RLW 518-GL-Nn3 A-Frame Turntable

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This document describes the assembly, of the RLW 518 A-Frame turntable.

RLW 518 A-Frame Turntable Mounted on the RLW 519-001 Turntable Pit
1.0 Introduction

Congratulations on your purchase of the Republic Locomotive Works Turntable kit. This kit is for the construction of an Nn3 A Frame turntable as shown in the picture above. This kit can be used to construct a high fidelity N scale replica of the Narrow Gauge Turntable at Laws California built in 1883 for the Carson and Colorado Railroad. Similar turntables were constructed at Keeler and Owenyo in California and at Candelaria Nevada. The picture above shows a typical result that you can achieve building this kit. It is shown mounted in an (unpainted) RLW 519-001 turntable pit.

Turntables were used to turn steam engines and rolling stock. Steam engines operate better when pulling loads forward. Turntables were often used where the space required or extra cost to construct a wye or reverse loop was prohibitive.

Companion documents describe how to construct the Box Frame turntable (Also included in this kit) (RLW 518) and turntable pit kits RLW 519-001 or RLW 519-002.

These superb turntable models were originally designed by Vince Daal of Port Daals. RLW redesigned them to improve the operational characteristics while retaining fidelity to the original modeling skill shown in the Port Daals kits. We converted the pit from a hydrocal base to a resin base and built in the means to easily add manual and automated indexing operation. Finally, the turntable styles were enhanced to include both box style and A-frame style turntables. These turntables were also redesigned using laser cut parts for faster and more prototypically accurate assembly components.

2.0 Kit Content

The kit comes with parts for constructing either a box frame or A frame turntable and the appropriate beams and support beams needed. Some of the support beams and the foundation beams will be used out of this kit for the A frame turntable. These instructions are for the A frame turntable. If you want to build a box frame turntable, please use the other instructions provided.

2.1 Box Frame Parts Fret

The Box Frame parts fret is labeled Port Daals 518-B-16-A.

![Figure 2.1.1 Box Frame Fret.](image-url)
2.2 Table Base Fret

This fret holds the Turntable base. It is labeled Port Daals 518-B-16-B.

![Figure 2.2 Table base Fret](image)

2.3 A Frame Parts Fret

This fret holds the wooden A frame parts. It is cleverly labeled A-Frame.

![Figure 2.3 A-Frame Parts Fret](image)

2.4 Cabling Elastic Strands

These gray strands of elastic are used to simulate the cables that bear the weight of a locomotive on the A frame turntable when it is loaded.

2.5 Bolt Wire

This is 0.010 brass wire used to model the bolts holding the A frame together through the center beam.

2.6 Brass Panel

The brass panel is used to construct cable raceways on the top of the A frame and on the center beam in the A frame.
2.7 Additional Items Required, Not in the Kit

2.7.1 PC Board Ties
RLW has PC Board ties. These are part number DGM100. You will require 34 PC board ties each 5/8 inch long. One package of DGM100 tie strips is sufficient for this kit.

2.7.2 Code 30, 40 or Code 55 Rail
You may use either code 30, 40 or code 55 rail for the table rails. While it is possible to use code 55 for the pit rail circle; it looks oversized to our taste and therefore code 40 or smaller rail is recommended. However, note that it is probably best to match the rail size that are expected on the feeder track.

2.7.3 Fine Rosin Core Solder
We recommend using Kester Electronic Silver Solder (0.020 diameter) available at most electronic shops or from Digi-Key (Part number KE1802-ND).

2.7.4 Paint
Depending on your prototype, you will need paint to paint the turntable and A frame. For the SPNG, a faded oxide red is appropriate. These turntables rapidly faded in the hot desert sun. Any exposed wood turned gray. Exposed iron rapidly rusted rail-brown including both hardware and the rails. Thus, the support cables rapidly became a gray-brown color in the hot sun when spiced with winter cold and water.

2.7.5 Optional items you may want to add:
The following are optional items you may need depending on alternatives you select.

- Small bits of brass to simulate nuts, bolts and washers. These are used to add additional detail.
- #80 Machine screws and washers (4 of each needed) no more than 1/4 inch long. These are used in the tapped holes in the shoulder washer to attach a turntable.
- A pair of small wire connectors. These allow easy disconnection of the contactor base from the turntable and rotational platform. Hermaphroditic connectors such as these can be extracted from a low profile IC socket such as Digi-Key part number ED3120-ND or a similar part likely available from your local electronics parts store (e.g. Radio Shack). You will need at least 4 of these.
- A pair of different colored 3/64 inch heat-shrink tubing about 3/4 inch long. These are used as insulators around the connectors above. Cutting the 3/4 inch pair in half
Kit Content

provides the four insulators you need.

Figure 2.7.2 Heat Shrink Tubing (3/64 inch diameter)

2.8 Tools Required

2.8.1 Drill and #65 and #77 Drills
The #77 drill is used to create bolt holes on the A frame; while the #65 drill is used to drill holes in the cable mount beam where the cable is mounted.

2.8.2 ACC Glue
For this, kit, the Gel form of ACC glue is recommended.

2.8.3 Glue Applicator
Precise application of glue is important in constructing this kit and so a means to deliver a tiny drop of glue is needed. This can be done with a commercial glue applicator; or a toothpick.

2.8.4 Nn3 Gauge (e.g. RLW 2429)
These gauges are used to keep the rails in gauge as you tack and then solder them to the PC rails. You can use either RLW 2428 or RLW 2429. Also, Aspen Model 4014-40 (code 40 rail) and Aspen Model 4015-55 (Code 55 rail) are useful.

2.8.5 (Optional) #80 Tap
This is used to tap the shoulder washer on the rotational platform on the 519-1 turntable pit for #80 machine screws.

2.8.6 Ohmmeter or Continuity Tester
Use this to test the turntable track to make sure that continuity is where it is supposed to be and that the two rails aren’t shorted together.
3.0 Construct Table Base

3.1 Prepare base and foundation beams.
Cut out the table base from the fret.

![Figure 3.1.1 Shows the table base with some PC ties glued down.](image)

3.2 Construct the turntable track.
1. Cut 34 PC board ties each 5/8 inch long.
2. Cut two pieces of rail 5 inches long (To be trimmed later to correct length). Choose either code 40 or code 55 rail.
3. Glue down every other PC tie on each side of the base and allow to dry. Figure 3.2.1 shows the result of doing this. The reason for doing this is that it enables you to use the scoring on the table base to align the rails so that they are dead center on the base. If you glue down all the PC ties, then you can no longer see the alignment scoring.

