12V Monorail

PLANNING & INSTALLATION GUIDE

BESA LIGHTING

Sensibly Contemporary…

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BESA MONORAIL BENEFITS

Imagine the beauty of handcrafted Besa glass pendants and spotlights with the flexible design options of a high quality monorail system. Designed as an attractive yet easy-to-use system, our Monorail keeps the focus on lighting.

So it looks good and it works. That's what we mean when we say "Sensibly Contemporary."

Rail Highlights:

- HAND-BENDABLE, no tools required, and FIELD-CUTTABLE brass rail sections keep their shape yet allow a variety of configurations
- LOW PROFILE RAIL
  4 Ft and 8 Ft rail sections are less than half inch tall
- Bronze and Satin Nickel finishes available

System Highlights:

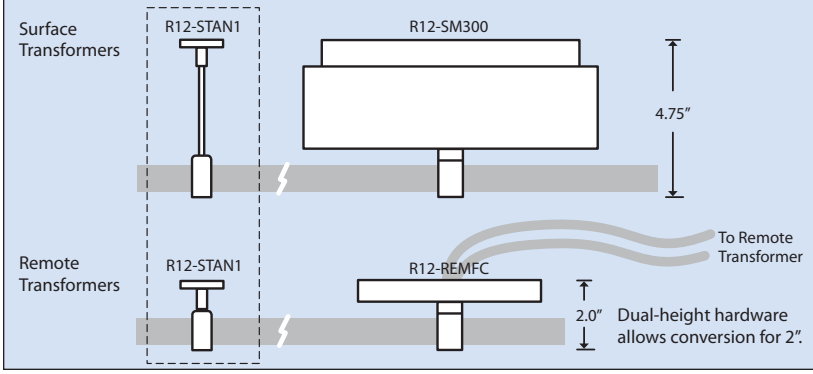
- LOW PROFILE SYSTEM
  Remote Feed Canopy and Dual-height Standoffs allow a closer fit to the ceiling
- EASY TO ORDER System
- 300W electronic or magnetic transformers support up to (6) 50W or (8) 35W low voltage elements
- Swivel Standoffs, Cable Hangers and Remote Transformers provide options for complex plans such as sloped or high ceilings

Designed to utilize the full Besa line of Quick-Connect pendant and spotlight elements

We also offer Quick-Connect Canopies and Accessories.

Besa Standoffs make the system easy

Our Rigid Standoff, supplied with dual-height hardware, has been designed to work with ALL power supply options. No need to worry about which parts go with which transformers.



KIT OR CUSTOM?

The first question in considering monorail, is whether your room can use a basic system or if it needs something more. A kit is perfect if:

- ☐ Your ceiling is only 8-10' high
- ☐ Your ceiling is level and not sloped
- ☐ You want to add no more than six 50W or eight 35W pendant or spotlight elements
- ☐ Your ceiling box is located where you plan to install the system, so you don't require a remote transformer

If you could not check off all four items, you will likely need to select your individual components as shown on the next page. Our "System Planning/Ordering Guide" on the page after that will guide you in planning a system for sloped ceilings, or using remote transformers, or for longer and more complex design options.

PACKAGED MONORAIL KITS

The easiest way to order a monorail system is a basic "Canopy Transformer"-style kit. The kits listed here contain everything you need except your pendant or spotlight elements (ordered separately). Your dealer may offer kits packaged with some of our popular pendant or spotlight items.

8 Foot Kit

All mounting hardware included
Not suitable for sloped ceiling use
Elements ordered separately
Includes:
1- Eight foot rail section
1- 300W surface-mount transformer (8" round magnetic)
3- Rigid Standoffs
2- Rail end caps

Kit Item Number / Description
R12-K08SM-BR 8' Monorail Kit, 300W Magnetic Transformer, Bronze finish
R12-K08SM-SN 8' Monorail Kit, 300W Magnetic Transformer, Satin Nickel finish

12 Foot Kit

All mounting hardware included
Not suitable for sloped ceiling use
Elements ordered separately
Includes:
1- Eight foot rail section
1- Four foot rail section
1- 300W surface-mount transformer (8" round magnetic)
5- Rigid Standoffs
1- Live rail connector
2- Rail end caps

Kit Item Number / Description
R12-K12SM-BR 12' Monorail Kit, 300W Magnetic Transformer, Bronze finish
R12-K12SM-SN 12' Monorail Kit, 300W Magnetic Transformer, Satin Nickel finish

16 Foot Kit

All mounting hardware included
Not suitable for sloped ceiling use
Elements ordered separately
Includes:
2- Eight foot rail sections
1- 300W surface-mount transformer (8" round magnetic)
7- Rigid Standoffs
1- Live rail connector
2- Rail end caps

