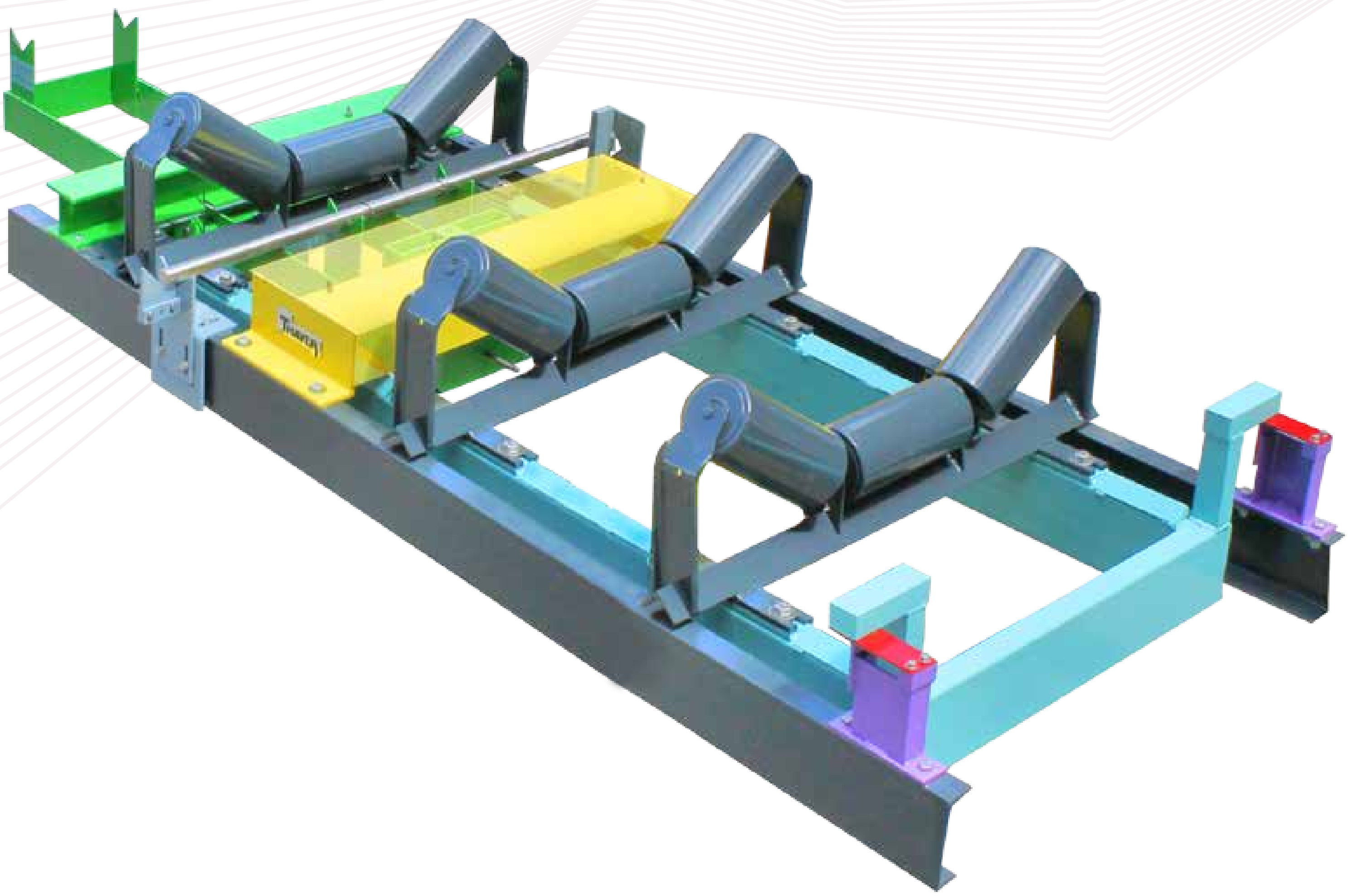
THAYER SCALE

CONTINUOUS WEIGHING & FEEDING OF BULK MATERIALS

FORCE MEASUREMENT FMSS SUSPENSION SYSTEM

Three Idler Model 3RF-6A & 3RF-8A Conveyor Belt Scales

SIMPLY THE HIGHEST PERFORMANCE BELT SCALES ON THE PLANET



FORCE MEASUREMENT FMSS SUSPENSION SYSTEM

THAYER SOLIDS FLOW CONTROL

Two Idler Model 3RF-6A & 3RF-8A Conveyor Belt Scale

Superior Performance

The THAYER models 3RF-6A & 3RF-8A Belt Scales are designed for high accuracy (1/4% typical) inventory control and totalization. The weighbridge features exclusive rocking flexure suspension in the approach configuration. Measurement sensitivity is high, deflection is low, and the load cell is isolated from the error-inducing effects of extraneous lateral forces, off-center loading, foundation distortion, inclination hold-back forces, and high sporadic shocks and overloads. Tare load is mass counterbalanced to create superior signal to noise ratio in weight sensing, orders of magnitude better than belt scale designs supporting full tare load on the load sensor.

ISOLATION LEVER AND "FMSS" MASS-COUNTERBALANCE

WEIGH BRIDGE

One of the most important components of a conveyor scale system is the design of the weigh bridge itself. Regardless of the type of load cell used, a belt scale will not be able to weigh lightly loaded material and maintain its calibration for long if certain design features are not in place.