![Figure 3.2.1 Alternating PC tie placement](image)

4. Align and tack down the rail using a track gauge and a small sliver (3/64 inch) of rosin core solder on each end and the center. Make sure to align each rail along the scored line on the base and in proper Nn3 Gauge. Figure 3.2.2 shows the result of
doing this. Be sure that the gauge is correct here. This will ensure that the remaining soldering of rail to PC ties will be easy to maintain in gauge.

It is **very** important that the rails be in proper alignment balanced along the scored lines and in gauge for optimal operation of the table. So take it slow and be careful.

5. Once you’ve tacked down the rail, then insert the other PC ties and glue them down. It is easiest to place a small dollop of glue on each side of the interior tie after the tie has been inserted under the rail. A pair of tweezers may be used to twist the PC tie over the glue on the base and align it. Figure 3.2.4 shows a sketch of how to do this; while Figure 3.2.5 shows a picture of this in progress:
Do all the interior ties. Allow the glue to dry thoroughly. Figure 3.2.5 shows the glued down interior ties.

6. Solder down the rail to each PC tie. Use small radius rosin core solder to do this. We recommend using Kester Electronic Silver Solder (0.020 diameter) available at most electronic shops or from Digi-Key (Part number KE1802-ND). This solder has superb conductivity and is very strong so your track will be effectively permanent. Cut off small pieces in lengths of 3/64 inches and place on the edge point where the outside of the track lies on the PC tie. The reason to use small pieces instead of feeding the solder continuously is to limit the amount of solder that flows onto the track. Heat the rail right over the PC tie until the small piece of solder melts and runs under the tie. The heat will transfer to the PC cladding and bond to it. There is a small amount of rosin in the core of this solder that acts to prep the nickel silver rail and the copper in the cladding to make the solder amalgamate with the copper and (copper in the nickel silver) rail. It is wise to keep the track gauge near and on the track so that the track remains in gauge as you solder it down. Also, it is wise to solder every other tie point so that you never overheat the copper cladding. The reason for this is so that the copper cladding doesn’t unbond from the pc base material. Keep doing every other one until you complete all 68 solder points. This will help keep the alignment precise and will prevent the copper cladding on the PC boards from lifting off the ties. Figure 3.2.6 shows the result of this soldering.
7. Take a high Track Per Inch razor saw (at least 48 TPI) or thin cut-off wheel on your rotary tool and cut a thin line through the copper cladding down the center of the PC ties. Figure 3.2.6 also shows the result of doing this. Be careful to only cut through the copper cladding on the surface. You want the tie material below the cladding to be left to provide additional strength to the track and to assure correct track gauge. It is important to cut all the way through the copper cladding on each tie because this insulates each rail from the other rail. Any tie whose cladding is not severed will create a short circuit.

8. Test to make sure that the two rails are electrically isolated from each other. Use an ohmmeter or continuity tester to assure that you have extremely high resistance between the two rails. (Anything over 5 Megohms resistance is great! ;)).

9. Strip 1/8 inch of insulation off from each of the wires from the rotational platform and solder them to the base of each rail. Use the center hole in the table base to route the wires up to the rails. By soldering the wires to the base you minimize their appearance on the turntable. Figure 3.2.7 below shows this step.

10. (Optional) Attach Turntable Base onto the Rotational Platform
Before mounting the A-Frame, you should mount the turntable base on the rotational platform if you are building your turntable to fit on the RLW 519-1 turntable pit. The instructions in the 519-1 also describe how to do this and are repeated here.

There are two options, you can tap the rotational platform for 0-80 screws or you can glue the turntable base down with brass wire. The rotational platform has four holes that are the correct tap size for a 0-80 screw.

In both cases the first step is to guide the track wires down the center of the rotational platform

Use of 0-80 Screws. Using a 0-80 tap, tap each of the four holes for an 0-80 screw. Use either two or four 0-80 3/8" fillet head screws to bolt down the turntable. These taps are available at your local hobby shop and are not part of the kit.

Use of brass wire to glue the turntable base. Alternatively, cut 4 3/8 inch pieces of brass wire (0.015) and glue them in the holes. Place the turntable in the exact center of the rotational platform. The table base has a hole in the center that you should place
Construct Table Base

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directly over the rotational shaft in the center of the rotational platform. Make sure that the table is exactly centered for smooth operation. Bend the wires over turntable base to hold it firmly and glue the brass wires onto the base.

11. (Optional) Build and attach Tiny Connectors.

To assist in easy disassembly of the turntable from the RLW 519-1 turntable pit, you may want to add a set of tiny connectors. The instructions in this section are also repeated in the instructions for the 519-1 turntable pit. If you complete this section, then you don’t need to repeat it when you construct the 519-1.

To complete this part you will need the 4 hermaphroditic connectors shown in the optional parts above and the heat-shrink tubing. Figure 3.4.1 below shows the basic layout. The first step in this section is to cut the long twisted pair of track power wires from the disconnected end about 1 inch from the end of the twisted pair. The four connectors have a both a male and female part so they can be used for both sides of the connection. For the two connectors attached to the long wires connected into the turntable track:

- Strip 3/64 inch of insulation off from the light and dark colored long wires to be attached to the turntable track and the two wires emanating from the contactor base.
- Tin the ends of the wire. (Heat the wires up and put a small dab of solder so that all the strands of the wire stick together).
- Put a 3/8” long piece of heat-shrink tubing over each wire. Make sure that it is at least 1/2 inch away from the bare wire ends so that it doesn’t pre-maturely shrink when you solder the wire to the male end of the connector. Match the colors (light to light, dark to dark).
- Holding the female end of a connector with a pair of needle-nose pliers, tin the male end of the connector (The long thin end:-)). Do this for two connectors.
- Solder each tinned wire on the twisted pair of wires to the male end of a connector. You want the solder connection to be as small in diameter as possible. The best way to do this is to align the male pin with the exposed wire and heat until the solder on
each melts and runs together. Then, holding the two in position, let cool until the solder solidifies. Do this for both the light and dark wire.

