Hangar Door Buyer's Guide

by Alexander Timoschuk Mechanical Engineer

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Rigid Door Structure

Most hangar door companies provide only the most basic door structures. It is so important to understand that a hangar door has more forces acting upon it that a simple wall. The building code only dictates the minimum requirements for the hangar door structure. The door section however, must also endure forces from the drive system, the door pick-up system, and wheel servicing loads. Hangar door structures generally consist of vertical hot rolled beams and horizontal cold-formed girts. Most hangar door companies do NOT provide structural diagonal bracing members to hold the door section square. These manufacturers are relying on the screws of the exterior cladding to hold the door section square. Over time, the structure will become rickety and the siding will start to detach.

When reviewing a hangar door, the bottom member of the door, and how this member houses the bottom wheels is an important point to look at. The wheels should be easily accessible and easily removable. To minimize cost, most hangar door manufactures only design the bottom member to resist the wind load. The bottom wheels are often supplied loose and bolted to the bottom member between two plates. Improper

Hangar Door Structure

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wheel mounting will lead to poor rolling of the door as well as premature rail wear. In many cases, the bolts that secure the wheel are supporting the entire door weight.

With small door sections, design flaws sometimes take longer to surface. For larger doors, many companies couple multiple small sections to make one larger section. This technique has serious limitation when not addressed properly will lead very poorly operating doors.

Although certification of the door structure is a requirement of the building code, some hangar door companies actually charge extra to have the door structure stamped by a professional engineer.

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Bottom rails

Bottom rolling hangar doors run on rails that are embedded into the concrete. The rails carry the load from the weight of the hangar door as well as half the wind load. The wind load is often higher than the weight of the door. The bottom rails should be a hard material and defined by a specification such as ASCE (American Society of Civil Engineers) or British standard BS11. Some companies use plain hot rolled square bars, which is a soft material prone to premature wear. Other hangar door companies sometimes use inverted angles as the tracks. The general rule is that a bigger rail is better. The bottom rail must be supported on “sleeper” or transversal steel supports. The sleepers, typically spaced 4 to 5ft center to center, must hold the rail straight until the concrete is poured.

To reduce cost, hangar door manufacturers have made the installation of the bottom rails the responsibility of the general contractor or their clients. The installation process involves the following:

Rail Flashings

Once the concrete is poured, changes are practically impossible to make. The form work around the the rails is critical to the proper operation of the hangar door. The hangar door manufacturer should be responsible for all works which could affect the door's performance.

1) Embedding the sleeper angles in a first pour.

2) Leveling the sleeper angles.

3) Cutting the rails to fit the job site conditions.

4) Welding the rails to the sleeper angles.

