

# **StopGate™ Barrier Arm GENERAL SPECIFICATIONS**

## **I. GENERAL**

All StopGate Barrier Arms shall be designed and manufactured by Energy Absorption Systems, Inc., of Chicago, Illinois.

## **II. DESCRIPTION OF SYSTEM**

### **A. General**

The StopGate Barrier Arm is a crashworthy positive gate. The gate is designed to prevent intrusion of vehicles onto railroad tracks or into other areas where occasional restriction is required. The system is deployed using a vertical pivot action, similar to the standard automatic warning gate, and utilizes a positive locking device at each end of the barrier gate arm to secure the gate across the roadway.

The StopGate Barrier Arm has been designed, tested and meets the evaluation criteria of Test Level 2 (TL-2) conditions, as specified in NCHRP 350. The gate is capable of stopping a 2000 kg [4410 lb.] vehicle traveling at 70 km/h [43 mph] impacting the arm at 90 degrees.

### **B. Component Description**

#### **Housing**

The housing shall be fabricated from steel plate and shall be hot dip galvanized after fabrication. Formed, channel shaped side plates shall be used to produce a strong configuration without welded corners.

Front and rear access doors shall be hung on slip-off type zinc hinges. Doors shall be sealed with neoprene strip gaskets. Openings for arm shafts shall be sealed with a bead of 100% silicone. 3-point lock with provisions for a padlock shall be a standard feature (padlock by others).

The housing base will provide eight 1-1/4 inch holes for mounting on the customer's foundation. Anchor bolts and template shall be supplied by the manufacturer.

#### **Arm Structure**

The arm shall be fabricated from a pair beams, each made of 4 inch schedule 40 pipe, 3 1/2 inch schedule 40 pipe, and 3 1/2 inch round tubing, spaced 355 mm [14 inches] apart in the vertical plane. The centerline of the arm

August 3, 2005

shall be 560 mm [22 inches] above the average roadway grade. The arm length shall be according to the customer's specifications; maximum arm length shall be 16.76 m [55 feet].

Gate arms shall be covered on both sides with 405 mm [16 inch] alternating red and white engineering grade reflectorized sheeting. Other striping materials, dimensions and colors shall be used, when specified.

The arm assembly shall include four 1/4" galvanized steel truss cables tensioned with galvanized turnbuckles to provide stability.

The arm assembly shall include a minimum of three LED light assemblies spaced along the length of the arm. The light assemblies shall be wired to illuminate continuously, and/or flash alternately when the arm is in the horizontal position and during the raise and lower cycles.

The arm assembly shall include an obstruction detection switch installed on the bottom edge of the lower beam. The normally-open switch shall be rated 1/2 ampere at 24VDC and have a pressure sensitivity of 4 psi. When switch contact is made during the lower cycle, the gate arm reverses direction and raises to the full up position. The gate arm remains up until a time delay relay closes and the gate arm begins its lower cycle. The time delay relay shall be adjustable from 1 to 100 seconds.

### **Arm Mounting Tubes**

Arm mounting tubes shall be hot-dip galvanized steel. The roadway arm shaft centerline shall be 1.40 m [55 inches] above the base line of the gate housing. Tubes shall be offset to place the gate arm centerline 560 mm [22 inches] above the roadway.

### **Counterweights**

Each gate shall be equipped with suitable lead and/or hot-dip galvanized steel counterweights. All lead counterweights shall be coated with enamel paint. Counterweight offset shall be determined by manufacturer to balance the arm in both the raised and lowered position.

### **Arm Shafts**

The main arm shaft shall be mounted in heavy-duty ball bearings and shall be lubricated from the inside. The main arm shaft shall be 3 1/2 inches in diameter. Shaft material shall be ASTM A311 Class B high strength, stress proof steel or approved equal.

### **Transmission**

The transmission shall be a fully enclosed, all gear, direct drive unit running in an oil bath. The drive train will not use belts or chains and shall be

August 3, 2005

connected to the arm shaft with a connecting rod having self-aligning ball ends. The connecting rod shall be constructed of ASTM A311 Class B high strength stress proof steel or approved equal.

A slip clutch shall be provided and set to allow momentary slippage to protect mechanism when the motor is instantly reversed or when the arm encounters an obstruction.

During the opening and closing cycles, the gate arm shall begin with zero velocity and accelerate smoothly reaching maximum velocity at mid-stroke (45 degrees). The arm will then decelerate smoothly to zero velocity at full stroke (90 degrees) preventing bounce or whip of the arm. Standard operating time to open or close the gate shall be approximately 13 seconds. Consult the factory for other available speeds.

The standard connecting rod assembly shall be designed to move the gate through 90 degrees of travel. An adjustable crank shall be provided to allow travel to vary from 90 degrees, when specified.