- Now slide the heat shrink tubing up over the solder connection right up around the lip of the connector. Clean off the soldering iron and heat the heat shrink tubing until it closes up around the solder joint and the small connector. Do this for both connectors.

- Now, put a 3/8” long piece of heat shrink tubing over the contactor-base wires you previously stripped. Push the tubing down close to the lugs so that you won’t shrink it while soldering the connectors. Do this for both pieces of wire.

The following instructions are used to place a set of male tiny connectors on the short (1 inch) wires that are normally attached to the contactor base when constructing the 519-1 turntable pit.

- Slide a tinned wire end from the contactor-base into the female end of one of the two remaining connectors. Solder this wire into the female side so the connection is permanent. Do this for the other tinned wire too. Completion of this step results in a pair of male connectors.

- Slide the heat-shrink tubing over the newly soldered connections so that only the male part of the connector is left exposed. Clean the soldering iron and then heat the tubing so that it shrinks around the soldered connection (and the female part of the connector).

- Test connect the male and female connectors together to make sure that it all works. These connectors can slide through the 1/8 inch tubing and so make it much easier to attach and detach the turntable from and to the rotational platform as well as detaching the contactor base for maintenance.

![Hermaproditic Connectors](image)

**Figure 3.2.9 Construction of Tiny Connectors**

12. Cut out the foundation beams from the Box fret labeled 518-B-16-A. These are labeled A-5 on the fret.

13. Glue the foundation beams onto the table base aligning the center lines. These beams are mounted over the serrated edges of the table base and cover the interior empty square spaces. Figure 3.2.6 and 3.2.7 above both show the result of this step. Make sure to align the beams so that the edges of the beam are square with the outer serrated edges.
14. (Optional) Finally, you may want to paint the turntable base. The ties are a very dark brown from creosote treatment; while the rail is painted rail brown to represent rust. You are likely to get better results using spray paint. Use masking tape to mask off the foundation beams and sides of the table so that you only paint the PC ties the creosote color. Let this dry and then cover the painted ties so that only the rail remains. Spray paint this rail brown (rust!). The turntable at Laws was painted oxide red and has been bleached a (much) lighter color by the sun. Mixing 1 part of oxide red with 3 parts of concrete generated the right color for my taste to match its current look. Use more oxide red if you want the turntable to appear newer. You may wish to paint the table base a gray color to simulate the bare wood look after having been out many years in the weather.

15. (Optional) The turntable at laws has the cross ties completely covered with planks that run lengthwise parallel to the rails on the table. You can use 1/32 inch thick scribed at 1/16 inch intervals scale wood siding to simulate this effect. If you wish to do this, cut out two pieces of siding that are 4.5 inches long by 1/4 inch wide so that you have 4 boards on each side of the PC ties and glue them down on each side of the

This completes the turntable base including rails and wiring. Next we turn to constructing the actual turntable.

### 3.3 Construct Cable Mount Beams.

#### 3.3.1 Build two cable mount beams.

1. A cable mount beam is placed on top of the foundation beam. A cable mount beam is 4 and 5/8 inches long and is 1/16 inch by 1/16 inch square. Six holes will need to be drilled in each cable mount beam to mount the cables.

2. Mark a center line in the Middle of the cable mount beam at the center point which is 2 and 5/16 inches from each end. Mark this with the laser cutter. This line will be used to measure off the drill points for the cables so be sure to make the center correctly.

3. The holes for the short cable pair is 13/32 inches away from center line on each side.

4. The holes for the middle cable pair is 1 and 7/32 inches away from center line on each side.

5. Finally, the holes for the long cable is 1 and 5/8 inches away from center line on each side.

6. Drill the holes in each beam with a number 65 drill (0.035”).

![Figure 3.3.1 Cable mount beam diagram.](image-url)
3.3.2 **Glue the cable mount beams on to the base.**

Measure and glue the cable in place. Note: The ACC glue immediately sets up in the presence of the elastic provided. So, place only a very small “dollop” of glue in the interior of a slot to glue down the elastic. This will leave the elastic flexible except at the attachment spot; well inside a slot. As a result, the cable will look much better in your model; having flexibility as it emerges from the slot.

1. **Short Elastic.** Glue elastic cable in 1/2 of short slot. Leave room for the other end. Run to other short hole and through it, then back to half glued short slot and glue it in the other half using ACC glue. Don’t stretch tight, because it will be stretched up to rest on center beam; but also don’t let it be loose also. It should run along the beam without being stretched but with minimal sagging. Do this for the other beam too.

2. **Middle Elastic.** Glue elastic cable in 1/2 of middle slot. Leave half the room for the other end. Run to the other middle hole and through it, then back to the half glued middle hole and glue it in. Again, don’t stretch too tight.

3. **Long Elastic.** Glue elastic cable in the interior long slot and run it to the other long beam slot without being stretched but with minimal sagging. There is only one long cable on each beam and it is placed on the interior side of the cable mount beam. Do this for the other beam too.

Figure 3.3.2 below shows how the cable mount beam should look. Note that the other beam should be the mirror image of the beam shown.

![Figure 3.3.2 Support Cable Construction](image)

4.0 **Construct A Frame**

4.1 **Construct The two A Frame sides.**

Cut out the pair of A frame sides from the A-Frame fret.
4.2 Construct Center Support Beam

The center support is placed on the center line between the twin posts of each A frame piece. In the prototype the center support beam is 12 inches by 12 inches with the A frame posts being 9 inches by 9 inches. The lower cross beam on an A frame piece is 9 by 9 on the prototype and the center beam extends one foot above it. The beam is flat on top and is the location of a cable raceway. Figure 4.2.1 sketches the look of the center support beam.

1. Remove and square cut off 0.110 inches of the rounded beams in the A-Frame fret. This will make the top of the center beam support.

2. Measure and square-cut the bottom of the support beam so that it is parallel to and long enough to reach the foot of the A-Frame. The bottom (longer part of the beam) is 0.35 inches.

3. Draw a light construction line down the center of the A-Frame so that you can align the center support beam when you glue it down.

4. Glue the center support beam in the center of the A-Frame as shown in Figure 4.2.1 below. Glue both the top and bottom pieces of the center beam support.