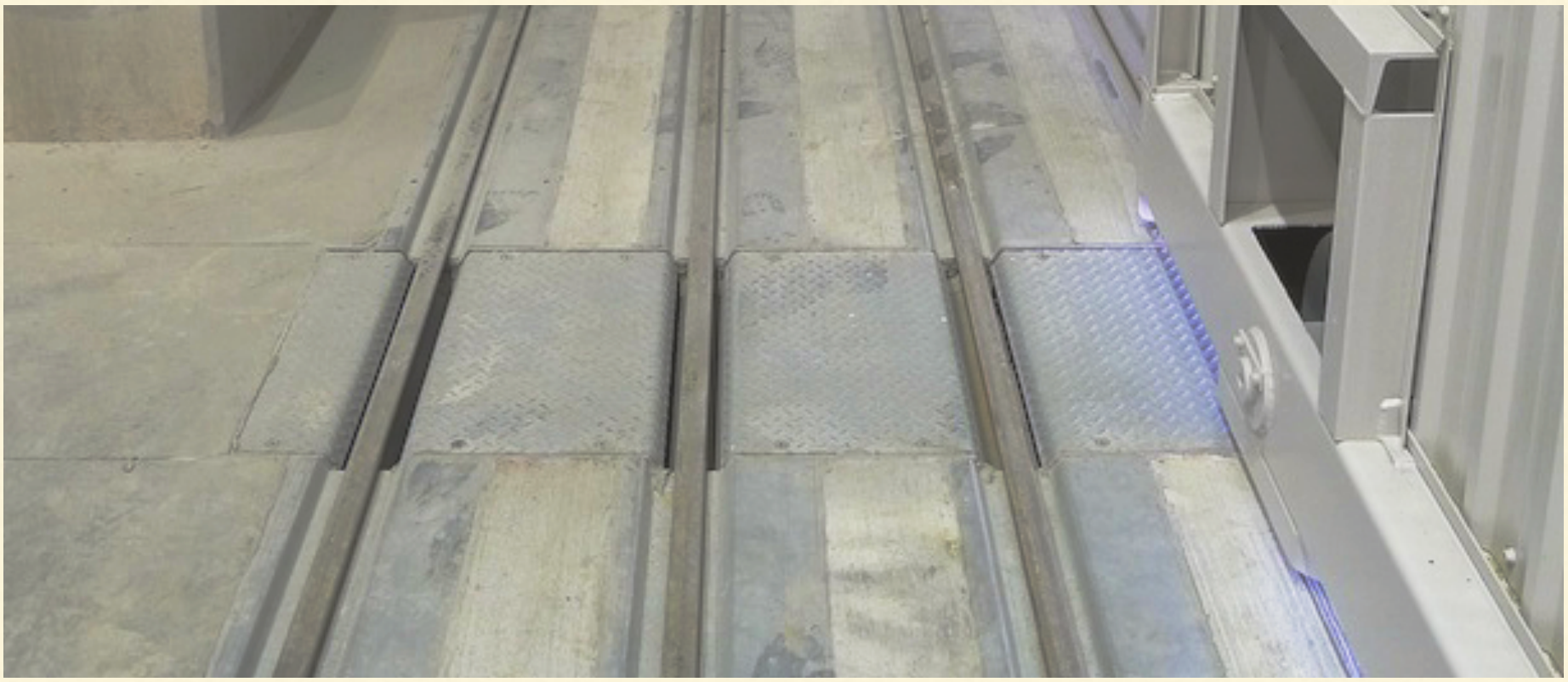
5) Buying and installing wood forms to form the wheel flange grooves.

6) Removing the forms and hoping nothing moved during pouring.

This entire process is prone to major errors. It involves two cement pours. It requires field welding, which can distort the rails. The wood forms are prone to moving. Once cast in concrete, the hope of repair is slim.

Once the concrete is poured, changes are impossible to make. Rails designed with high mechanical properties should only be considered. Bigger is always better.

Depending on the geographical location of the hangar, frequent rain and snow will adversely affect the opening and closing of the hangar door. Not many hangar door companies can offer a solution for removing the water that will accumulate in the grooves formed around the bottom rail's crown. As a result, many architects and or contractors try to devise a system to



Rail Drainage

Water will always erode concrete, it is just a question of time. The rail will rust and the rust will track it's way into the hangar. Rail drainage is option that cannot be added later. The hangar door manufacturer should be responsible for the supply of the rail drainage system.

evacuate the water along the hangar door bottom rails. Many times, these home-made systems prove to be very costly and ineffective. Drainage pits with hot dipped galvanized steel basins factory installed within the rail system by the hangar door manufacturer is always preferable. The basins should be connected to the buildings drainage system to eliminating the need for draining.

Water will always erode concrete. It's just a matter of time. The rail will rust, and rust will track all over the hangar's floor. Rail drainage is an option that cannot be added later. The hangar door manufacturer should be responsible for the supply of the rail drainage system.

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Hangar Door Hardware

Hangar door Hardware consists of all the little bits and pieces of that makes a hangar door a hangar door. The selection of materials and sizing of bearings is often never called out in any specifications. I will list some of the major items a wise shopper will look for.