Kit Item Number / Description
R12-K16SM-BR 16' Monorail Kit, 300W Magnetic Transformer, Bronze finish
R12-K16SM-SN 16' Monorail Kit, 300W Magnetic Transformer, Satin Nickel finish

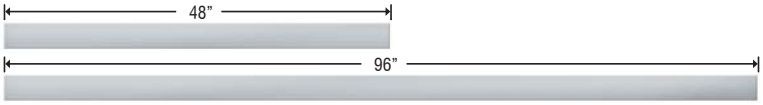
RAIL & FITTINGS

Rail Sections

Low profile brass rail is hand-bendable and field-cuttable for a variety of configurations

4FT: 48" L x 0.18" W x 0.4" H
R12-RAIL4-BR Bronze
R12-RAIL4-SN Satin Nickel

8FT: 96" L x 0.18" W x 0.4" H
R12-RAIL8-BR Bronze
R12-RAIL8-SN Satin Nickel



METAL FINISHES:

BR Bronze **SN** Satin Nickel

End Cap

Finishes off the end of the rail

R12-NDCAP-BR
R12-NDCAP-SN

Live Rail Connector

Physically & electrically connects two rail sections on same transformer

R12-ICONN-BR
R12-ICONN-SN

Isolating Rail Connector

Physically connects two rail sections, on separate transformers

R12-DCONN-BR
R12-DCONN-SN

SUPPORT HARDWARE

Rigid Standoff

For use with all power supplies. Includes dual height hardware, for either 2" or 4.75."

R12-STAN1-BR
R12-STAN1-SN

* 2" height for use with Remote Feed Canopy

Swivel Standoff

For use on sloped ceilings with all power supplies. Post is field-cuttable for height adjustment

R12-STAN2-BR
R12-STAN2-SN

Extension Posts

Field-cuttable posts for longer suspensions on Besa standoffs (Rigid or Swivel)

R12-EXT06-BR 6"
R12-EXT06-SN

R12-EXT12-BR 12"
R12-EXT12-SN

R12-EXT18-BR 18"
R12-EXT18-SN

Adjustable Cable Support

For longer drops, includes 5' of cable. Recommended for use with minimal curves. Rail connection includes an adjustable cable retainer, for ease of use.

R12-CBL60-BR
R12-CBL60-SN

T-Bar Clips:

All Besa standoffs and cable supports are compatible with standard T-Bar clips, for use with suspended ceiling systems. Standard clips utilize a 1/4-20 threaded post, 5/8" long.

POWER SUPPLIES

Surface Transformers*

Magnetic, 300W

R12-SM300-BR
R12-SM300-SN

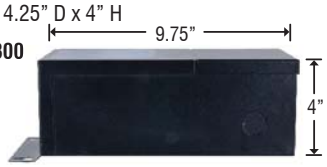
Remote Transformers

Electronic 300W DC
10.375" L x 1.625" D x 1.875" H

R12-RD300

Magnetic 300W
9.75" L x 4.25" D x 4" H

R12-RM300



* Surface Transformers and Remote Feed Canopy include 2' of Flexible Feed Cable (10 AWG)

Remote Feed Canopy*

For use with Remote Transformer applications

R12-REMFC-BR
R12-REMFC-SN

Flexible Feed Cable

5 Ft of cable for longer reach (10AWG)

R12-FLX60-BR Bronze
R12-FLX60-CL Clear

Covering almost any design need, our system components have been specifically designed to simplify the ordering process.
Follow these 3 simple steps to determine the components you need. For reference, the Besa Monorail components are listed on the next page.

Then choose your rail-ready Besa pendant and spotlight elements, using series #RSP (for spotlights) or #RXP (for pendants).

Step 1) Select the appropriate power supply for your needs:

A) Determine total load

QTY Desired Light Elements = _____ x Wattage = _____ Total Load

B) When the Power Supply is local to the monorail *(surface-mounted)*

Total Load (Watts) _____ ÷ 300 = _____ *(QTY)* **R12-SM300** Magnetic Surface Transformer

C) When the Power Supply is remote

Total Load (Watts) _____ ÷ 300 = _____ *(QTY)* **R12-RD300** Electronic Remote Transformer

OR _____ *(QTY)* **R12-RM300** Magnetic Remote Transformer

PLUS _____ *(QTY)* **R12-REMFC** Remote Feed Canopy

(required with either electronic or magnetic remote transformer)

Total Load Suggestions

- For all 50W elements, simply multiply QTY x50
- For elements with different lamp ratings, simply ADD all the wattages