5. (Optional). The prototype has two support bolts that are just below the two cross beam supports that create the A in the A-frame. You can model these by drilling #77 drill holes just below (1/32") below the two cross beam supports on both A-Frames. Cut two lengths of 0.010 brass wire each 0.450 inches long and two that are 0.300 inches. Glue them in with a tiny drop of ACC in each drill hole. You may have to trim the two pieces of wire slightly but let a little stick out to represent the bolt. This is a great place for a tiny piece of brass to simulate a nut and washer over the wire that represents the bolt.

6. Repeat these steps for the other Center Beam Support.

4.3 Construct A Frame Cross Beam

The A Frame Cross Beam is 1 and 5/8 inches long.

Construct a beam that is 3/32” x 1/16” x 13/8” timber. It may be convenient to use two 3/32” x 1/32” x 13/8” timbers to construct this cross beam.
4.4 Construct Cable Race Ways

Four cable raceways are constructed now. These are small U shaped brass pieces that are 1/16 inch wide by 1/16 inch deep with two edge lips that are 1/32 inch high. It looks like the following diagram.

These raceways are used to hold the cables in place. There are four of them. Two are placed on top of the cross beam over each A frame apex point and hold the long and middle support cables in place. The other two are placed on top of each center support beams and constrain the short cables that support the table.

1. Score the bend lines for the two edge lips on each raceway before cutting out them out as shown by the dotted line in figure 4.4.1 above.

2. Cut out the four raceways and bend the 1/32” lip edges up. Cut out the four small 1/32” triangle chunks in the center of two of the raceways.

3. Glue these on the top of the Cross beams so that the lip edges run parallel to the cable beams. Figure 4.4.2 shows the result of this operation. Notice that these raceways are bent around the curving top of the center support beam (as in the prototype).

4. Glue the other two raceways at the two apex points of the cross beam. The apex point is the point over where the A frame comes together to form the top of the A. The cross beam sits on top of the two A frames and joins them together. The two raceways are placed so that the lips are parallel to the A frame so they can constrain the cables to the raceway. Figure 4.4.2 also shows the correct orientation of the raceways.

5. (Optional). Drill and place the Support rods in each of the A-Frames.

4.5 Assemble A Frame

In this step, the two A-Frames are glued to the center cross beam. Make sure that the cross beam is properly centered and that it is glued squarely to the top of each of the A-Frames.
An easy way to do this is to mark off center lines on the cross beam so that you know it is properly done. Also, make sure that it fits perfectly on the turntable base. Each foot of the A-Frame should set with no overlap on either side on top of the foundation beam on each side of the turntable base.

When you are sure that this all fits nicely, glue down the cross beam to the two A-frames and let the glue dry.

Figure 4.5.1 illustrates these steps.

4.6 Attach the Cross Braces on the A-Frame.

Figure 4.6.1 shows the assembled A-Frame with the cross braces attached. Glue them onto the center beam and the A-frame on each side. Make sure that each of the ends is snug against the A-frame and the cross-beam. You may note that the cable raceways are missing in figure 4.6.1. If you haven’t glued them onto the A-Frame, now is the time to do so.

Allow the glue to dry thoroughly. At this point, you may want to paint the A-Frame and add any additional NBW details.
5.0 Attach A-Frame to Turntable Base

This is the final assembly phase of the A-Frame Turntable.

5.1 Attach Cable Mount Beams to Turntable Base.

Glue a cable mount beam along and on top of the foundation beam on each side of the turntable. Be very careful to not get glue on the elastic cables. ACC glue attacks the elastic and immediately stiffens it. The glue may also attach the elastic to the foundation beam impairing your model. One way to prevent this is to cover the cable mount beam on three sides with masking tape so that glue cannot get on the elastic. If it is accidently attached, see if you can separate the elastic from the cable mount beam with out breaking the elastic. Careful use of a sharp hobby knife with a number 10 blade may help in the separation. Slip the blade between the beam and the elastic cable and carefully slide it along the attachment area until the elastic is no longer attached to the cable mount beam. If you cut the elastic, remove the old pieces and carefully replace it.

5.2 Stretch the elastic cables away from the cable mount beam

This step is used to move the appropriate elastic cables away from the mounting point for the A-Frame and to set it up so that you can easily stretch the elastic cables into the raceways when the A-Frame glued to the turntable base has setup. Figure 5.2.1 above shows how to do this. Cut off a temporary “separator beam” piece of the scrap fret material from which you removed the table base foundation beams. A piece approximately 2.25 inches long is sufficient to hold the elastic cables but won’t over stretch the elastic cable material. Note that you may also want to stretch the outer side of the short cables over the separator beam to assure that they aren’t accidently attached to the cable mount beam via spilled glue when gluing down the A-Frame.
5.3 Attach A-Frame to Turntable Base.

With the turntable base setup as shown in figure 5.2.1 above, Glue down the A-Frame. The elastic cables are held away and also are setup so that they can be stretched up onto the cable raceways correctly when the A-Frame glue has setup strongly attaching the A-Frame to the turntable base. Be very careful to not spill glue onto the elastic cables.

5.4 Mount Cables on A-Frame

Once the A-Frame glue is setup and the A-Frame is strongly attached to the turntable base, you can stretch the elastic cables up onto the cable raceways.

1. Start with the short interior cables. A blunt pair of tweezers is helpful in mounting the elastic cables. Grasp the elastic cable in the middle of the center support beam on one of the interior short elastic cables and pull it up and loop it over the center support beam cable raceway on the interior side. Do this with the other interior elastic cable on the other side.

2. Next do the short exterior cables. Cable placement is much easier on the exterior. Grasp the middle of the short exterior cable and pull it up and loop it over the center support beam cable raceway on the exterior side. Do this with the other exterior short elastic cable on the other side.

3. The remaining cables are placed up on the cross beam cable raceways. They are all on the exterior. Alternate placing cables on each side. Grasp one of the middle cables in the middle of the turntable base on one side of the turntable and stretch it up over the cable raceway on the cross beam at the apex of the A-Frame. Grasp the other middle cable on the same side and also stretch it up and over the cable raceway on the cross beam at the apex of the A-Frame. Now do this step with the other pair of middle cables on the other side of the turntable.

4. Finally, grasp one of the long cables, again in the middle of the turntable base and remove it from the separator beam and stretch it up over the cable raceway at the apex of the A-Frame on the cross beam. There is only one long cable on each side of the turntable (as in the prototype) on the interior side of the cable support beam. The separator beam now is only holding one cable and will tend to swing down. Remove the separator beam and discard it. Grasp the middle of the elastic cable on the other side of the turntable and stretch it up over the cable raceway at the apex of the A-Frame on the cross beam.