Secondary Lever

THAYER employs a secondary lever system, even though it cost more to do so, because it permits the following:

1. We can add mass (weight) to counterbalance the dead load (idler support frame, idlers, belts) and by using a secondary lever, we do not load down the suspension pivot.

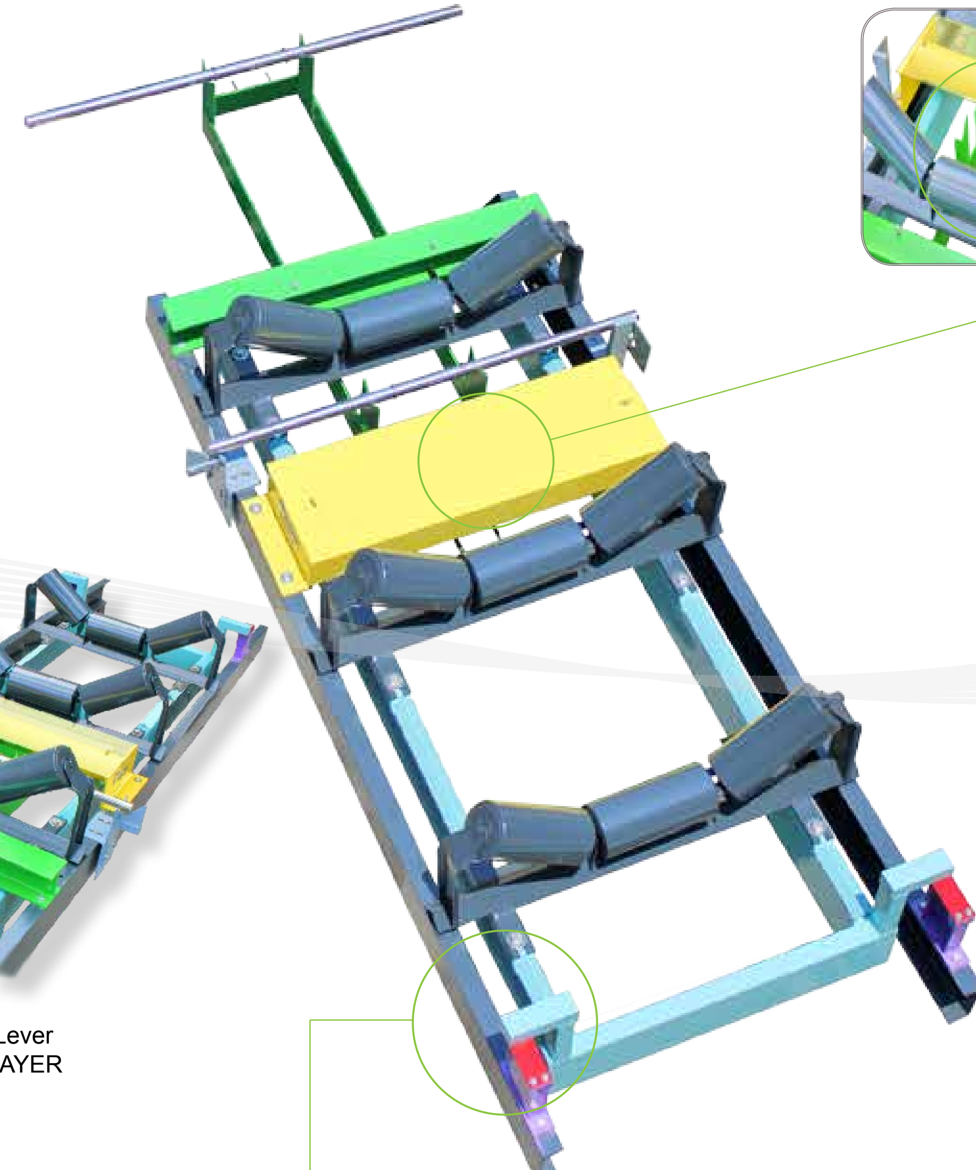
2. The scale provides for complete mass counter-balancing of the dead load (idlers and belt) of the conveyor permitting the load sensor to react only to the net material load.

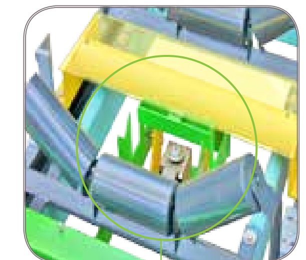
3. By positioning the load cell correctly, relative to the secondary lever we can match load cell size to the net loading. Only in this way can any capacity scale be supplied to the same high accuracy standards.

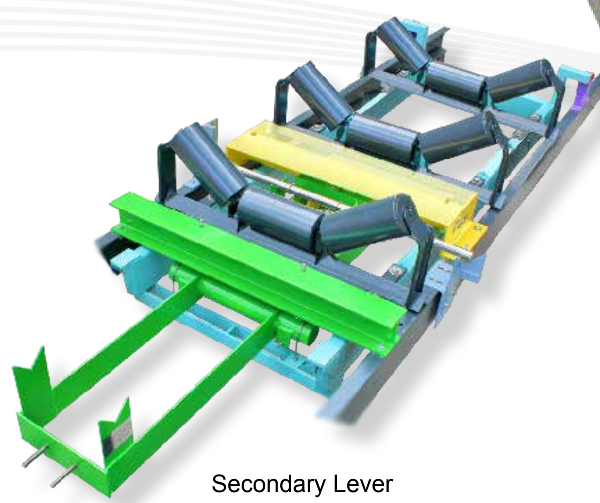
4. The resulting increased lever ratio of the secondary lever reduces idler deflection, providing additional immunity to errors associated with belt tension.