For optimal performance, it is best to locate the feed near the center of the rail

Step 2) Select your rail and fittings:

A) Rail Sections

Total Desired Length (in Ft) _____ ÷ by 8 = _____ *(QTY)* **R12-RAIL8** 8 Ft Sections

(if needed to achieve desired length) _____ *(QTY)* **R12-RAIL4** 4 Ft Sections

B) Live Rail Connectors

QTY Rail Sections _____ – QTY Power Supplies = _____ *(QTY)* **R12-ICONN** Live Rail Connectors

C) Isolating Rail Connectors

QTY Power Supplies Per System _____ – 1 = _____ *(QTY)* **R12-DCONN** Isolating Rail Connectors

(may be 0 if qty of power supplies = 1)

D) End Caps

QTY Systems Ordered _____ x 2 = _____ *(QTY)* **R12-NDCAP** End Caps

Rail Length Suggestions

- For rail sections, round up or add 4' length(s)
- Curves require extra rail, we suggest adding 20% to the total

Step 3) Select the right support hardware:

A) For Standard Flat Ceiling *(rigid standoffs)*

Total Length of System _____ ÷ 2 = *(QTY)* *(QTY)* **R12-STAN1** Rigid Standoffs

B) For Sloped Ceiling *(swivel standoffs)*

Total Length of System _____ ÷ 2 = _____ *(QTY)* **R12-STAN2** Swivel Standoffs

(sloped ceiling use typically requires extension posts, below)

C) For High Ceiling *(adjustable cable support)*

Total Length of System _____ ÷ 2 = _____ *(QTY)* **R12-CBL60** Adjustable Cable Supports

QTY Power Supplies per system = _____ *(QTY)* **R12-FLX60** Flexible Feed Cable

D) To Increase Height of Standoffs

QTY of Rigid or Swivel Standoffs _____ = _____ *(QTY)* **R12-EXT06** 6″ Extension Posts

(choose extension length) _____ *(QTY)* **R12-EXT12** 12″ Extension Posts

_____ *(QTY)* **R12-EXT18** 18″ Extension Posts

Standoff Suggestions

- A surface transformer often acts as a support, which may reduce the qty of rigid standoffs by one
- On sloped ceilings, typically the height of the standoffs will vary, so extension posts may be required

Add finish choice to your part numbers: ☐ **-BR** Bronze ☐ **-SN** Satin Nickel

The Besa monorail system was designed to accomodate almost any system need that might arise.
So the possible configurations are almost endless...

Straight Line

Shown here in Bronze, as a low-profile configuration with Remote Feed Canopy.

Basic S Curve

Standard 8 Ft. Kit

Tight S Curve

Standard 8 Ft. Kit

Free-Form

Standard 8 Ft. Kit

Besa Quick-Connect canopies and accessories offer you additional creative lighting options

3 Light T23XQ-SN round canopy shown here with Mica spotlights in Blue

Besa bar canopies can be wall-mounted for use with Besa spotlights.
3 Light T23VQ-BR shown here with Scope spotlights in Clear/Frost.

6 Light T26XQ-SN round canopy shown here with 6 *Skyhooks* and Mia pendants in Garnet

QUICK-CONNECT CANOPIES

Compatible with Besa Quick-Connect Pendants and Spotlights

Integral 12V electronic transformers

T21Q
1 Light

T21MQ
1 Light

T23VQ
3 Light Bar

T24VQ
4 Light Bar

T23XQ
3 Light Round

T26XQ
6 Light Round

Rail Adapter (R12-QCADP)

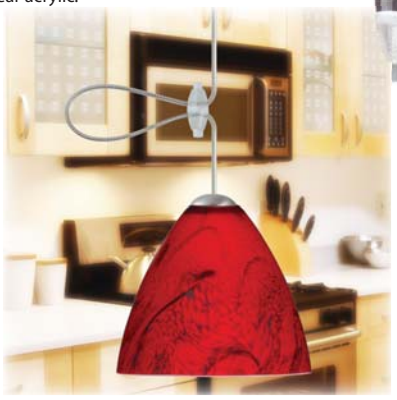
For connecting Besa Pendant or Spotlight Elements to Besa monorail systems only. Available separately for use with #SP or #XP series elements, or included as part of the #RSP and #RXP element configurations.

Skyhook™ Suspension Hooks (T100)

Allow pendant drops to be placed as desired. Easily overcome the problem of an inconveniently placed junction box. Skyhooks are suitable for use on sloped ceilings.

Pendant Height Adjuster (CA1-CL)

Shorten low voltage pendant cords without cutting.
Made of clear acrylic.