5.5 Place Final Paint on the Turntable.

Congratulations! The turntable is now complete except for final painting. Figure 5.5.1:5 below shows the typical result of building this turntable. It is mounted on the rotational platform for the RLW 519-1 turntable pit.
Attach A-Frame to Turntable Base

Figure 5.5.1 Completed A-Frame Turntable.

Figure 5.5.2 Frontview A-Frame Turntable

Figure 5.5.3 Frontview A-Frame Turntable

Figure 5.5.4 Sideview A-Frame Turntable

Figure 5.5.5 A-Frame Turntable
6.0 Congratulations, Thank You and Additional Kits.

6.1 Congratulations
Well, that does it. You’ve built an A-frame style turntable!

6.2 Thank You!
Thanks again for purchasing the turntable kit. We hope it will bring you many years of reliable Nn3 operations.

We are always looking for ways to improve, so if you have any comments, suggestions or pictures of your work, we’d appreciate hearing from you. We’d especially like to hear about your experience with this kit.

6.3 Additional Kits and Information:
This kit was brought to you by Republic Locomotive Works. It was designed on work by Vince Daal. You can find more kits especially for the N scale narrow gauge modeler at Republic Locomotive Works on the Internet:

HTTP://WWW.REPUBLICLOCOMOTIVWORKS.COM
RLW 518-GL-Nn3 -
Box-Frame Turntable
Assembly

V. Bruce Hunt
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This document describes the assembly of the RLW 518
Box-Frame turntable. A companion document describes
the assembly of the A-Frame Gallows Turntable.

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Figure 1.0 below shows where we are headed with this kit. It shows a completely assembled and unpainted Box-Frame turntable mounted on the RLW rotational platform ready for mounting on the RLW 519-001 or RLW 519-002 turntable pits:

Figure 1.0 Assembled, Unpainted Box-Frame Gallows Turntable.

2.0 Kit Content

The kit comes with parts for constructing either a box frame or A frame turntable and the appropriate beams and support beams needed. None of the A-frame fret parts will be
used in constructing this turntable. These instructions are for the box frame turntable. If you want to build an A-frame turntable, please use the other instructions provided.

2.1 Box Frame Parts Fret

The Box Frame parts fret is labeled Port Daals 518-B-16-A.

![Figure 2.1.1 Box Frame Fret.](image)

2.2 Table Base Fret

This fret holds the Turntable base. It is labeled Port Daals 518-B-16-B.

![Figure 2.2 Table base Fret.](image)
2.3 **A Frame Parts Fret**

This fret hold the wooden A frame parts. It is cleverly labeled A-Frame. This fret will **NOT** be used to build the Box-Frame Turntable.

![Figure 2.3 A-Frame Parts Fret](image)

2.4 **Cabling Elastic Strands**

These gray strands of elastic are used to simulate the cables that bear the weight of a locomotive on the Box frame turntable when it is loaded.

2.5 **Code 30 Pit Rail.**

Included in the kit is a 14 inch length of code 30 nickel silver rail for the pit rail. You will need to cut 13.3 inch length with square ends to form the pit rail. Although not functionally needed in this kit, it provides the cosmetic appearance that the table rides on it. This rail is substantially lighter than either code 40 or code 55 rail that is used for the table rails and therefore is more correctly scaled for the pit. You of course can substitute code 40 or even code 55 rail.

2.6 **Additional Items Required, Not in the Kit**

2.6.1 **PC Board Ties**

RLW has PC Board ties. These are part number DGM100. You will require 34 PC board ties each 5/8 inch long. One package of DGM100 tie strips is sufficient for this kit.

2.6.2 **Code 30, 40 or 55 Rail for the table rails.**

You may use either code 30, 40 or 55 rail for the table rails. However, note that it is probably best to match the table rail size that is used on the feeder track.

2.6.3 **Fine Rosin Core Solder**

We recommend using Kester Electronic Silver Solder (0.020 diameter) available at most electronic shops or from Digi-Key (Part number KE1802-ND).

2.6.4 **Paint**

Depending on your prototype, you will need paint to paint the turntable and Box frame. For the Pacific Coast Railway, it appears that the turntable was unpainted, so a faded wood grey is appropriate to approximate the graying of the timbers in the hot California
sun. Any exposed wood turned gray. Exposed iron rapidly rusted rail-brown including both hardware and the rails. Thus, the support cables rapidly became a gray-brown color in the hot sun when spiced with winter cold and water to activate rusting.

2.6.5 Optional items you may want to add:
The following are optional items you may need depending on alternatives you select.

- Small bits of brass to simulate nuts, bolts and washers. These are used to add additional detail.
- #80 Machine screws and washers (4 of each needed) at least 1/4 inch long. These are used in the tapped holes in the shoulder washer to attach a turntable.
- A pair of small wire connectors. These allow easy disconnection of the contactor base from the turntable and rotational platform. Hermaphroditic connectors such as these can be extracted from a low profile IC socket such as Digi-Key part number ED3120-ND or a similar part likely available from your local electronics parts store (e.g. Radio Shack). You will need 4 of these.
- A pair of different colored 3/64 inch heat-shrink tubing about 3/4 inch long. These are used as insulators around the connectors above. Cutting the 3/4 inch pair in half provides the four insulators you need. You can also obtain this from Digi-key or Jameco. Be sure to get the smallest diameter (3/64”) heat shrink tubing.

2.7 Tools Required

2.7.1 Drill and #65 and #77 Drills
The #77 drill is used to create bolt holes on the Box frame; while the #65 drill is used to drill holes in the cable mount beam where the cable is mounted.

2.7.2 ACC Glue
For this, kit, the Gel form of ACC glue is recommended.
2.7.3 **Glue Applicator**  
Precise application of glue is important in constructing this kit and so a means to deliver a tiny drop of glue is needed. This can be done with a commercial glue applicator; or a toothpick.

2.7.4 **Nn3 Gauge (e.g. RLW 2429)**  
These gauges are used to keep the rails in gauge as you tack and then solder them to the PC rails. You can use either RLW 2428 or RLW 2429. Also, Aspen Model 4014-40 (code 40 rail) and Aspen Model 4015-55 (Code 55 rail) are useful.