5. The secondary lever system utilizes stainless steel aircraft cables as flexural elements to transmit and FOCUS pure tension forces to the load cell. The cables, being non-extendable, but laterally yieldable connecting links, permit the lever to align itself under conditions of varying stringer distortion. This is a most significant feature. A belt scale must use the conveyor stringers as its mounting base. These stringers not only deflect under varying conveyor loads, but may also rotate (or twist). A suspension system having the least possible structural redundancy is therefore essential.

6. This unique system is not affected by dirt, shocks or vibration, and can withstand overloads in excess of 1,000 pounds without causing damage or affecting calibration.







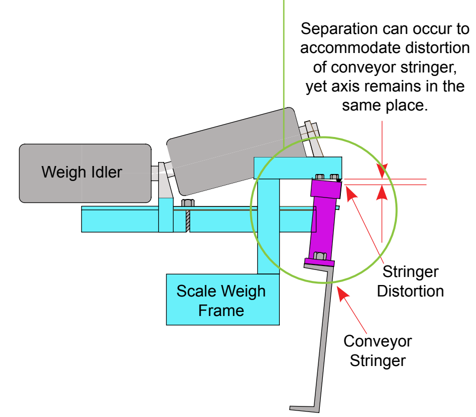
Secondary Lever unique to THAYER

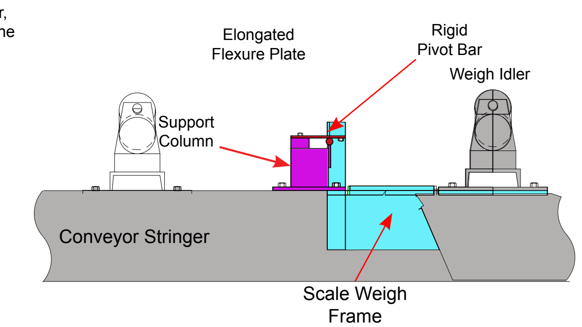
THAYER'S RF Flexure Suspension (patented)

The axis position is permanent, being held in its horizontal position by the flexure plate and in its vertical position by the load rod which bears on the flexure plate, which in turn is bolted to the bottom side of the square and elevated suspension extension shaft.

There is insignificant rotational hysteresis. While the load rod may be likened to a dull knife edge (it is round), the flexure plate bearing surface directly in contact can rock without sliding through small rotational displacement.

The reaction to lateral forces creates an insignificant moment transfer to the weigh suspension (this is part of the patent). Since the flexure plate (which is hardened blue tempered steel) is also the upper bearing block of the pivot, tensile or compressive forces reacting to lateral forces therein have no moment arm distance to operate.





THAYER Load Cell Utilization Factor

The distinct specification of continuous belt scale weighing applications and the unique environment and operational issues those applications typically encounter, places too many requirements on the load sensing system for any <u>single</u> technology to completely satisfy. Therefore, using THAYER'S exclusive FMSS technology in the design of its belt scale suspension system allows the choice of using either its LC-137 LVDT Load Cell or its LC-174 Strain Gauge Load cell. This puts Thayer in a unique position that allows us to offer equipment to match a wide range of applications such as light material loading, severe environmental conditions, and commercial certification.

LOAD CELL UTILIZATION FACTOR

The performance of a load cell and its instrumentation is specified on the basis of the load cell's rated output. If the load cell is supporting a quantity of dead-weight (i.e. idlers, belting, suspension system) and has been further oversized to accommodate problems of overload protection, off-center conveying, shock, vibration and negative integration, then the amount of range left to do the job of weighing is only a fraction of the cell's rated output. The percentage of the load cell's rated output reserved for the actual job of weighing material is called the LOAD CELL UTILIZATION FACTOR.

Thayer's "RF" Belt Scales with "FMSS" Force Measurement Suspension System mass counter balance technology assures better than 80% Load Cell Utilization.

Provides :

- Field adjustable mechanical TARE balancing of dead loads typically as high as 200 times NET loads, thereby providing the full utilization of the load cell force range.
- Reduces deflection of load receptor to a fraction of load cell deflection.
- Reduces zero shifting as a result of foundation distortion.
- Provides preferred access location of load cell for inspection or removal.
- Simplifies the application of test weights for calibration/performance verification.

<u>Two Types Load Cells to Choose From</u>

THAYER LC-137 LVDT Load Cell

The LC-137 (LVDT) Load cell was specifically developed as the ideal adjunct to THAYER'S "reverse-action" Force Measurement Suspension System. It is essentially a precision and extremely durable "tension-style" force transducer that is manufactured in a fine series of force ranges from 5 to 465 lbs. The LC-137 is the ideal load cell for "light loading" applications where mechanical tare loads represent as much as 10 to 40 times the net material load and provides unparalleled overload protection at 1000% of rated output. So superior is the LC-137 Load Cell that it is *<u>guaranteed for 15 years</u>*.

