



Driving Systems Incorporated

THE SCOTT DRIVING SYSTEM

The Scott System was developed in 1974, by Charlie Scott, who established MED (Mobility Engineering & Development). Charlie developed and produced the Scott System for drivers with high-level disabilities. In 1989 Driving Systems Inc. took over production of the Scott System

The objective of Driving Systems Inc. is to provide a safe and reliable vehicle for persons with high-level disabilities. Some of our drivers have put over 300,000 miles on their van and are still driving vans from 1976. The Scott van is the only system accepted by the VA through testing by Texas A & M in actual on the road driving.

The system allow the driver to independently enter the vehicle, drive to their destination, and leave the vehicle without transferring from their power wheel chair. All of these operations are accomplished without aide from others.

Driving Systems Inc. is located in Van Nuys, CA and has customers through the USA and Canada.

APPLICATION GUIDELINES FOR THE SCOTT DRIVING SYSTEM

Scott system drivers fall into two main categories. Those with finger dexterity and those without the ability to use their fingers, such as drivers with a high-level spinal cord injury. There are many individuals who are marginally able to drive two-handed systems because of strength and range of motion issues. Through integration of functions and long experience in actually working with disabled clients in the course of individualizing vehicles, the Driving Systems provides answers to many of the dilemmas of high-level driving controls. Taken as a group our drivers are usually unable to drive any other type of control systems.

Drivers who are unable to accomplish throttle, brake and steering functions with both hands independently are logical candidates for the Scott System. Many spinal cord injury drivers lack the coordination to safely operate a two handed system. A Scott System driver can use just one hand to operate throttle, brake and steering which allows the weaker hand to be used for secondary electrical controls such as turn signals, wipers, headlights, shifting and cruise control. Head controls and mouth-stick operation of secondary controls is also an option.

The Scott System can be configured for either a right hand or left hand dominant driver using a three-post steering configuration. Drivers with adequate finger dexterity use the wheel version.

TYPES OF DISABILITIES AMONG SCOTT SYSTEM DRIVERS:

Quadriplegics to c4 -c5, Triplegia, Osteogenesis, osteo imperfecta. Post polio, rheumatoid arthritis, spina bifida, multiple sclerosis, muscular dystrophy and spinal muscular atrophy. Unique situations have led to clients driving while standing and thalidomide patients driving with their feet.

GENERAL FEATURES

One handed method of controlling vehicle

The Scott System is a unique approach to driving controls for high-level disabled individuals. The System is installed in a full size Ford Econoline van. The Ford steering column is removed and an aluminum control column is installed through the floor, to the right of the driver and behind the engine cover. The steering column design allows the inclusion of all three driving tasks, steering, braking and acceleration in a single, simple mechanism, similar to aircraft control.

The steering system uses the stock Ford steering gearbox, modified to connect to our hydraulic components and slave hydraulic steering valve. The gas and brake systems operate by positional vacuum control valves which port vacuum to boosters to augment the function of the vehicle's brake and throttle pedals.

Throttle, brake and steering functions are fully mechanically linked to the original Ford equipment. This linkage provides a closed loop design for all three driving controls and allows the driver positive feedback on the controls and a negligible amount of lag time. The links provide direct correlation between the controls and the road wheels, gas and brake.

A backup system is integrated into the vehicle to provide steering and brake in the event of power or other vehicle failure. In the event of a vehicle failure the throttle will return to the off position. Both the brake and throttle systems work in parallel with the van's OEM pedals. The pedals can be operated without any impact on the high-level system equipment.

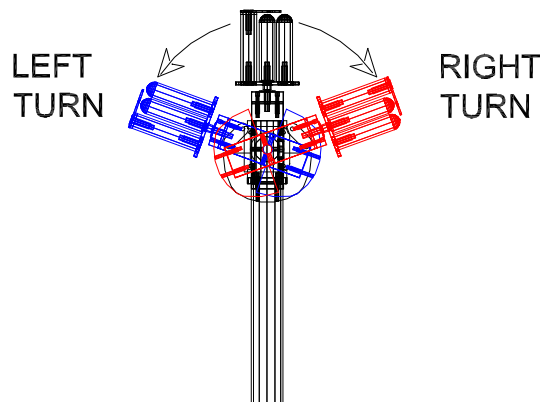
OPERATIONAL CHARACTERISTICS

Motions required to control functions

The steering wheel version turns 180° or 270° for full left to right lock to lock steering. The three-post version, used by individuals without finger function, provides full road wheel movement in 180° of control handle movement. This version of steering requires pronation and supination of the forearm.