Besa Quick-Connect Pendants and Spotlights are compatible with Besa Monorail and Quick-Connect Canopies. They are available from your dealer.

Spotlights:

DIVI
3.375" x 2.625" H
50W MR16

MICA
3.375" x 1.75" H
50W MR16

NICO 3
3.25" x 3.0" H
50W MR16

SCOPE
2.375" x 4.0" H
50W MR16

TAMBURO 3
3.0" x 3.0" H
50W MR16

TIPSTER
No Glass
50W MR16

Pendants:

BABYBELLE
3.0" x 7.25" H
35W Bi-Pin

BAGGIO 7
7.0" x 8.5" H
35W Bi-Pin

BRELLA
6.0" x 4.0" H
50W Bi-Pin

CANTO
4.0" x 4.125" H
50W Bi-Pin

COPA
3.125" x 9.875" H
50W Bi-Pin

COURGETTE
2.75" x 7.0" H
35W Bi-Pin

DIVI
3.375" x 2.625" H
50W MR16

DOMI
5.0" x 2.875" H
50W Bi-Pin

HOPI
7.5" x 5.5" x 2.75" H
50W Bi-Pin

KANI
5.75" x 4.5" H
50W Bi-Pin

KARLI
4.0" x 7.5" H
50W Bi-Pin

KARLITO
2.75" x 5.75" H
35W Bi-Pin

KIKI
3.75" x 6.0" H
35W Bi-Pin

KONA
5.5" x 2.5" H
50W Bi-Pin

LASSO
4.75" x 3.0" H
50W Bi-Pin

LEXI
5.5" x 3.625" H
35W Bi-Pin

MIA
5.0" x 4.5" H
50W Bi-Pin

MICA
3.375" x 1.75" H
50W MR16

NICO 3
3.25" x 3.0" H
35W Bi-Pin

NICO 4
3.5" x 3.75" H
35W Bi-Pin

PAHU 4
4.0" x 7.0" H
35W Bi-Pin

PALLA
4.75" x 3.875" H
50W Bi-Pin

PERI
5.375" x 3.125" H
50W Bi-Pin

SABRINA
4.4" x 3.5" H
50W Bi-Pin

SCOPE
2.375" x 4.0" H
50W MR16

SILO
3.125" x 7.875" H
50W Bi-Pin

SPAZIO
8.75" x 2.5" H
50W Bi-Pin

TAMBURO 3
3.0" x 3.0" H
35W Bi-Pin

TAMBURO 4
3.0" x 4.125" H
35W Bi-Pin

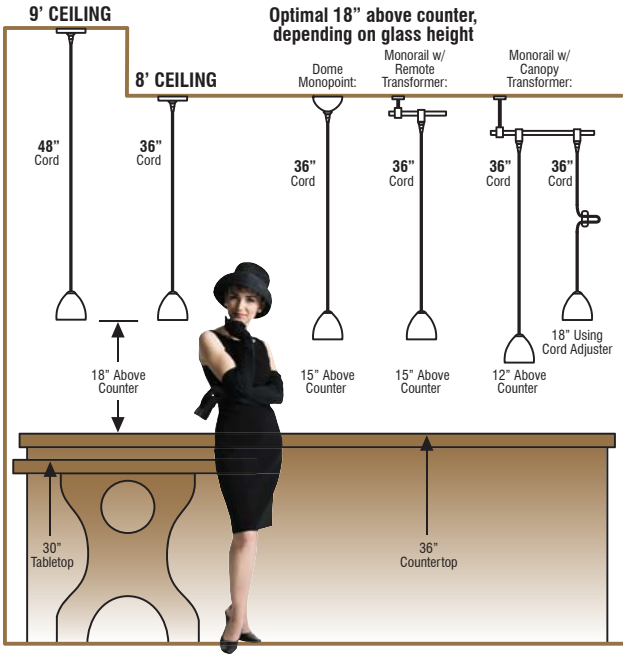
TAY TAY
4.125" x 3.875" H
50W Bi-Pin

TRILO
7.0" x 3.125" H
50W Bi-Pin

ZUMI
2.625" x 10.0" H
35W Bi-Pin

Pendant Height Settings

Set your pendant at a height that will provide optimal light without generating glare. This diagram shows some general guidelines.



12V Power Supplies

MONORAIL SYSTEM:

The low voltage transformers available for our Monorail System are 300W, which can power up to six 50W elements. Depending on the design requirements, an electronic or magnetic type can be ordered.

Electronic transformers are smaller and lighter, so they are preferred for their low-profile appearance. It is important to use a low voltage electronic dimmer, as failure to do so can substantially shorten the useful life of the transformer.