THAYER LC-174 Strain Gauge Load Cell

The LC-174 Load Cell is a conventional Strain Gauge "S" Beam Load Cell that is housed in an enclosure that has identical mounting dimensions to that of the LC-137.

Available in force ranges from 25 to 2,000 lbs with an overload protection of 150% of rated output.

CALIBRATION MADE EASY

CALIBRATION

A belt scale should be thought of as a precision instrument and its performance should be quickly and easily checked. Thayer Scale can provide an accurate reliable calibration using a calibrating weight instead of test chains for all scale capacities. Thayer Scale developed and patented the first automatic calibration system in 1971.

The 3RF-6A & 3RF-8A use a test weight in the form of a round bar which resides in one of two positions (“V” notches) on an intermediate lever between the approach-retreat suspension and the load cell itself. This bar provides tare counterbalance in its “zero” position, and simulated calibration loading in its “span” position. This method of “test weight” application is referred to as the “moveable-poise” method, in contrast to the additive weight method.

For belt scale calibration, the test weight represents a specific pounds per ft. loading value and the system instrumentation provides an automatic belt length measurement. This combination produces accurate, repeatable calibrations free from human error. Unlike electronic calibration which simply simulates a load cell output to the instrumentation, the test weight mechanically exercises the scale mechanism. Thayer’s unique suspension design assures that the test weight will accurately load the scale, with one weight at less than 60 lb. while representing 80-100% of full scale load. Because the need for test chains is eliminated, calibration time is reduced to a matter of minutes and can be performed by one person

THAYER TEST WEIGHT USING “SEE-SAW” SECONDARY LEVER

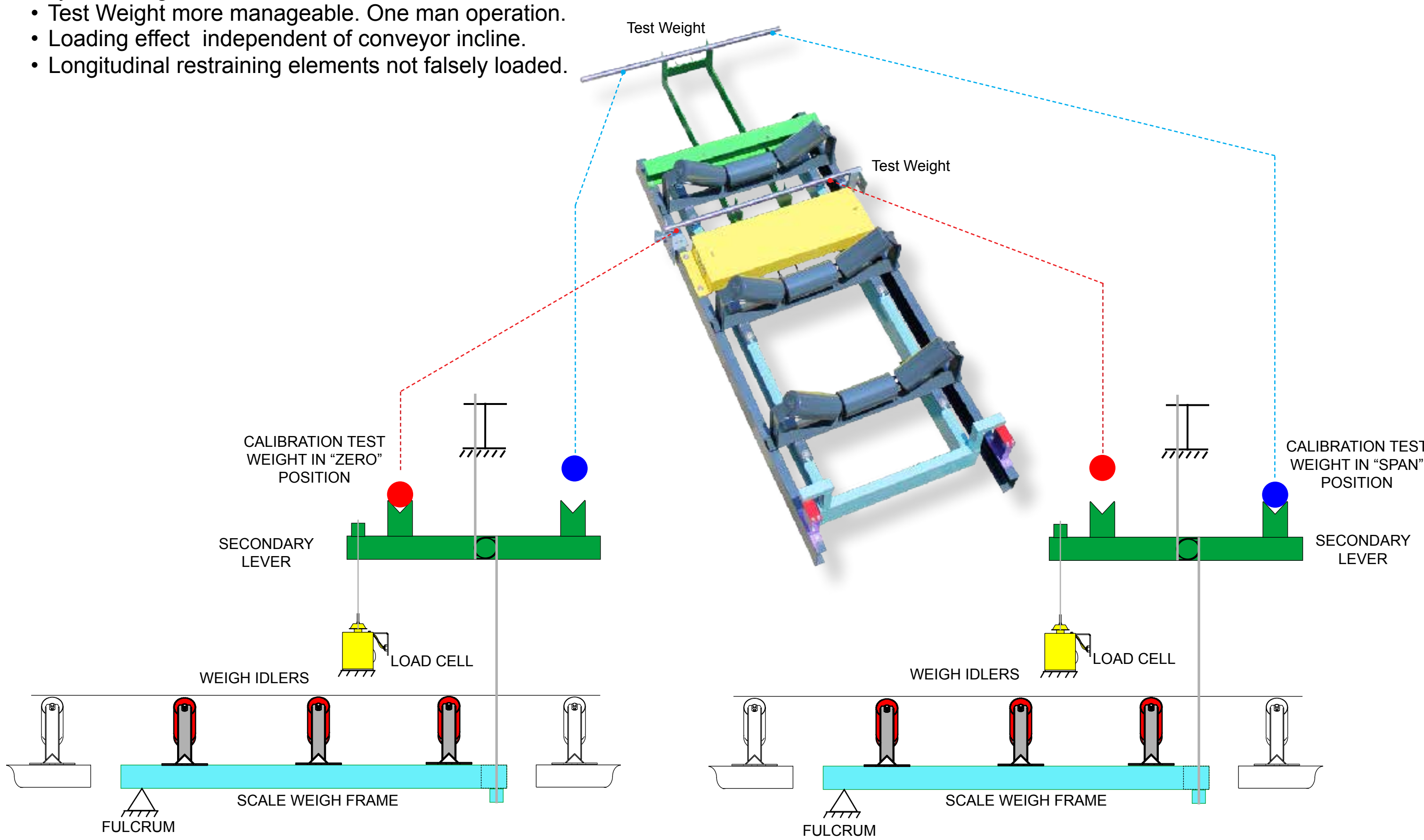
On high capacity scales where it is impractical to apply the test weight directly to the end of the weighbridge because of the physical size of the test weight, a special arrangement of the secondary lever is used.