2.7.5 **(Optional) #80 Tap**  
This is used to tap the shoulder washer on the rotational platform on the 519-1 turntable pit for #80 machine screws. This is available at most hobby shops or online from Walthers.

2.7.6 **Ohmmeter or Continuity Tester.**  
Use this to test the turntable track to make sure that continuity is where it is supposed to be and that the two rails aren’t shorted together. If you don’t have a multi-meter that also measures resistance, now is the time to obtain one. You can get one from your local Radio Shack or on the web from any number of suppliers including Digi-key and Jameco.

### 3.0 Construct Table Base

3.1 **Prepare base and foundation beams.**  
Cut out the table base from the fret. Also cut out the foundation beams from the

![Figure 3.1.1 The table base with some PC ties glued down.](image)

3.2 **Construct the turntable track.**  
1. Cut 34 PC board ties each 5/8 inch long.
2. Cut two pieces of rail 5 inches long (To be trimmed later to correct length). Choose either code 30, 40 or 55 rail.
3. Glue down every other PC tie on each side of the base and allow to dry. Figure 3.2.1 shows the result of doing this. The reason for doing this is that it enables you to use the scoring on the table base to align the rails so that they are dead center on the
base. If you glue down all the PC ties, then you can no longer see the alignment scoring.

4. Align and tack down the rail using a track gauge and a small sliver (3/64 inch) of rosin core solder on each end and the center. Make sure to align each rail along the scored line on the base and in proper Nn3 Gauge. Figure 3.2.2 shows the result of doing this. Be sure that the gauge is correct here. This will ensure that the remaining soldering of rail to PC ties will be easy to maintain in gauge.

It is **VERY** important that the rails be in proper alignment balanced along the scored lines and in gauge for optimal operation of the table. So take it slow and be careful.
5. Once you’ve tacked down the rail, then insert the other PC ties and glue them down. It is easiest to place a small dollop of glue on each side of the interior tie after the tie has been inserted under the rail. A pair of tweezers may be used to twist the PC tie over the glue on the base and align it. Figure 3.2.4 shows a sketch of how to do this; while Figure 3.2.5 shows a picture of it in progress.

![Figure 3.2.4 Place and glue interior PC ties](image1)

Do all the interior ties. Allow the glue to dry thoroughly. Figure 3.2.5 shows the glued down interior ties.

![Figure 3.2.5 Interior Ties glued onto the table base](image2)

6. Solder down the rail to each PC tie. Use small radius rosin core solder to do this. We recommend using Kester Electronic Silver Solder (0.020 diameter) available at most
electronic shops or from Digi-Key (Part number KE1802-ND). This solder has superb conductivity and is very strong so your track will be effectively permanent. Cut off small pieces in lengths of 3/64 inches and place on the edge point where the outside of the track lies on the PC tie. The reason to use small pieces instead of feeding the solder continuously is to limit the amount of solder that flows onto the track. Heat the rail right over the PC tie until the small piece of solder melts and runs under the tie. The heat will transfer to the PC cladding and bond to it. There is a small amount of rosin in the core of this solder that acts to prep the nickel silver rail and the copper in the cladding to make the solder amalgamate with the copper and (copper in the nickel silver) rail. It is wise to keep the track gauge near and on the track so that the track remains in gauge as you solder it down. Also, it is wise to solder every other tie point so that you never overheat the copper cladding. The reason for this is so that the copper cladding doesn’t un bond from the pc base material. Keep doing every other one until you complete all 68 solder points. This will help keep the alignment precise and will prevent the copper cladding on the PC boards from lifting off the ties. Figure 3.2.6 shows the result of this soldering.

7. Take a high Track Per Inch razor saw (at least 48 TPI) or thin cut-off wheel on your rotary tool and cut a thin line through the copper cladding down the center of the PC ties. Figure 3.2.6 also shows the result of doing this. Be careful to only cut through the copper cladding on the surface. You want the tie material below the cladding to be left to provide additional strength to the track and to assure correct track gauge. It is important to cut all the way through the copper cladding on each tie because this insulates each rail from the other rail. Any tie whose cladding is not severed will create a short circuit.

8. Test to make sure that the two rails are electrically Isolated from each other. Use an ohmmeter or continuity tester to assure that you have extremely high resistance between the two rails. (Anything over 5 Megaohms resistance is great!;-)).

9. Strip 1/8 inch of insulation off from each of the wires from the rotational platform and solder them to the base of each rail. Use the center hole in the table base to route the wires up to the rails. By soldering the wires to the base you minimize their
appearance on the turntable. Figure 3.2.7 below shows this step.

![Diagram of Wiring Turntable Rails]

**Figure 3.2.7 Wiring Turntable Rails**

10. **(Optional) Attach Turntable Base onto the Rotational Platform**

Before mounting the Box-Frame, you should mount the turntable base on the rotational platform if you are building your turntable to fit on the RLW 519-1 turntable pit. The instructions in the 519-1 also describe how to do this and are repeated here.

There are two options, you can tap the rotational platform for 0-80 screws or you can glue the turntable base down with brass wire. The rotational platform has four holes that are the correct tap size for a 0-80 screw tap.

In both cases the first step is to guide the track wires down the center of the rotational platform.

**Use of 0-80 Screws.** Using a 0-80 tap, tap each of the four holes for an 0-80 screw. Use either two or four 0-80 3/8” fillet head screws to bolt down the turntable. These taps are available at your local hobby shop and are not part of the kit.

**Use of brass wire to glue the turntable base.** Alternatively, cut four 3/8 inch pieces of brass wire (0.015) and glue them in the holes. Place the turntable in the exact center of the rotational platform. The table base has a hole in the center that you should place directly over the rotational shaft in the center of the rotational platform. Make sure that the table is exactly centered for smooth operation. Bend the wires over turntable base to hold it firmly and glue the brass wires onto the base.
11. (Optional) Build and attach Tiny Connectors.

To assist in easy disassembly of the turntable from the RLW 519-1 turntable pit, you may want to add a set of tiny connectors. The instructions in this section are also repeated in the instructions for the 519-1 turntable pit. If you complete this section, then you don’t need to repeat it when you construct the 519-1.