The Scott System is designed to operate at stock hydraulic pressures. There is no effect on normal life expectancy of hydraulic seals and O-rings due to excessive pressure.

DRIVING SYSTEMS TRI-POST STEERING MOVEMENT



The driving functions of throttle and braking are provided by pivoting control column. The column pivots forward for throttle and backward for brake. Current Scott System vans have control columns which travel 3" for brake and throttle (6" of overall travel).

Service and Maintenance

From 25 plus years of knowledge with high-level driving aids, dSi has established maintenance schedules and a bi-annual safety check to insure safe and reliable operation on the driving system. In a safety check, all key components are inspected and adjusted to any changes in the driver's physical condition. If the driver were to obtain a new/different wheelchair, a new fitting may be required to match the driver station with the new wheelchair.

After about five years, we recommend replacement of the two vacuum boosters used for throttle and brake. These parts typically last ten years. All parts and components of the Scott System van are obtainable from dSi or local sources. Most maintenance repairs can be made in the same day, and the driver is back on the road.

The system is relatively easy to trouble shoot and maintain. Most problems can be diagnosed over the phone and if a part is needed, it can be send that day.

General Service Recommendations

Faithfully following the manufacturer's service recommendations as outlined in the booklet provided with each vehicle will insure years of trouble free service.

We recommend two exceptions as follows:

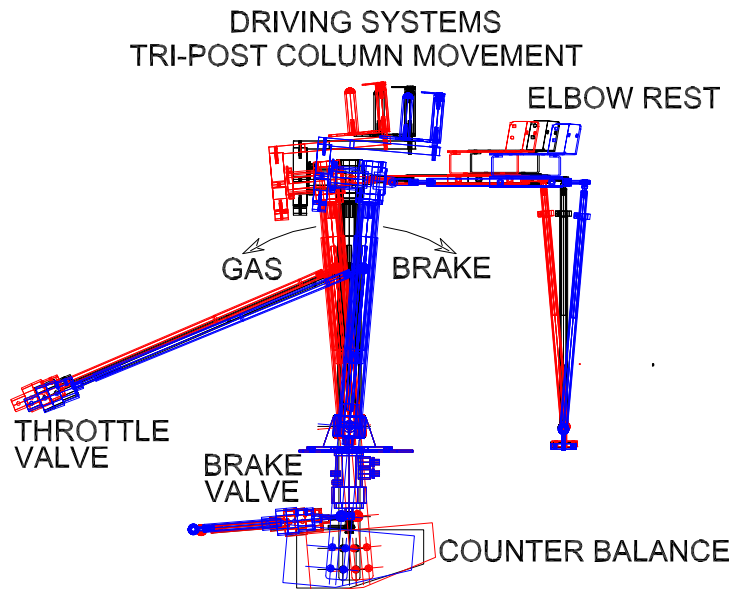
Oil change and Lubrication

Most of the Scott systems vehicles are operated on basically shorter runs, which tends to shorten the life of the lubricants. Therefore, we suggest that the engine oil and filter should be changed at 3,000 to 3,500 mile intervals. Always have the chassis lubricated at the time of the oil change, especially in wet weather.

Mobility system

No routine servicing of the driving system is required except to maintain the level of oil in the power steering fluid reservoir. All other portions of the system have a lifetime self lubricated and sealed bearings. No additional services or lubrication is required.

The power steering reservoir is located under the hood on the driver's side.



RELATED PRODUCTS

W/C tie down

We integrate our tie-down and other commercially available models into the system. What ever works best to accommodate the client's wheelchair.

Push button box and Auxiliary box

The Scott System uses a 30 button control panel custom positioned to the client's reach. All vehicle functions are controlled from this standard push button box. Additional circuits can be added for client's needs.

A simple relay control box is located inside the dash. It contains an array of automotive relays and an analog PC board to control the dimming of the push button lamps, the wiper resistance circuits and a ignition shutoff delay timer for emergency engine shutoff.

A row of circuit breakers, in the relay box, protects the systems circuitry.

APPLICATION GUIDELINES

Appropriate vehicles

See:
Basic Vehicle Specification Sheet

User characteristics

Driving Systems has worked with a wide variety of individuals with a wide range of disabilities. Often the Scott System is a last resort when nothing else will work. Scott System drivers are characterized by a combination of reduced range of motion, lack of strength and an inability to use left and right hands independently.