Magnetic transformers are desirable for reliability and ease of dimming, so they are typically recommended for commercial applications. Our magnetic surface transformers come standard with a debuzzing coil to reduce noise when using a low voltage magnetic dimmer.

REMOTE TRANSFORMERS:

When using a remote style transformer, the transformer must be installed in an accessible location such as a closet. Because of voltage drop, it is important to select the appropriate gauge wire to run from the remote transformer to the monorail feed. Failure to do so can result in excessive voltage drop, which causes the lamps to dim.

REMOTE TRANSFORMER WIRE CHART
300W 12V System

Distance	10'	20'	30'	40'
Wire	#10 AWG	#8 AWG	#6 AWG	#4 AWG

Our magnetic remote transformer has multiple secondary connections, which can be used to compensate for voltage drop. It is important to follow the installation instructions, as over-driving the lamps can dramatically shorten lamp life.

Low Pressure Halogen Lamps

Besa 12V Quick-Connect Pendant Elements are provided with a low pressure halogen lamp, suitable for use in Open Fixtures. A halogen lamp shield is not required. Lamps suitable for use in Open Fixtures must be used when relamping.

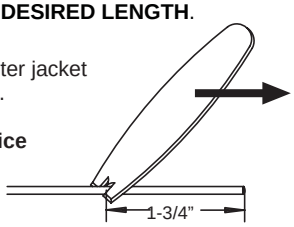
Please note, if a halogen lamp that is not suitable for use in Open Fixtures is used, then a halogen lamp shield would be required. These may be ordered separately. The marking on the lamp carton indicates the use, based on these icons:


NOT Suitable For Use In Open Fixtures

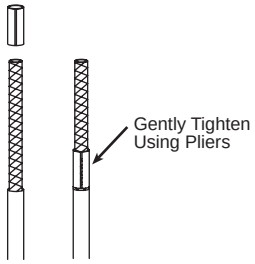

Suitable For Use In Open Fixtures

Quick-Connect Jack Installation

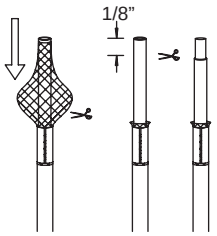
1. Making a clean cut, and **SHORTEN THE CORD TO THE DESIRED LENGTH**.
2. Carefully strip off 1-3/4" of the outer jacket using the Stripping Tool provided. **It is important not to damage the inner silver braiding. Practice this step on a scrap section of cord first.**



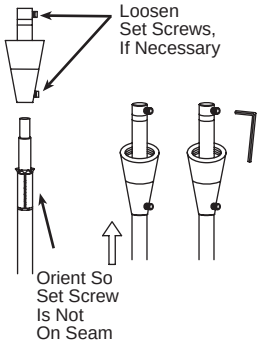
3. Slide the Brass Collar over the braiding. Make sure the Brass Collar does not damage the braiding to ensure a good connection.



4. Remove the exposed braiding by pulling away from the center conductor, then cutting off excess. Leave 1/16" of braided material or less.
5. Strip off 1/8" of insulation from the Center Conductor. The exposed stranded wire of the Center Conductor must be tightly wound before proceeding.



6. Feed the wire until it reaches the top set screw position. Confirm by viewing the Center Conductor through the Viewing Hole.
7. The Brass Collar should align with the bottom of the Quick-Connect Fitting, if not then trim the Center Conductor.
8. Tighten the top set screw first, then the lower. Do not overtighten the set screws and make sure the set screws avoid the seam in the Brass Collar. The pendant can now be installed onto Quick Connect Adapter.



9. Insert the post of the Quick Connect Fitting into the Quick Connect Adapter. Thread the top half of the conical section until it seats with the adapter.

A) Read all instructions.
B) Do not conceal or extend exposed conductors through a building wall.
C) Do not install this system in wet locations.
D) For low voltage exposed insulated conductor systems required by 30.1(c) do not install any part of this system less than 7 feet (2.2m) above the floor.
E) To reduce the risk of fire and burns, do not install this lighting system where the exposed bare conductors can be shorted or contact any conductive materials.
F) To reduce the risk of fire and overheating, make sure all connections are tight.
G) Do not install any luminaire closer than 6 inches (15.25 cm) from any curtain, or similar combustable materials.
H) Turn off electrical power before modifying the lighting system in any way.

Installation of the 12V Monorail System

NOTE:
To install each component, refer to individual Installation Instructions that are provided with each component.

1) Getting Started

Carefully remove all of the system components and the corresponding installation instructions provided with each component.

2) Transformer Installation

HINT:
For optimal performance, it is best to locate the feed near the center of the rail system.