To complete this part you will need the 4 hermaphroditic connectors shown in the optional parts above and the heat-shrink tubing. Figure 3.2.9 below shows the basic layout. The first step in this section is to cut the long twisted pair of track power wires from the disconnected end about 1 inch from the end of the twisted pair. The four connectors have a both a male and female part so they can be used for both sides of the connection. For the two connectors attached to the long wires connected into the turntable track:

- Strip 3/64 inch of insulation off from the light and dark colored long wires to be attached to the turntable track and the two wires emanating from the contactor base.
- Tin the ends of the wire. (Heat the wires up and put a small dab of solder so that all the strands of the wire stick together).
- Put a 3/8” long piece of heat-shrink tubing over each wire. Make sure that it is at least 1/2 inch away from the bare wire ends so that it doesn’t pre-maturely shrink when you solder the wire to the male end of the connector. Match the colors (light to light, dark to dark).
- Holding the female end of a connector with a pair of needle-nose pliers, tin the male end of the connector (The long thin end:-)). Do this for two connectors.
- Solder each tinned wire on the twisted pair of wires to the male end of a connector. You want the solder connection to be as small in diameter as possible. The best way to do this is to align the male pin with the exposed wire and heat until the solder on each melts and runs together. Then, holding the two in position, let cool until the solder solidifies. Do this for both the light and dark wire.
• Now slide the heat shrink tubing up over the solder connection right up around the lip of the connector. Clean off the soldering iron and heat the heat shrink tubing until it closes up around the solder joint and the small connector. Do this for both connectors.

• Now, put a 3/8” long piece of heat shrink tubing over the contactor-base wires you previously stripped. Push the tubing down close to the lugs so that you won’t shrink it while soldering the connectors. Do this for both pieces of wire.

The following instructions are used to place a set of male tiny connectors on the short (1 inch) wires that are normally attached to the contactor base when constructing the 519-1 turntable pit.

• Slide a tinned wire end from the contactor-base into the female end of one of the two remaining connectors. Solder this wire into the female side so the connection is permanent. Do this for the other tinned wire too. Completion of this step results in a pair of male connectors.

• Slide the heat-shrink tubing over the newly soldered connections so that only the male part of the connect is left exposed. Clean the soldering iron and then heat the tubing so that it shrinks around the soldered connection (and the female part of the connector).

• Test connect the male and female connectors together to make sure that it all works. These connectors can slide through the 1/8 inch tubing (but only one at a time!) and so make it much easier to attach and detach the turntable from and to the rotational platform as well as detaching the contactor base for maintenance.

• Cut out the foundation beams from the Box fret labeled 518-B-16-A. These are labeled A-5 on the fret.

• Glue the foundation beams onto the table base aligning the center lines. These beams are mounted over the serrated edges of the table base and cover the interior empty square spaces. Figure 3.2.6 and 3.2.7 above both show the result of this step. Make sure to align the beams so that the edges of the beam are square with the outer serrated edges.

• (Optional) Finally, you may want to paint the turntable base. The ties are a very dark brown from creosote treatment; while the rail is painted rail brown to represent rust. You are likely to get better results using spray paint. Use masking tape to mask off...
the foundation beams and sides of the table so that you only paint the PC ties the creosote color. Let this dry and then cover the painted ties so that only the rail remains. Spray paint this rail brown (rust!). The turntable at San Luis Obisbo was unpainted and has been bleached a grey color by the sun. You may wish to paint the table base a gray color to simulate the bare wood look after having been out many years in the weather.

15. (Optional) The turntable at San Luis Obisbo has the interior cross ties completely exposed and there were a pair of planks that run lengthwise parallel to the rails on the outside of the rails table. You can use 1/32 inch thick scribed at 1/16 inch intervals scale wood siding to simulate this effect. If you wish to do this, cut out two pieces of siding that are 4.5 inches long by 3/16 inch wide so that you have 2 boards on each side of the PC ties and glue them down on each side of the rails.

This completes the turntable base including rails and wiring. Next we turn to constructing the actual turntable.

3.3 Attach Cable Mount Beams to the Turntable Base.

3.3.1 Glue the cables onto the Cable Mount Beams.

Measure and glue the cable in place. Note: The ACC glue immediately sets up in the presence of the elastic provided. So, place only a very small “dollop” of glue in the interior of a slot to glue down the elastic. This will leave the elastic flexible except at the attachment spot; well inside a slot. As a result, the cable will look much better in your model; having flexibility as it emerges from the slot. Figure 3.3.1 below shows how a cable mount beam should look. Note that two identical beams are to be built.

Choose one side with holes of each cable mount beam to be the top. The cable mount beams are the beams that have two pair of 3 holes at each end lengthwise on the beam. For each beam do the following:

1. **Short Elastic.** Glue elastic cable in one of the two holes nearest the middle of the beam. Run the cable to the other hole nearest the middle of the beam and glue it into the other hole. Don’t stretch tight, because it will be stretched up to rest on the box top of the box frame. Let this cable loop slightly out from the beam; at most 3/16 inch at the maximum distance away from the beam. Do this for both beams.

2. **Middle Elastic.** Glue elastic cable in the middle hole of one of the three holes at one end of the cable mount beam. Run the cable to the other three holes on the other end of the cable mount beam and glue the taut but not stretched elastic into the middle hole of the other three holes on this beam. It is easiest to run the cable through the other hole and pull it to the point where it doesn’t sag, but is not stretched either. Then cut the cable and glue it into the middle hole on the top side of the cable. Do this for both beams.

3. **Long Elastic.** Glue elastic cable in one of the outer holes (holes closest to ends of beam) and run it to the other empty hole on the other side; again without being stretched but with minimal sagging. It is easiest to run the cable through the other end hole and glue the taut but not stretched elastic into the outer (only one left) hole on the other side. Do this for the other beam too.
3.3.2 Attach the Cable Mount Beam to the Table Base

The cable mount beams are mounted on the foundation beams on the table base. Be sure to align the center lines on each Cable Mount Beam with the center line on the Table base so that the Cable Mount Beams are centered and balanced on the table base. Be very careful to not get glue on the elastic cables. ACC glue attacks the elastic and immediately stiffens it. The glue may also attach the elastic to the foundation beam impairing your model. One way to prevent this is to cover the cable mount beam on three sides with masking tape so that glue cannot get on the elastic. If it is accidently attached, see if you can separate the elastic from the cable mount beam with out breaking the elastic. Careful use of a sharp hobby knife with a number 10 blade may help in the separation. Slip the blade between the beam and the elastic cable and carefully slide it along the attachment area until the elastic is no longer attached to the cable mount beam. If you cut the elastic, remove the old pieces and carefully replace it.