In this configuration, the test weight provides tare mass counter-balance in its “storage” position on the secondary lever and a test load of known value in its “calibrate” position. By taking advantage of ratios in the secondary lever, smaller, easily manageable test weight(s) can be used to produce significantly higher loading values. This method of applying the test weight does not introduce error on inclined conveyors. Since the test weight is on the scale at all times, its moments due to the sine component remains constant regardless of the test weight’s position on the lever.

The weight is always present on the secondary lever, which also serves as a means to counterbalance dead loads and control the force range presented to the load cell. In the movable poise weight design the weight resides in either one of two locating “V” notches, but is never added or subtracted from the lever itself.

In one position, the weight serves as “counterbalancing” weight for a portion of the dead load. In the other position, the weight serves as the calibration test load. This unique method, whereby the movement of the weight alone affords the means to apply a large effective test load, is the only practical and economical system known for calibrating “heavily loaded” conveyor scales.

Key advantages:
- Test Weight more manageable. One man operation.
- Loading effect independent of conveyor incline.
- Longitudinal restraining elements not falsely loaded.



CALIBRATION TEST WEIGHT LIFT & STORAGE

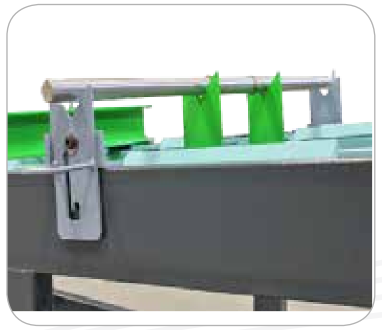
Many plants have instituted safety procedures that prohibit operations personnel from being in close physical proximity to moving conveyors. Consequently, routine calibrations can become tedious as lock-out/tag-out procedures must be followed before test weights can be manually re-positioned. As most large conveyor belt drive systems allow for only so many re-starts in a given time frame, the calibration process can become time consuming, requiring extended process down time.

Recognizing that routine calibrations are more likely to be performed on a regular basis if they are easy to accomplish, Thayer Scale offers two different types of test weight placement methods. A “manual” system and an automated test weight placement system.

The manual test weigh lifter requires that the operator lift a lever to change the placement of the calibration weight. When using the Automated Test Weight Lifter (ATWL) the instrumentation automatically re-positions test weights at the proper time during the calibration routine, eliminating the need to stop and re-start the conveyor as well as eliminating the need for operators to be in close physical proximity to high speed conveyors. THAYER’s Automated Test Weight Lift (ATWL) and Storage System provides quick, repeatable, and traceable calibration results without the need for operator intervention and with minimal process down time.

THAYER’S test weight lift and storage assembly provides a safe, convenient method of placing the calibration weight on the scale weigh bridge accurately and provides these advantages.

- SAFE-eliminates need to go between belt strands.
- EASY-permits one person to operate.
- CONVENIENT STORAGE-prevents loss or damage.
- REPEATABILITY-weight is ALWAYS positioned in the same location test after test.

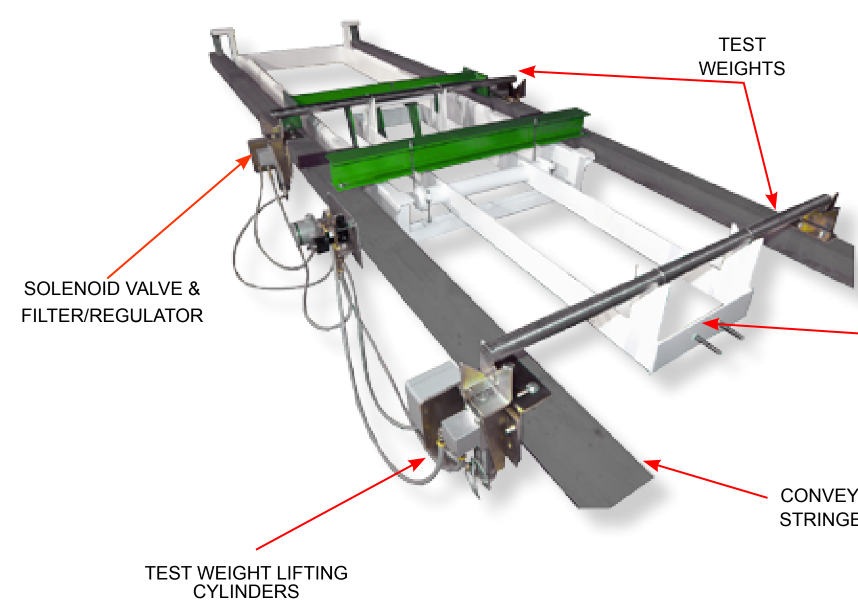


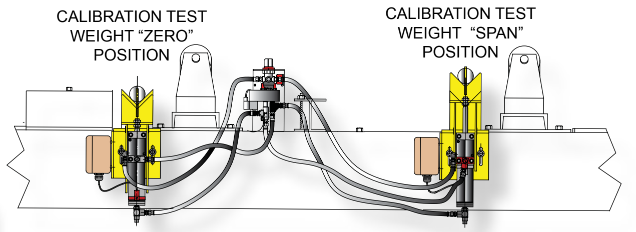
OPTIONAL AUTOMATED TEST WEIGHT LIFTER:

THAYER’s Automated Test Weight Lifter (ATWL) mechanism provides a means for applying a known CERTIFIED test weight to allow completely automatic calibration. The calibration sequence can be initiated via the belt scale instrument keypad or via a contact closure. A self-checking software algorithm in the weigh belt instrumentation prevents erroneous calibration. Test weight calibration eliminates the need for test chains. Two actuator assemblies lift and retract when signals from the instrument energize the solenoid valve assembly. When the solenoid is energized the extended actuators retract, slowly placing the test weight on the scale.