For Remote Transformer (R12-RD300 or R12-RM300):
A) Determine Remote Transformer location.
B) Extend wire from the Remote Transformer to the J-Box for the Remote Feed Canopy (R12-REMFC).
C) Install the Remote Feed Canopy to the J-Box.

For Surface Transformer (R12-SM300):
A) Determine the Surface Transformer location
B) Install the Surface Transformer to the J-Box

3) Layout the Rail Sections:

IMPORTANT!
After field-cutting rail, clean middle section to eliminate all metal fragments.

A) Position the rail sections on floor and determine the layout design
B) If necessary, field cut and hand bend the rail to the desired length and shape
C) Install the Rail Connectors. Note that R12-ICONN is conductive, and R12-DCONN is non-conductive.
D) Install the End Caps (R12-NDCAP) onto both ends of the monorail run

IMPORTANT!
Do NOT use the Rail Connectors on the field-cut side of the rail, only use with the factory cut side.

4) Install Monorail Supports:

A) If necessary, cut the standoff stems to the desired length
B) Using a plumbline, mark the standoff locations on the ceiling
C) Install the standoffs onto the ceiling

5) Install the Rail:

A) Raise the rail and secure to the standoffs and the transformer feed

HINT:
For long runs, it is easiest to install the rail sections first, then install the rail connectors.

6) Install the Rail Adapters and Elements:

A) Secure the Rail Adapters to rail in the desired location for the Elements
B) For Pendant Elements, shorten if necessary and install the quick connect fitting
C) Install the Elements onto the Rail Adapters by threading on the quick connect fitting
D) Install the appropriate lamps into the Elements.

7) Turn system on

IMPORTANT!
If system does not turn on, shut off power and refer to the monorail troubleshooting guide.

After the first half hour, switch off and check all connections for excessive heat. Loose connections must be tightened to prevent overheating, which can damage the system and pose a potential fire hazard. Do not overtighten.

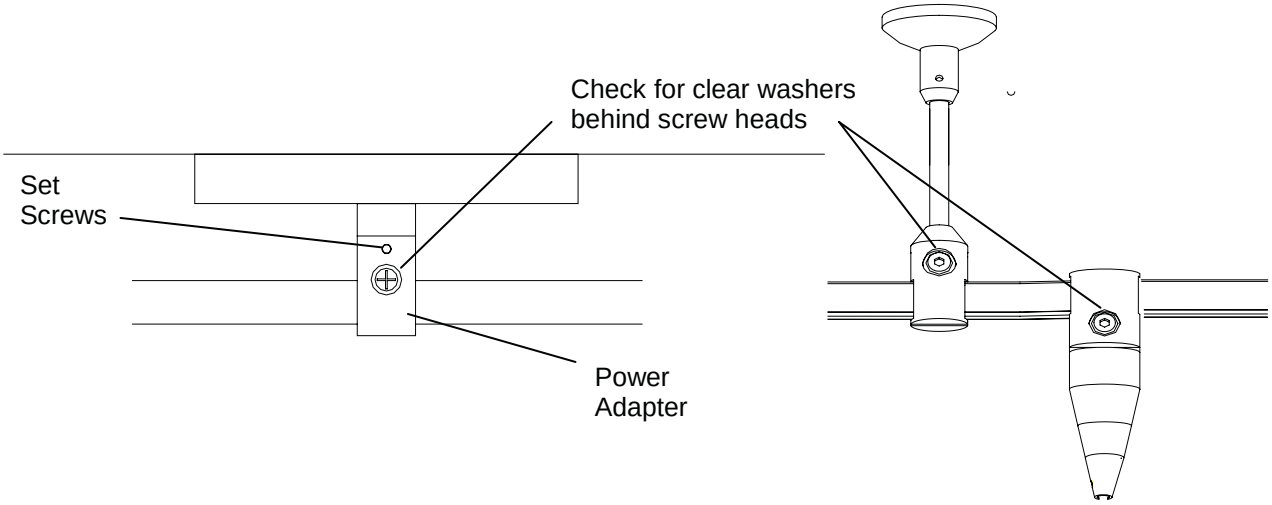
Please note, complete detailed instructions are included with each Besa Monorail component.

A) Problem: The system does not turn on.

Switch off power immediately and turn off power at main circuit breaker.
Leaving power on during a short will harm the transformer.

