# GENERAL MIROTECH MIRROR DATA SHEET

## INTRODUCTION

This Technical Datasheet provides information of Miro Tech copper free mirrors. The Miro Tech mirrors are silver palladium mirrors with double coat paint.

## STANDARDS

Miro Tech products comply with:
* EN 1036-1 – Glass in building – Mirrors from silver-coated float glass for internal use
–Part 1: Definitions, requirements and test methods
* EN 1036-2 - Glass in building – Mirrors from silver-coated float glass for internal use
– Part 2: Evaluation of conformity/Product standard
All Miro Tech products are produced in ISO 9001, ISO 14001 & OSHAS 18001-certified plants.

Miro Tech has Nederland certificate of the mirror´s quality. TUV certificate.

## MECHANICAL PROPERTIES

* Weight (at 18°C): $\rho$ = 2,500 kg/$m^3$
* Density: 2.5

* Young's modulus (modulus of elasticity): E = 70,000 N/mm$^2$
* Poisson's ratio: μ= 0.2
* Shear modulus: G = E/ [2 (1+v)] ~ 29,166 N/mm$^2$
* Knoop hardness: 6 GPa
* Mohs hardness: 6
* Characteristic bending strength: 45 N/mm$^2$

## THERMAL PROPERTIES

* Softening point: ~ 600 °C
* Fusion temperature: ~1,500 °C
* Linear expansion coefficient: α = 9.10-6/K (between 20° and 300°)
* Specific heat capacity: C = 720 J/(kg.K)

## OPTICAL PROPERTIES

* Refractive index N to visible radiation (380 to 780 nm):
- air/glass: 0.67
- glass/air: 1.50

## ELECTRICAL PROPERTIES

* Specific resistance: 5.107 Ω.m at 1,000 Hz and 25 °C
* Dielectric constant: 7.6 at 1,000 Hz and 25 °C

## DURABILITY OF MIRO TECH MIRROR

Miro Tech products are tested using the durability method described in EN 1036-1.
Miro Tech outperforms the requirements set out in EN 1036-1.

| | EN 1036-1 criteria | **Performance of Miro Tech Mirrors** |
|---|---|---|
| Neutral salt spray test:<br>- Maximum corrosion around the edge | 1.0 mm | 0.5mm |
| Copper accelerated acetic acid salt<br>spray test:<br>- Maximum corrosion around the edge<br>- Maximum number of spots (Diameter between 0.2 and 3 mm) | 1.5 mm<br>2<br>(Accepted provided < 0.2 mm) | 0.75 mm<br>< 1<br>(Accepted provided < 0.2 mm) |

| | | |
|---|---|---|
| Condensation water test<br>- Maximum corrosion around the edge<br>- Maximum number of spots (diameter ≤ 0.3 mm) | 0.2 mm<br>1 | 0.1 mm<br>0 |

The actual thickness will be the average of four measurements, rounded to the nearest 0.01 mm, taken at the centre of each side.
The actual thickness, rounded to the nearest 0.1 mm, must not vary from the nominal thickness by more than the tolerances given in the table.

## MIRROR SPECIFICATIONS

Miro Tech exclusively uses chemical products from reputable German and Italian companies.

The glass is cleaned with a specialised product that removes any residue generated by the cutting machine process.

Manna Glass Copper-Free Mirror is manufactured with a super-sensitised palladium chloride layer instead of a traditional copper layer. This results in finer silver grain clusters with double passivation and a double application of imported lead-free, environmentally friendly and corrosion-resistant waterproof paint.

## Production procedures composition compared with other mirrors

| | MiroTech mirror | Another copper-free mirror | Typical conventional mirror |
|---|---|---|---|
| washing | ✓ | ✓ | ✓ |
| scrubbing | ✓ | | |
| polishing | ✓ | ✓ | ✓ |
| rinsing | ✓ | ✓ | ✓ |
| sensitization | ✓ | ✓ | ✓ |
| super sensitization* | ✓ | | |
| uses palladium to improve the adhesion of silver film to glass substrate. | | | |
| silver deposition | ✓ | ✓ | ✓ |

| | | | |
|---|---|---|---|
| passivation* | ✓ | ✓ | |
| | rinsed with deionized water, copper free production to protect silver from oxidation | | |
| paint adhesive treatment | ✓ | ✓ | ✓ |
| drying of metallic coating | ✓ | ✓ | |
| application first coat of paint | **unleaded** | leaded/unleaded | leaded/unleaded |
| 1st & 2nd coat baking | ✓ | ✓ | ✓ |
| 2nd coat of paint | **unleaded** | leaded/unleaded | leaded/unleaded |