### **Motor**

The motor shall be a 1 hp 12VDC or 24VDC, totally enclosed, non-ventilated (TENV) electric motor, rated at 1725 rpm's and 80 amps (full load). Depending on the length of the gate arm, the motor shall be directly coupled to a 1000:1 or 1200:1 double-reduction worm gear speed reducer.

### **Failsafe Operation**

In the event of main power loss to the StopGate controls with the gate in the fully raised position, failsafe battery power is switched on, energizing the circuit controlling the gate lower cycle. With this contact closure, the gate lowers to the closed and locked position until main power is restored or the gate is manually operated. When main power is re-applied, the failsafe circuit is de-energized and normal operation resumes.

### **Hand Crank**

A hand crank and drill crank shall be included with each gate to operate the gate during power failure. Door safety switches will automatically break the control circuit power when the door is opened to allow for manual operation.

### **Limit Switch**

The gate limit switch shall be a unit assembly containing 8 individual switches having one set of normally open and one set of normally closed contacts each. Contacts shall be totally enclosed and will have UL rating of not less than 15 amperes at 250 volts AC. The limit switch shall be readily accessible and easily replaced with normal hand tools. Each individual switch

August 3, 2005

shall be controlled by an independent, adjustable cam. The limit switch body, shafts and cams shall be of corrosion resistant non-ferrous materials.

### **Safety Switches, Terminal Blocks and Wiring**

To protect operating and maintenance personnel from injury during service or installation, a manual disconnect switch shall be furnished, installed and fully wired in the operator assembly leads. Automatic disconnect switches shall be arranged to break the control circuit when either door is opened. NEMA rated terminal blocks shall be provided and installed inside the housing. All control wires will terminate on these blocks. Each terminal shall be clearly labeled and all conductors shall be color coded and/or numbered. The wiring diagram will reflect such colors or numbers. No conductor shall be smaller than #16 AWG stranded.

### **Cables**

The barrier arm shall be equipped with a system of three, 3/4-inch diameter annealed stainless steel cables, laced together into a net-like structure.

### **Cable Anchoring System**

The cables shall be anchored at both the housing and the tip end of the gate arm. For anchoring the cable, passive end locks shall be provided.

### **End lock**

The end lock design will automatically engage the cable assembly when the gate arm is lowered to the horizontal position. Neither mechanical linkages, nor actuators shall be required for alignment and engagement of the cable assembly.

### **Side Arm Lock**

For anchoring the cable at the housing end, a side arm lock shall be provided. After the barrier arm is lowered, the side arm lock will rotate to lock onto rods welded solidly in the side arm channel. The side arm lock shall be used to secure the side arm tubes in the down position in the event of a vehicle impact.

When the barrier arm is struck in the down position, the arm assembly will shear away from the side arm tube assembly, and will engage the anchoring system.

## **C. Material Specifications**

1. Metal work shall be fabricated from either MI020 Merchant Quality or ASTM A-36 steel. After fabrication, metal work shall be galvanized in accordance with ASTM A-123. All welding shall be done by or under the direction of a certified welder.

2. The system shall be assembled with galvanized and stainless steel fasteners. All bolts, nuts and washers shall be Commercial Quality "American National Standard" unless otherwise specified.

### **III. TEST CRITERIA**

- A. The StopGate Barrier Arm is capable of passing the NCHRP 350 Test Level 2 tests with both the light car and pickup truck at speeds up to 70 km/h (43 mph) head-on into the gate when lowered in the horizontal position. NCHRP TL-2 specifies the following evaluation criteria:

#### **NCHRP 350 Evaluation Criteria**

For head-on impacts, a non-redirective crash cushion should be capable of meeting the Occupant Risk Criteria as recommended in NCHRP 350. For vehicles weighing between 820 and 2000 kg [1810 and 4410 lbs.], the theoretical impact velocity of a hypothetical front seat passenger against the vehicle's interior (calculated from vehicle acceleration and 610mm [24"] forward displacement) should be less than 12 m/s [39.4 ft/sec], and the vehicle's highest 10 millisecond average acceleration subsequent to the instant of the hypothetical passenger impact should be less than 20 g's.

- B. Impact conditions that differ from those described in the NCHRP Report 350 test matrix for non-redirective crash cushions may result in different crash results than those encountered in testing. Furthermore, impacts in excess of TL-2 impact severity or the existence of unusual impact conditions such as vehicle instability resulting from traversing curbs of excessive cross slopes prior to impact may compromise crash performance. Under these conditions, performance criteria relative to structural adequacy, occupant risk and vehicle trajectory may not meet NCHRP 350 evaluation criteria.

### **IV. INSTALLATION**

Installation of the StopGate Barrier Arm shall be accomplished in accordance with the recommendations of Energy Absorption Systems, Inc.