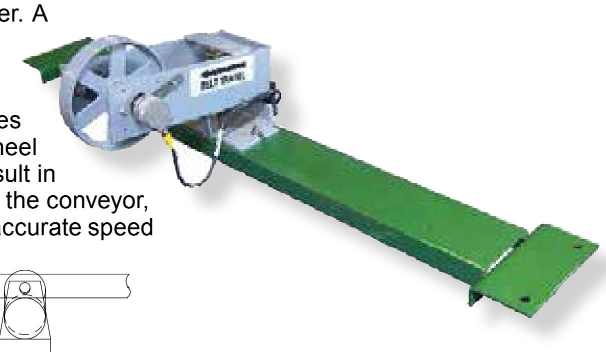
Each actuator assembly consists of a rod locking cylinder, flow controls, anti-rotation brackets and a junction box assembly. A limit switch on each actuator assembly provides position feedback to the instrument. Generally, two actuator assemblies are required per test weight. Each complete ATWL assembly also consists of a Hose Cradle with a 2-position solenoid valve and a filter-regulator unit.

The cylinders supplied have a special rod lock feature. This feature will stop movement of the piston rod when less than 50 psi of air pressure occurs. When calibration is complete the actuators return to their original positions.



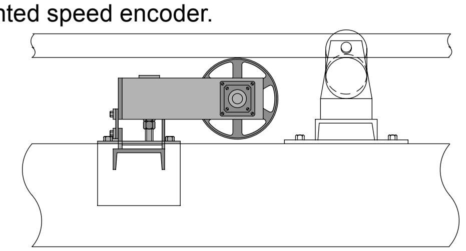


Precision Belt Speed Measurement



Accurate belt speed measurement requires the use of a precision wheel and pulser. A spring is used to maintain proper contact pressure of the wheel with the tension side of the belt in all operating conditions. The THAYER belt travel pulser assembly includes a precision cast/machined wheel with a "pre-calibrated" circumferential tolerance of ± 0.05% and a high resolution digital transmitter. The transmitter produces pulses equivalent to 1/100 to 1/200 of a foot of belt travel. The speed pick-up wheel has a narrow face width so it is less susceptible to material build-up, which can result in speed measuring errors. Since belt stretch is not constant throughout the length of the conveyor, and therefore, can affect speed measurement, the speed pickup produces a more accurate speed signal than that which is produced by tail pulley mounted speed encoder.

- Digital Pulse Output
- Heavy-duty Construction
- Spring loaded to maintain positive tracking
- Self-cleaning
- Minimum surface area for material build-up
- Easy to install
- Unaffected by temperature and voltage variations



THAYER Belt Scale Applications Program

THAYER is the only belt scale manufacturer that analyzes the customer's conveyor and application data to predict "real-world" performance. The computer program essentially tailors each component of the scale and conveyor to maximize the performance of the complete system based on the specific requirements of the application.

The program considers the parameter variations that are normally experienced in conveyor installations, the lack of dimensional precision of the conveyor components and the installation imperfections occurring as the result of both the initial set up and the subsequent conveyor maintenance activities.

The most logical approach to designing and installing high accuracy belt weighing equipment is to design for minimum error influences in every phase of the project. This involves conveyor analysis work to seek out preferred locations for load and speed measurements within a conveyor, suspension system configurations (scale design) that are least affected by conveyor influences, particularly alignment factors (load deflection vs. installed alignment conditions), and many other factors.

The typical computer analysis involves inputting eleven (11) key parameters which describe the application in sufficient detail to estimate accuracy for the installation as initially defined.

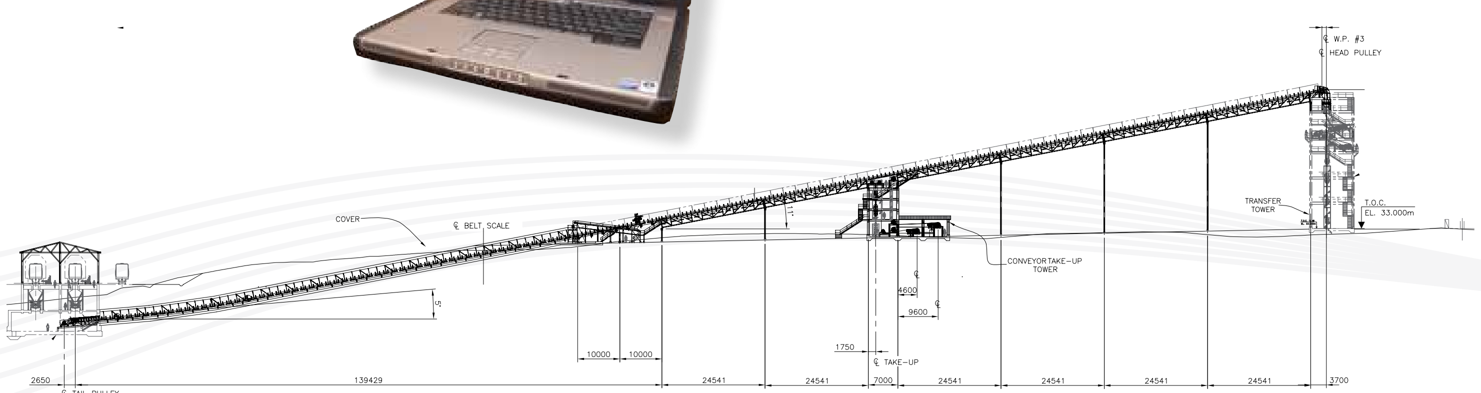
Major factors include:

- Conveyor design,
- Scale suspension design
- Location of load and speed sensors in relation to both conveyor terminal equipment and loading points
- Installed alignment conditions
- Duration and constancy of loading cycle
- Condition of rolling conveyor elements,
- The uniformity and stiffness of the belt itself
- Condition and size of take-up apparatus
- The precision with which the system can be routinely calibrated & adherence to a calibration schedule
- Operating environment.

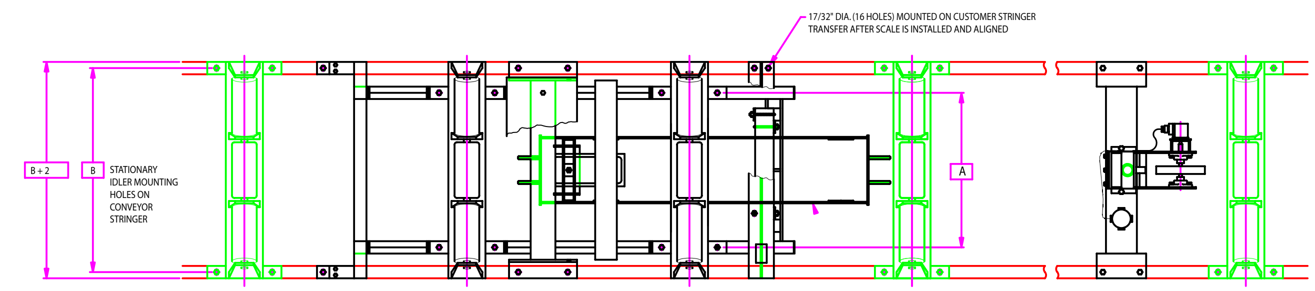
Subsequent runs are performed to evaluate the effects under various conditions, using different belt scale weigh bridge configurations, weigh bridge locations, idler spacing, weights and locations of gravity take-up, etc.

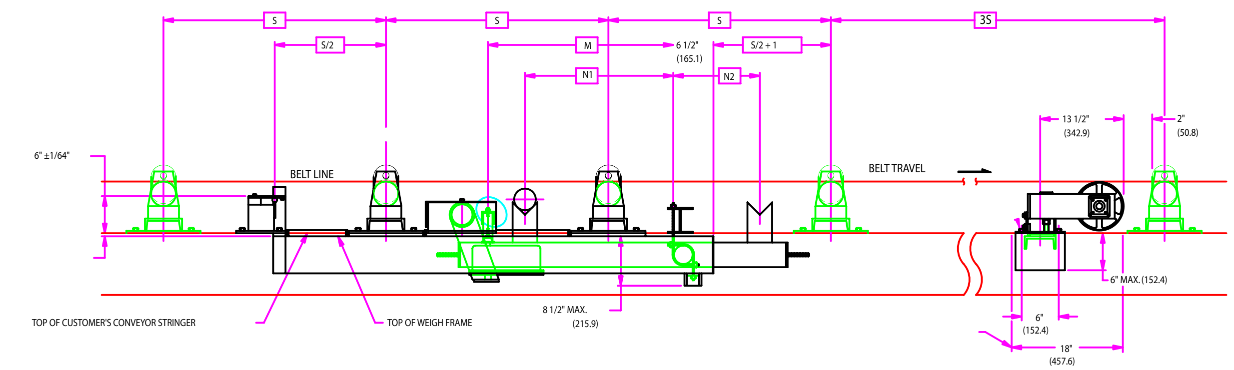
Actual "bias error" (offset between THAYER totalized weight and check scale weight) and "as-found error" (random error, i.e. repeatability) can be calculated for a given conveyor application using Thayer's belt scale performance math model.

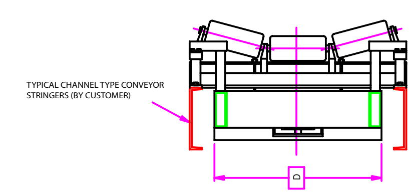
This unique program was developed by THAYER, and is based on many years of experience in the field of high accuracy continuous weighing. The objective of the program is quite simple: To provide a means of producing a high performance Belt Scale installation.