## Production procedures durability compared with other mirrors:

| | European Norm EN1036 | Typical conventional mirror | Mirotech copper-free mirror |
|---|---|---|---|
| ISO 3768 CASS Test @ 120 hours | | | |
| maximum edge corrosion (µm) | 2500 | 500 - 1000 | 250 |
| spot failures-number/sq. dm. | <0.3 mm | 3 | ≤1 |
| 3<0.3 mm | | | |
| ISO 3770 salt test @ 5% | | | |
| maximum edge corrosion (µm) | 1500 | 300 | 100 |
| spot failures-number/sq. dm. 2<3 mm | 1 ≤1 | | |
| | 5<0.3 mm | | |
| ASTM C 1503-01 salt spray test - 20% US spec for 300 hours | | | |
| maximum edge corrosion (µm) | 3000 | 500 | 200 |
| spot failures-number/sq. dm. 2<3 mm | 1 1 | | |
| | 5<0.5 mm | | |
| max. number of spot failures | 5 | | |
| DIN 50017humidity test - 480 hours | | | |
| maximum edge corrosion (µm) | 200 | 0 | 0 |
| appearance | no clouding of silver film | clouding occurs in 3-4 days | no clouding of silver film |
| ammonia immersion (10%) - 240 hours | no standard established | paint delaminates in 3-5 days | no paint delamination 10 days |
| typical edge failure - 2 hours (µm) | 250 | 200 | ≤50 |
| heat test @ 160 degrees F (71 C) | no standard | severe clouding after 4 hours | no clouding after 10 days |
| heat test @ 425 degrees F (218 C) | no standard | severe clouding after 30 minutes | no clouding after 10 hours |

Normal standard for Miro Tech´s mirrors:

| | | |
|---|---|---|
| Silver thickness | > | 0,76 |
| Cooper thickness | > | Cu Free |
| Base coat | 27 µm | ± |
| Topcoat | 27 µm | ± 7 µm |
| Grid test | ≤ | 2 |

Xylene test ≥ 100

## QUALITY

### 1 INTRODUCTION

Mirror quality can be affected by faults that distort the appearance of the image of reflected objects. Such alterations can result from optical faults, defects in the glass and faults in the reflective coating.

### 2 DEFINITIONS OF FAULTS

- The following definitions apply:
- Optical faults: faults directly associated with the distortion of the reflected image.
- Glass appearance faults: faults which alter the visual quality of the mirror on silver-coated float glass. They can be spot and/or linear and/or enlarged area faults.
- Spot faults: solid or gaseous inclusions, deposits, crush marks etc. In some cases, spot faults are accompanied by a type of distortion called ‘halo’. The nucleus of the spot fault is measurable.
- Linear faults: scratches, extended spot faults, etc.
- Brush marks: very fine, barely visible circular scratches that are associated with glass cleaning techniques.
- Scratches: any kind of scratches that are not brush marks.
- Reflective silver coating faults: faults in the reflective silver layer that alter the appearance of the silvered glass. They consist of scratches, stain, colour spots and edge deterioration.

- Stain: a change in the reflective coating marked by brownish or yellowish discolouration.
- Edge deterioration: discoloration of the reflective silver at the edge of the silvered glass.
- Protective coating(s) faults: faults where the metallic layer is exposed. These can be scratches or loss of adhesion of the protective coating(s).
- Edge faults: faults that affect the as-cut edge of the silvered glass. These can include entrant/emergent faults, shelling, corners on/off and vents.