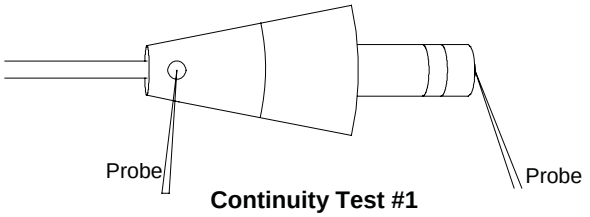
1. Confirm that total load does not exceed 300 watts, then check for short circuit condition at the rail.
You will need a continuity tester or multi-meter to check for shorts.

i. Loosen the set screws on the power adapter that comes out of the transformer and disconnect the adapter completely from the transformer.
ii. Remove any quick connect pendants or fixtures by screwing out. The quick connect adapters must remain on the rail.
iii. Check for continuity by placing a probe on each monorail conductor. The tester should **NOT** light.
iv. If the tester lights it is indicating a short circuit which is unintended. The most common reason for a rail short is a missing washer behind the screw heads on the standoffs or the quick connect adapters. Contact your local Besa Distributor if any replacement parts are needed.
v. If the rail checks out OK, proceed to Step 2 below.

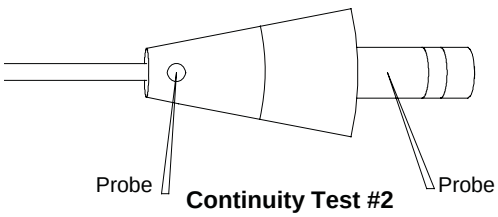


2. It is possible that a short or open circuit exists at the Quick Connect.
You will need a continuity tester or multi-meter to help check the Quick Connect.

i. Remove the lamp. Place a probe on the base of the collar and the other on the end of the Quick Connect, per Continuity Test #1. The tester should not light. If the tester lights, it is indicating a short circuit, refer to the **Quick Connect Repair and Troubleshooting** section on next page. Otherwise, move to the next step to check for an open circuit.
ii. Reinstall lamp and perform the same continuity test as above. If the tester lights, then the Quick Connect has been installed properly and you can proceed to Step 3 on next page. If the tester does not light, you either have an open circuit or a defective Quick Connect.
iii. Test the Quick Connect by performing an additional continuity test with the probes shown in Continuity Test #2. If the tester does not light, the Quick Connect part is defective and needs to be replaced (Contact your local Besa Distributor). If the tester does light, refer to the **Quick Connect Repair and Troubleshooting** section on next page.



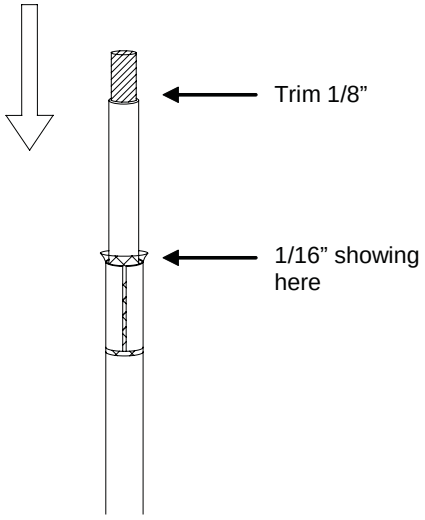
Continuity Test #1

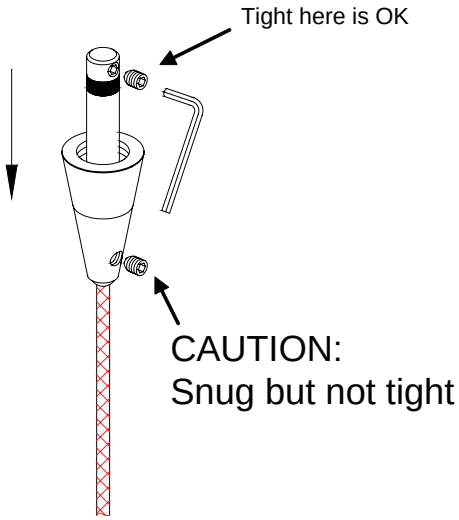


Continuity Test #2

Quick Connect Repair and Cable Troubleshooting

Remove the Quick Connect Jack from the cord and follow the troubleshooting directions below:

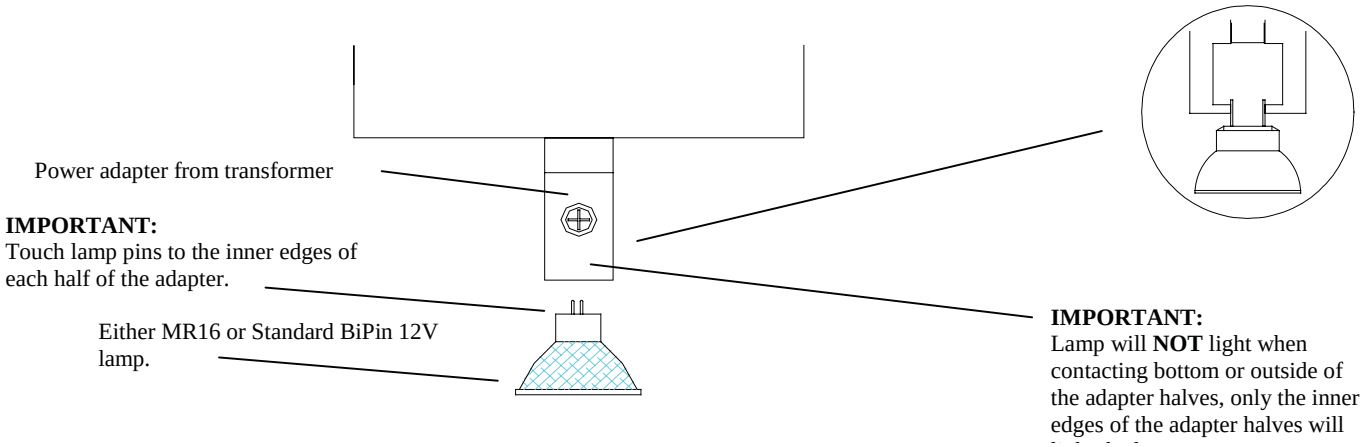




1. Verify that 1/8” of insulation has been trimmed from the inner wire.
2. Verify that approx. 1/16” of braided wire protrudes from the top of the collar.
3. The distance from the bottom of the collar to the top of the inner wire should be 1 3/4”.
4. Reinstall the Quick Connect part, verifying that the 1/8” of bare conductor has been extended into the top part. The top set screw must make contact with the bare conductor.
5. Perform continuity check before mounting. If an open or short still exists, then a complete Quick Connect reinstall is recommended. Cut the cord below the collar and follow the instructions provided with the pendant.

3. You’ve checked and corrected all shorts and/or open conditions, but still the system does not turn on.
First of all, if using a magnetic transformer, verify that the circuit breaker has been reset.

i. Check the transformer. Shorts can damage the transformer if not immediately removed. The transformer output is high frequency and cannot be seen by most multi-meters. A simple lamp test can verify the status of the transformer: **Caution: Have a qualified person perform this operation.**
ii. Remove rail from power adapter halves coming from the transformer, then restore power to the transformer.
iii. Hold a 12volt lamp with a clean cloth rag or glove and raise it to the transformer. Touch the pins of the lamp to the inner edges of each half of the adapter. **Do this only for 1 to 2 seconds! A lit lamp indicates a good transformer.** Contact your local Besa Distributor if a replacement transformer is needed.
iv. Turn off power; remove insulator and re install monorail to the power adapter.



B) Problem: Sections of the system (not the fixtures) feel hot to the touch.

1. Heat is an indication of a poor electrical connection. The high current in low voltage systems requires intimate contact between conducting parts. If only a partial connection is present the system may still operate but the current flow through the small contact area will heat up.
   CORRECTIVE ACTION:
   Make sure connections involve firm metal to metal contact, firmly tighten the screws on rail adapters, quick connects and fixture adapters. Operate system for 20 to 30 minutes and re-check the hot spot. If not corrected replacement of the part is warranted.

C) Problem: Lights burn out quickly, or burn very brightly.

1. Bad socket connection.
   CORRECTIVE ACTION:
   Inspect lamp pins for evidence of discoloration.
2. Finger oils on quartz lamps.
   CORRECTIVE ACTION:
   Wipe the glass with a clean soft cloth on all lamps after installation.

D) Problem: System comes on but lights flicker or, are dim.

1. Insufficient minimum load……. (Electronic transformers only)
   CORRECTIVE ACTION:
   Increase lamp load to above the minimum (see transformer instruction sheet).
2. Wrong lamps installed; 24 volt lamps operating from a 12 volt power supply.
   CORRECTIVE ACTION:
   Re-lamp with 12 volt lamps.
3. If lamps become dim or flicker after operating normally over for a period of time. This is a sign of deteriorating 12volt connections due to the high current.
   CORRECTIVE ACTION:
   Re check all secondary connections paying close attention to any discoloration, oxidation or hot spots.

E) Problem: The circuit breaker on the main panel trips on initial power up.

1. There may be a short on the 120-volt side of the transformer.
   CORRECTIVE ACTION:
   Re check connections and perform a continuity test.

2. Frequent tripping of circuit breaker upon system start up may be nuisance tripping. This caused by high inrush current needed to start up cold lamps.
   CORRECTIVE ACTION:
   The use of a dimmer helps to buffer the load to the transformer.