Allow the glue to dry. Figure 3.3.2 shows a sketch of the cable support beams attached to the table base:

![Support Cable Beam Construction](image)

3.3.3 Loop the Cables away from the Center Line.

This step is used to move the appropriate elastic cables away from the mounting point for the Box-Frame and to set it up so that you can easily stretch the elastic cables onto the top of the Box-Frame when it is glued to the turntable base and has setup. Figure 3.3.3 below shows a sketch of how to do this. Cut off a temporary “separator beam” piece of the scrap fret material from which you removed the table base foundation.
beams. A piece approximately 2.25 inches long is sufficient to hold the elastic cables but won’t over stretch the elastic cable material.

Set aside the Turntable base. We’ll return to it when you’ve constructed the Box frame.

4.0 Construct Box Frame

4.1 Extract Box Frame sides and Top.
Cut out the pair of Box frame sides from the Box-Frame fret. Also, cut out the Box frame top from the Box-frame fret.

4.2 Assemble Box Frame
There are two sub-steps in this step. The first is to attach the box frame sides to the box frame top and the second is to place the angle braces for support. While optional, we recommend that you paint the assembled box-frame here.
4.2.1 **Glue the box-frame sides to the box-frame top.**

The top of the box frame is designed to be placed inside the two box-frame sides so that the sides will fit perfectly onto the two cable mount beams as figure 4.2.1 shows. *Don’t* glue the sides under the box frame top! This makes the width of the frame to narrow to fit on the table base!

1. Glue one side of the box frame top to the top side of the box-frame side. (The box-frame top is square so you can start with any side.) The top side of a side frame is the one with the horizontal cross beam. Make sure that the angle is square (i.e. 90 degrees).

2. Glue the other side of the box frame top to the top side of the other box-frame side. Again, make sure that the angle is square.

3. Allow the glue to dry so that the frame is solid and square.

4.2.2 **Glue on the angle Braces.**

The kit includes four angle braces. These braces are placed on the four corners of the frame to support the box-frame and keep the box square. Figure 4.2.2 shows one side of the frame; the other side is identical.
4.2.3 (Optional) Paint the Box-Frame

This is a good point to paint the box-frame. This step can be deferred until the last step at a cost of increasing difficulty of accessing the interior of the box-frame. Colors for painting are, of course, dependent on the paint schemes adopted by your railroad. However, exposure to weather and use rapidly faded and chipped the paint. Exposed hardwood rapidly becomes grey with exposure to weather. Dripping oil and hot steam stained the table.

4.3 (Optional) Construct Cable Race Ways

Four cable raceways are optionally constructed. These are small U shaped brass pieces that are 1/16 inch wide by 1/16 inch deep with two edge lips that are 1/32 inch high. It looks like the following diagram.

These raceways are used to hold the cables in place. There are four of them. They are placed on top of the box-frame at each corner. They hold the support cables in place.

1. Score the bend lines for the two edge lips on each raceway before cutting out them out as shown by the dotted line in figure 4.4.1 above.

2. Cut out the four raceways and bend the 1/32” lip edges up. Glue these on the top of the box frame sides so that the lip edges run parallel to the cable beams. Do this for both ends of the box-frame. Figure 4.4.2 shows the placement and orientation of this operation.

3. (Optional). Drill and place Support rods in each of the Box-Frames.

Allow the glue to dry thoroughly. At this point, if you haven’t already, you may want to paint the Box-Frame and add any additional NBW (Nuts, Bolts, Washers) details.
5.0 Attach Box-Frame to Turntable Base

This is the final assembly phase of the Box-Frame Turntable.

5.1 Attach Box-Frame to Turntable Base.

With the turntable base setup as shown in figure 3.3.3 above, Glue down the Box-Frame. The elastic cables are held away and also are setup so that they can be stretched up onto the cable raceways correctly when the Box-Frame glue has setup strongly attaching the Box-Frame to the turntable base. Be very careful to not spill glue onto the elastic cables.

5.2 Mount Cables on Box-Frame

Once the Box-Frame glue is setup and the Box-Frame is strongly attached to the turntable base, you can stretch the elastic cables up onto the cable raceways.

1. Start with the short cables. A blunt pair of tweezers is helpful in mounting the elastic cables. Grasp the elastic cable in the middle of the center support beam on one of the short elastic cables and pull it up and loop it over the two cable raceways on the top of the box-frame. Do this with the other short elastic cable on the other side.

2. Alternate placing cables on each side. Grasp one of the middle cables in the middle of the turntable base on one side of the turntable and stretch it up over the cable raceways on the top of the box-frame. Now do this step with the other middle cable on the other side of the turntable. Be sure to not let the cable slide along the sharp sides of the cable raceways as they can act as a knife cutting the cable!

3. Finally, grasp one of the long cables, again in the middle of the turntable base and remove it from the separator beam and stretch it up over the cable raceways on the top of the box-frame. There is only one long cable on each side of the turntable (as in the prototype) on the interior side of the cable support beam. The separator beam now is only holding one cable and will tend to swing down. Remove the separator beam and discard it. Grasp the middle of the elastic cable on the other side of the turntable and stretch it up over the cable raceways on the top of the box-frame.

5.3 Place Final Paint on the Turntable.

Congratulations! The turntable is now complete except for final painting. Figure 5.3.1 below shows the typical result of building this turntable. It is mounted on the rotational platform for the RLW 519-1 turntable pit.
Figure 5.3.1 Completed Box-Frame Turntable.

Figure 5.3.2 Overhead view Box-Frame Turntable

Figure 5.3.3 Front view of the Box-Frame Gallows Turntable
6.0 Congratulations, Thank You and Additional Kits.

6.1 Congratulations
Well, that does it. You’ve built a box style turntable!

6.2 Thank You!
Thanks again for purchasing the turntable kit. We hope it will bring you many years of reliable Nn3 operations.

We are always looking for ways to improve, so if you have any comments, suggestions or pictures of your work, we’d appreciate hearing from you. We’d especially like to hear about your experience with this kit.

6.3 Additional Kits and Information:
This kit was brought to you by Republic Locomotive Works. It was designed on work by Vince Daal. You can find more kits especially for the N scale narrow gauge modeler at Republic Locomotive Works on the Internet:

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