WHEELS

There exists a wide variety of qualities when it comes to bottom wheels. It is obvious that small wheels cost less and put more stress on the bottom rail. Some companies provide wheels that must be field bolted to the door structure. Problems with alignment and friction from poor alignment will always affect the door in a negative way. The wheel material and hardness of the wheel is very important because it determines the load capacity. Of equal importance is the wheel bearing size, and the diameter of the axel. A proper balance is important for the longevity of the drive system. Soft wheels will pick-up debris and erode the bottom rail. Small axels will lead to premature bearing failure and poor door performance. Not to mention costly maintenance. Hardened alloy steel wheels are best. Bigger wheels are better. Larger bearings and axels last longer.

TOP ROLLERS

The top guides and top rollers have to work through the deflection limits of the roof. With top rollers, as with the bottom wheels, a larger diameter is better. The material hardness and bearing size is of great importance. Many hangar door companies use a wide flange beam as a top track. The top roller must transfer the wind load from the door structure to the building. These loads are very high. In addition to the windload, the rollers must float up and down to accommodate the building deflection. Door companies often simply put a steel tube within another tube to address the vertical movement. This leads to seizing and eventually to door jamming.

Top rollers should be made from hardened alloy steel. The rollers should have high capacity bearing grease packed for life. The top roller shafts should be located in big bronze sleeves to freely move up and down as the building deflects. This system offers reliable door operation with little maintenance.

DOOR BUMPERS

Door stop bumpers are normally never used during the electric operation of the door. The problem is that when a power failure occurs, the door will be pushed manually with a tow vehicle.

Many hangar door companies provide doorstop bumpers within the top track assemblies. The problem with situating bumpers in the top rails is that the loads required to stop a big door section is tremendously high. The building supplier normally does NOT account for this load. Spec-Dor provides doorstop bumpers that are at the end of the bottom rails.

Spec-Dor provides a heavy steel plate that gets embedded into the concrete. The bumpers have large calibrated rubber bumpers that can absorb the crashing load and transfers them to the floor.

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Weather-Stripping

A common problem with many hangar doors is their inability to seal out the outside. In cold climates, poor sealing will lead to higher heating bills and possible condensation. In desert climates, dust infiltration can cause havoc to aircraft maintenance. It is important to understand that a hangar door must be designed with allowances for a sealing system. In some cases, it is almost impossible to add effective seals to a poorly designed hangar door. For hangar door companies the most challenging area to seal is the top of the hangar door. The top weather-stripping system must remain effective within the building's allowable roof deflection. Rubber that is expected to remain pointing vertically generally fails within a year. Many manufacturers install seals in a way where access for maintenance or replacement is difficult and/or very costly. In many cases the exterior cladding covers over the weather-stripping making the removal of the cladding necessary to replace the seals. The location of, and the access to, the hangar door seals must be taken into consideration during the door design process.

