied to the quartz crystal plate, the distortion occurs inside the crystal plate. The phenomenon is called the piezo electric effect or piezo electric reverse effect.

## 3. Synthetic Quartz Crystals... How?

The synthetic quartz crystal is grown by the hydrothermal method using the pressured container called the autoclave. The crystal is insoluble to most of the solution under the normal temperature and pressure but becomes soluble by the hydrothermal reaction in the high temperature and high pressure. The growth of the synthetic quartz crystal is taking advantage of this reaction. The high pressure necessary for growing is obtained by filling the alkaline solution up to the approximate 70 to 85% of the capacity of the autoclave and applying the temperature. The ordinary growing temperature is approximately 300 to 400°C and the growing pressure is approximately 90 to 145MPa.

The autoclave, upper growing area and lower dissolution area is partitioned by the perforated panel called the baffle. Hang the seed crystal in the upper growing area and place the raw material, Lasca, a fragment of the natural quartz crystal in the lower dissolution area. By maintaining the temperature in the growing area lower than the solution area, the raw material in a saturated state in the dissolution area will rise to the growing area by the heat convection provided by the temperature difference. Since the growing area is lower than the dissolution area in temperature, the solution will become a super-saturation and re-crystallize the surface of the seed crystal.

The growing speed is approximately 0.4 to 0.6mm per day and the growing number of day is from about 40 days to more than 200 days depending on the applications. With the strict temperature and pressure control for a long period of time, you will get approximately 1,500 to 2,500kg of high quality synthetic quartz crystals in one growth process.

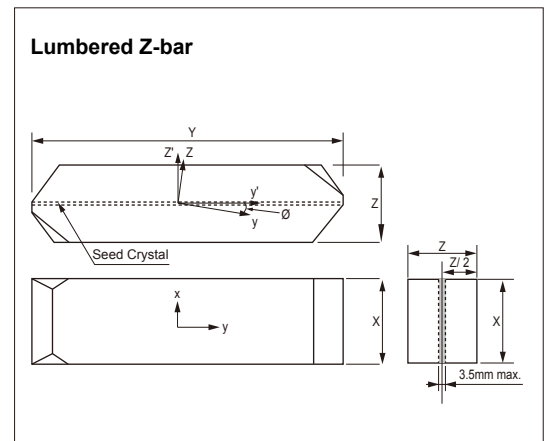




**Lumbered Z-bar**

| Type     | Orientation (°) | Dimensions (mm) |       |     |
|----------|-----------------|-----------------|-------|-----|
|          |                 | X±0.2           | Z±0.2 | Y±5 |
| LZ3118MS | 0°              | 31.0            | 18.0  | 210 |
| LZ3119MS | 0°              | 31.0            | 19.0  | 210 |
| LZ3120MS | 0°              | 31.0            | 20.0  | 210 |
| LZ3122MS | 0°              | 31.0            | 22.0  | 210 |
| LZ7018MS | 0°              | 70.0            | 18.0  | 200 |
| LZ7019MS | 0°              | 70.0            | 19.0  | 200 |
| LZ7020MS | 0°              | 70.0            | 20.0  | 200 |
| LZ7022MS | 0°              | 70.0            | 22.0  | 200 |
| LZ7032MS | 0°              | 70.0            | 32.0  | 200 |
| LZ5034MS | 0°              | 50.0            | 34.0  | 210 |
| LZ5038MS | 0°              | 50.0            | 38.0  | 210 |
| LZ5040MS | 0°              | 50.0            | 40.0  | 210 |

**Dimensions**



**Specifications**

- Kind of crystal: Right hand crystal unless otherwise specified.
- Twinning: No electrical or optical twinning is included.
- Please inquire about dimension other than the above.

**Infra-red quality indication  $\alpha$  ( $3500\text{cm}^{-1}$ )**

| Grade | Maxima |
|-------|--------|
| Aa    | 0.026  |
| A     | 0.033  |
| B     | 0.045  |
| C     | 0.060  |
| D     | 0.080  |
| E     | 0.120  |

**Inclusion density**

| Grade/ Size Range $\mu\text{m}$ | Densities per $\text{cm}^3$ |         |          |      |
|---------------------------------|-----------------------------|---------|----------|------|
|                                 | 10 - 30                     | 30 - 70 | 70 - 100 | >100 |
| I <sub>a</sub>                  | 2                           | 1       | 0        | 0    |
| I <sub>b</sub>                  | 3                           | 2       | 1        | 1    |
| I                               | 6                           | 4       | 2        | 2    |
| II                              | 9                           | 5       | 4        | 3    |
| III                             | 12                          | 8       | 6        | 4    |

**Etch channel density  $\rho$**

| Grade | Maximum number $\rho$ per $\text{cm}^2$ |
|-------|---|
| 1aa   | 2                                       |
| 1a    | 5                                       |
| 1     | 10                                      |
| 2     | 30                                      |
| 3     | 100                                     |
| 4     | 300                                     |