## 3 GLASS FAULTS

### 3.1 INSPECTION METHOD

The silvered mirror must be observed in a vertical position with the naked eye under normal diffused lighting conditions (natural daylight or simulated daylight, between 300 lux and 600 lux at the silvered mirror) at a distance of at least 1 metre. The direction of observation is normal, i.e. at right angles, to the silvered mirror. The use of an additional intense lighting source such as a spotlight is not permitted during inspection.

The dimension and number of brush marks, scratches and spot faults which distort vision must be noted.

### 3.2 ACCEPTANCE LEVELS

The tables below show the acceptance levels for mirror glass faults for standard sizes.

## Acceptable Defect Tolerances

Acceptable tolerances vary depending on the quality grade and the size of the mirror, but generally follow these limits:

| Defect Type | Central Zone Limits (80% of Mirror) | Outer Zone Limits (Outer 20% of Perimeter) |
|---|---|---|

| | | |
|---|---|---|
| Scratches (Linear) | Generally, not permitted unless very faint and short (e.g., <25 mm). | Permitted if faint and non-bunched. |
| Bubbles & Spots (Point) | Max diameter of 1.5 mm to 5 mm. Usually only 1 to 2 per standard pane area. | Larger and more numerous blemishes are permitted if they do not cluster. |
| Edge Corrosion / Chips | Not permitted at cut edges. | Minimal, small chips are acceptable if they can be completely covered by a frame. |
| Distortion | Strictly no warping, wavy reflections, or magnifying anomalies. | Slight inherent distortion is permitted on very large stock sheets, provided the glass meets standard float glass flatness. |

# 4 REFLECTIVE SILVER COATING FAULTS

## 4.1 INSPECTION METHOD
Same as section 3.1

## 4.2 ACCEPTANCE LEVELS
The reflective silver coating faults are not allowed if they are visible under the condition set out section 3.2

# 5 PROTECTIVE COATING FAULTS

## 5.1 INSPECTION METHOD
Same as section 3.1.

## 5.2 ACCEPTANCE LEVELS
The presence of pinholes, burst bubbles, flaking of the protective coating along the edges or other faults in the protective coating(s) must not be permitted using the method described in section 3.2

# 6. OPTICAL QUALITY

## 6.1 QUALITATIVE VISUAL INSPECTION METHOD
A silvered mirror must be examined in 500 mm × 500 mm areas at a time. The observer must be positioned at 2 metres in front of and perpendicular to the area being examined. An irregular background must be present behind the observer. The

reflected image must not be optically distorted by another reflective surface or window.

### 6.2 ACCEPTANCE LEVELS

The mirror meets the requirements if it does not exhibit any distorting optical variation of the image following the visual inspection described in section 6.1.

## 7 EDGE FAULTS

### 7.1 INSPECTION METHOD

Same as section 3.1.

### 7.2 ACCEPTANCE LEVELS

The edge quality of stock size mirrors can be affected by the presence of entrant or emergent faults and shelling. The edges of the mirrors must be checked for the presence of shells corners and edge vents using the method described in section 3.1.

#### 7.2.1 CHIPS OR SHELLS

For stock sizes, entrant or emergent chips or shells must be accepted provided they do not exceed a maximum length and depth of 10 mm and half the nominal glass thickness.

#### 7.2.2 CORNERS ON/OFF

For stock sizes, occasional corners may be removed or added. No more than 5% of the sheets on a delivery may be affected.

#### 7.2.3 VENTED (CRACKED) EDGES

Vented (cracked) edges are not allowed for stock sizes.

## 8 ENVIRONMENTAL CONSIDERATIONS

Miro Tech products have been developed to be environmentally friendly.

The current Miro Tech production line has enabled the elimination of the copper layer and the reduction of lead content to less than 0.3% (3000 ppm). It has also reduced ammonia waste by 90%.

Miro Tech's mirrors:

1. Lead content in paints has been reduced to less than 0.004% (40 ppm).
* No lead is intentionally added; only limited lead contamination from other natural materials used in the paint's manufacture.
None of the substances identified as substances of very high concern (SVHC) in the REACH Candidate List is present above 0.1% in Miro Tech products.