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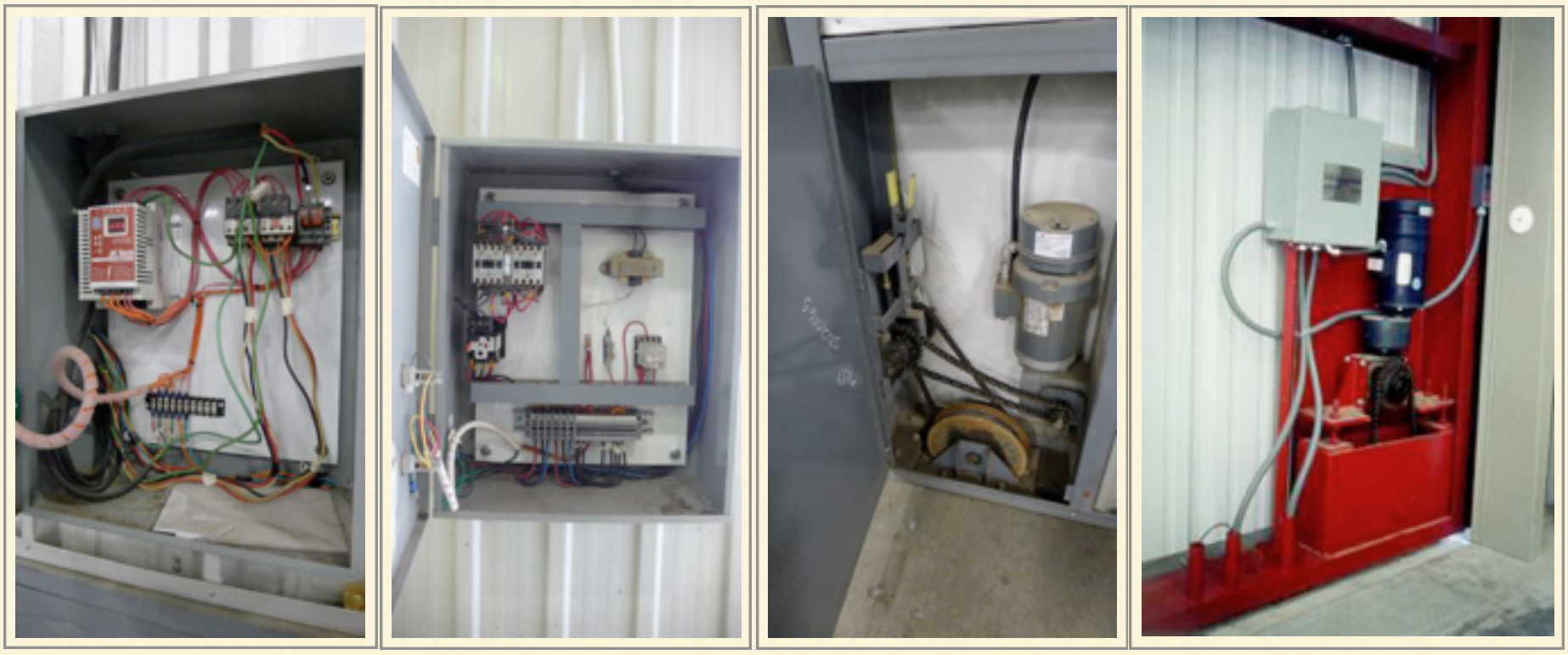
Door Controls and Drives

The proper way to motorize a hangar door is with a gearbox driven by an electric brake motor. The gearbox drives one, or more, of the hangar door's wheels with a chain and sprockets. Hangar door companies, have been providing what appears to be similar drive systems for years. Unfortunately, drive systems are rarely specified in detail. As a result, some hangar door manufacturers undersize, omit, or provide low end products. The type of gearbox is also important. **Worm** gearboxes are very economical but cannot be back driven. With worm gear gearboxes, towing the hangar door without removing the drive chain will break gearbox. High quality helical **bevel** gearboxes do not have his problem and, in general, will last the life of the door for a small premium in price. The size or capacity of the drive components is also a very important element to consider. Gearboxes and motors higher kilowatt or horsepower ratings are generally better. In many applications, the hangar door's drive systems will spin the drive wheel without moving the door. A good hangar door manufacturer will be able to predict the load required to drive the door. In some application, it is advisable to use multiple drive unit working in tandem to create a proper drive system. If a system is not de-



signed correctly, the sheer inertia of the door weight can destroy the gearbox.

The drive components should be big and strong. Bigger is better but the type is important. Always ask if a brake in included.

Hangar door controls should be designed to easily and safely operate the door from the fully closed to the fully open position. The most basic of systems will have a reversing contactor housed in a control panel simply turning on and off the motor. The system will have an open and a close pushbutton on the face of the control panel. The door operator will push and hold the push button until the door is opened or closed. Some systems, but not all, will have limit switches that will automatically stop the door in the open or closed position.

Today we have much more sophisticated systems that use VSDs or Variable Speed Drive modules that will slowly and smoothly accelerate the door to maximum speed without mechanical shock or noise. Today's systems can de-accelerate the door in a controlled fashion and stop the door repeatedly within a millimeter. User interfaces have also improved with the use of joysticks and pendant pushbutton stations. Wireless transmitters and sophisticated safety edges protect hangar personnel. Man-door lock-out switches and access controls integration are just a small sample of what modern hangar door controls can do.

All Controls should be built to UL or other recognized standards by a certified builder. All controls should have the right wire size, properly labeled with wire numbers, wire ducks with covers, and properly labeled terminal strips.