THAYER SCALE 3RF-6A & 3RF-8A BELT SCALE





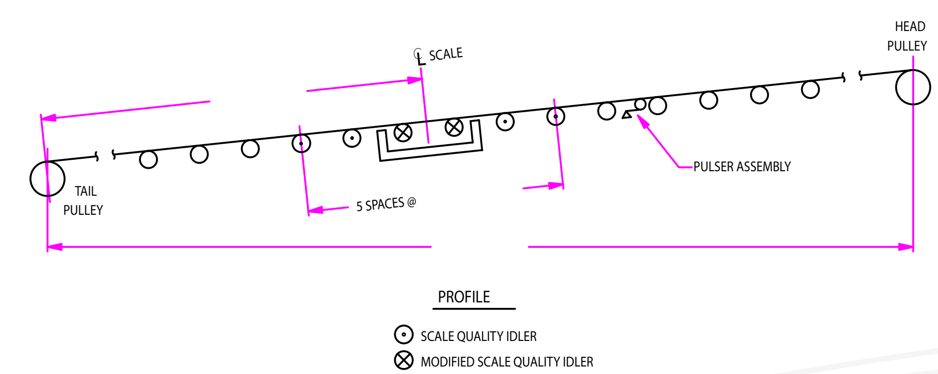


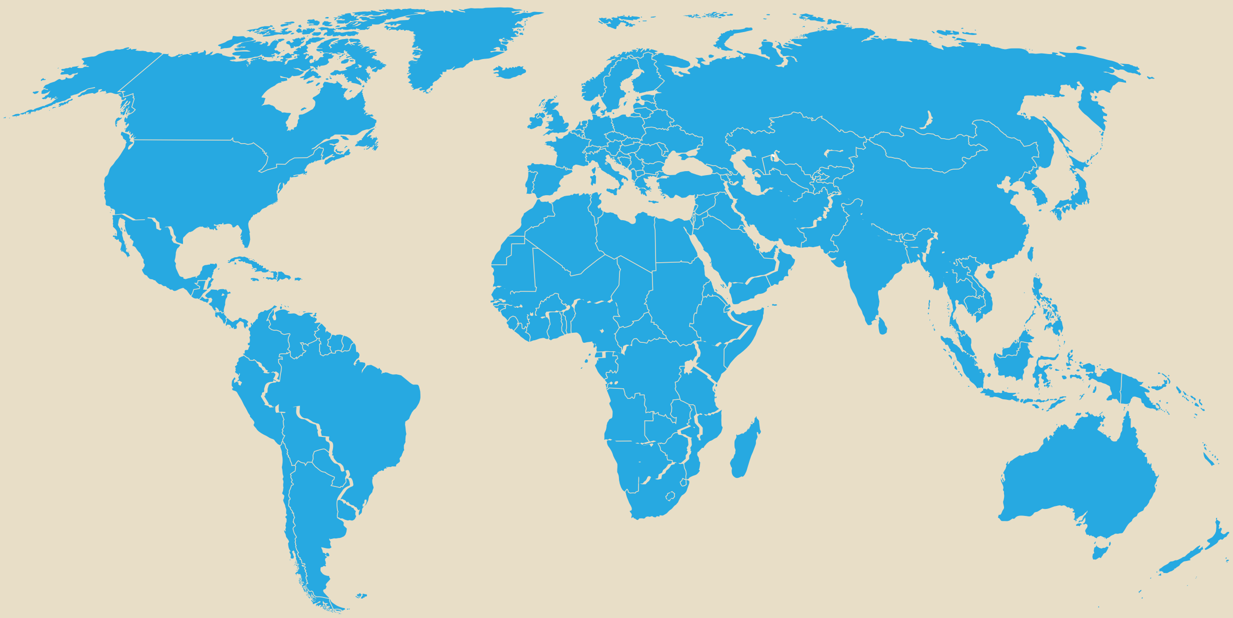
Model 3RF-6A

MODEL NUMBER	BELT WIDTH	A	B	D
3RF-6AR-24	24" (609.6)	25" (635)	33" (838.2)	27" (685.8)
3RF-6AR-30	30" (762)	29" (736.6)	39" (990.6)	33" (838.2)
3RF-6AR-36	36" (914.4)	33" (838.2)	45" (1143)	39" (990.6)
3RF-6AR-42	42" (1066.8)	39" (990.6)	51" (1295.4)	45" (1143)
3RF-6AR-48	48" (1219.2)	45" (1143)	57" (1447.8)	51" (1295.4)
3RF-6AR-54	54" (1371.6)	51" (1295.4)	63" (1600.2)	57" (1447.8)
3RF-6AR-60	60" (1524)	57" (1447.8)	69" (1752.6)	63" (1600.2)

Model 3RF-8A

MODEL NUMBER	BELT WIDTH	A	B	D
3RF-8A-30	30" (762)	29" (736.6)	39" (990.6)	33 1/2" (850.9)
3RF-8A-36	36" (914.4)	33" (838.2)	45" (1143)	39 1/2" (1003.3)
3RF-8A-42	42" (1066.8)	39" (990.6)	51" (1295.4)	45 1/2" (1155.7)
3RF-8A-48	48" (1219.2)	45" (1143)	57" (1447.8)	51 1/2" (1308.1)
3RF-8A-54	54" (1371.6)	51" (1295.4)	63" (1600.2)	57 1/2" (1460.5)
3RF-8A-60	60" (1524)	57" (1447.8)	69" (1752.6)	63 1/2" (1612.9)
3RF-8A-72	72" (1828.8)	69" (1752.6)	81" (2057.4)	75 1/2" (1917.7)
3RF-8A-84	84" (2133.6)	81" (2057.4)	93" (2362.2)	87 1/2" (2222.5)





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