* http://echa.europa.eu/web/guest/candidate-list-table

## 9 HEALTH AND HYGIENE CONSIDERATIONS

A mirror's environment is its greatest adversary. Over time, humidity and other atmospheric conditions, ammonia-based cleaners and many mastic adhesives used in installation degrade its protective coatings and corrode its reflective surface. Copper-free mirrors are proven superior to conventional copper mirrors. This is evidenced by test results.

To extend the life of your mirrors:

1. Ensure bathrooms are well-ventilated during showers to prevent condensation that can run and pool at the edge.
2. Avoid using ammonia-containing cleaners on your mirrors.
3. Refrain from using acidic silicon and adhesives for the installation of your mirror.
4. Never spray cleaners directly on a mirror. Instead, spray a rag first and then wipe.
5. Always protect the edge from excessive moisture. If the mirror is designed to meet a countertop, ensure that the countertop is kept dry or seal it with a silicone safe for use on mirrors.

6. When in doubt, use a gentle approach. A damp cloth can clean a mirror exceptionally well. An old photographer's technique is to wipe a mirror with newsprint to avoid lint.

## 10. FABRICATION

It is important to emphasise that care must be taken at every stage of fabrication to maintain the integrity of the back and edges of a mirror. Any significant damage to these areas will render the product unusable. Equally important is the cleanliness of the fabrication shop. Dirt, grit, solvents and other contaminants can cause damage not only to the surface but also to the backing.

• Always use gloves when handling mirrors. This provides protection from sharp edges and prevents body salts and chemicals from damaging the edges and backing.

• Regularly vacuum or sweep the cutting tables with a stiff brush to minimise dust and eliminate glass grit and particles that could scratch mirrors.

• Conduct as much fabrication in the factory or workshop as possible to reduce the risk of on-site damage where conditions are typically less than ideal.

• Locate fabrication areas away from parts of the workplace where mirrors could be exposed to solvents, heavy-duty cleaners and other substances that could affect the backing.

• Thoroughly wash mirrors, particularly the backs and edges, after fabrication using only clean water. If a glass washing machine is used, a recommended mild detergent may be employed. Commercial glass cleaners should not be used as they often contain ammonia or other strong chemicals that can damage the mirror edge.

• After fabrication, the glass shop should apply an approved sealant to all edges to provide additional protection against

moisture and other degrading chemical or atmospheric penetration of the backing.

• When grinding and polishing edges, a wet working is the recommended tool.

The following neutral silicones have been approved by Miro Tech's quality department for the installation of mirrors:

- Dow Corning 817 Neutral Silicone
- Silgaze N10 Neutral Silicone
- V-Tech VT-210 Neutral Silicone
- Wacker GN Neutral Silicone
- Dorman Mirror Adhesive
- Bohle Xtragrip Mirror Adhesive
- Other specialist mirror adhesives are available but must be approved

## CLEANING RECOMMENDATIONS

The final step in any outstanding mirror installation is proper cleaning. The techniques described here are good practices for you and should also be passed on to your customers so they can maintain the mirror for the life of the job.

• The best and safest cleaner for a mirror is clean warm water used with a soft cloth. Be careful not to allow the edges of the mirror to get or remain wet for a prolonged period.

• Do not use any acid or alkali cleaners for mirror cleaning after installation. They can attack the surface, edges and backing of the mirror. Never use an abrasive cleaner on any mirror surface.

• Do not use cleaners with heavy ammonia bases. These can also damage the mirror edges and backing and result in a ruined mirror.

• Remove surface marks or stubborn dirt with 0000 oil-free steel wool, not solvents. These could attack and damage the edges and backing.

• Never spray any cleaner directly on a mirror. Instead, apply the cleaner to a soft cloth and then wipe the mirror. This will also prevent “puddling” at the mirror edge where the cleaner could attack the backing.

• Always use soft, grit-free cloths when cleaning a mirror to reduce the risk of scratching the surface.

• Be sure to dry all joints and edges thoroughly to ensure no commercial cleaner encounters the edge and backing.

• Be sure to inform your customers that routine cleaning maintenance can be accomplished simply and effectively by washing, rinsing and drying the mirror.

~ NOTE: Good ventilation will prevent mirrors from “sweating” and creating condensing liquids which could be corrosive and damaging to mirrors.

General Data Sheet
Published June 2026
Supersedes any prior publication until updated