Steering wheel users fall into two categories. The majority are two handed drivers who use the 270° turning ratio. Usually these people lack the strength or coordination to use both hands independently. They "walk" their fingers on the wheel to maintain control of the steering at all times. An auxiliary control box is located in the wheel, so the driver does not reposition their hands on the wheel to operate secondary functions.

Triplegics, who have the use of one hand only, use a 180° ratio steering system. This allows the driver to easily turn the steering wheel lock to lock without changing hand position on the wheel or exceeding the possible movement of the driver's wrist.

About half of the Scott System drivers are high-level quadriplegics. Driver with injuries as high as C4-C5 are driving Scott System van daily. The Scott System van is a very natural fit to this category of driver. Quadriplegics, through the use of their shoulder muscles are very adaptable to pronation / supination movements necessary to operate the three-post system. These are more easily trained, gross movements which are also easily improved through practice. Micro muscle movements don't come easily to spinal cord quads. Coordination of separate throttle/brake and steering tasks are also difficult for spinal cord drivers. Integration of these tasks inn the Scott System is much more user friendly. Very often a spinal cord driver can be driving in just a few minutes. Driver training time is also substantially reduced.

Strength

Very little upper body strength is required to operate the Scott Driving System controls. The effort levels are below 3 pounds for throttle, brake and steering. Once the brake/throttle control forces are initiated the vacuum boost takes over and the force needed to maintain the activity is lessened. The inertial weight of moving the column is balanced by a lead weight mounted to the column below the floor. So the major effort to operate the brake and throttle involves opening a vacuum pop-it valve .060 of an inch. As vacuum flows to the corresponding vacuum diaphragm, the effort level is absorbed by the increasing collapse of the diaphragms.

Range of motion

As you might expect this is a very important consideration. The positioning of the steering column behind the engine cover allows the wheelchair driver to approach the column very closely. For steering wheel users the wheel is as close as is practical considering the need for about 3 or 4 inches of brake travel. The use of the wheelchair armrests provides support, stability for smooth accurate steering. Throttle operation is accomplished ordinarily by wrist or shoulder extension. Most throttle operations happen in about 3 inches of range.

Hand function

The mini wheel is 10 inches in diameter and is covered with soft foam. It provides a good gripping surface for most drivers. We have however made adaptations with smaller diameter wheel rims and additional wheel surface feathers to enhance grip.

The secondary electrical functions are available on the face of the wheel mounted switch box. Most often, these are operated by the thumb. Switches can also be mounted on the top or sides of the control box and operated by reaching over the wheel.

Hand function in high level spinal cord injured drivers present a different set of problems. The design of the three post with an armrest, allows for a variety of adjustments depending on the size of hands and length of forearm. A palm guard keeps the hand trapped between the pins. Some drivers have use of their biceps muscles and when the brake is applied, the hand has a tendency to slide up the peg. As with the wheel, it is very important that the forearm and elbow rest is attached to the steering column. The armrest provides the ability to brake even though the driver's hand is unable to really grip the 3 post pins.

Training

Training is provided by dSi to qualified dealers. These dealers are welcome to come to our shop for free training and education. The systems is relatively easy to trouble shoot and maintain. Most problems are diagnosed over the phone and if a part is needed, it is sent that day.

Driver Fitting

Dealers can perform the fitting procedure to make the Scott van mate up with the driver's size and position in the vehicle. This is a critical aspect of safe driving and will be overseen by dSi staff.

There is no issue more central to the safe operation of a modified van of this type than the correct position of the driver in the driver's station. To begin with, the driver should be as close to the steering column as possible. Often, the right front wheelchair tire is virtually touching the steering column base plate. This position allows the driver to reach the column without leaning over or stretching for the controls.

Upper torso stability is an important issue effecting the road driving performance.

Static adjustments have their place in the initial part of the fitting. But, on the road testing is the true test of the driver's responses when exposed to the inertial force inherent to every day driving. In our experience, all spinal cord injured drivers experience some problems with torso stability. Wheelchair back height, posture, positioning belts, shoulder pads and passive restraints are often part of the solution. If the driver is not securely supported, the most sensitive, precise control cannot be achieved.

Side to side stability is an issue in high-speed turns. A properly placed left side shoulder pad limits movements to the left side while the right side armrest tends to limit movement to the right.

DEALER INVOLVEMENT

Driving Systems Inc. is involved with dealers in the post system installation phase of the modification. After the Scott System is installed into the vehicle, the van is shipped to the client's dealer for a variety of additional equipment

Dealers can install:

Raised Top and Doors

Wheelchair tie-down

Wheelchair Lift

Flattened floor and carpet installation

Interior enhancements

Driver Fitting