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INTERNATIONAL
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SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J1981

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ROAD HAZARD IMPACT TEST FOR WHEEL AND TIRE ASSEMBLIES (PASSENGER CAR, LIGHT TRUCK, AND MULTIPURPOSE VEHICLES)

***Foreword*—**This Document has not changed other than to put it into the new SAE Technical Standards Board Format.

This SAE Recommended Practice has been prepared to provide a uniform test procedure for evaluating the effect, on wheel and tire assemblies, of impacting a road hazard such as a pothole or curb. No attempt has been made to simulate the exact conditions encountered when the wheel and tire assembly strikes such a hazard. The equipment developed for this test does, however, attempt to reproduce under controlled conditions the wheel and tire deformations that may be experienced with a road hazard impact. The test equipment can also be used to determine, with a high degree of accuracy, the threshold condition at which damage first occurs.

In preparing SAE J1981, laboratory and road tests carried out by a number of manufacturers were studied. The pendulum test specified was designed to provide equivalent damage with low cost equipment that would give accurate and reproducible results.

1. ***Scope*—**Test is designed for the testing of wheel and tire assemblies used with passenger cars, light trucks, and multipurpose vehicles. The test is limited to a frontal (radial) impact with both wheel rim flanges being impacted simultaneously. For side impact on the outboard rim flange only, please refer to SAE J175. This SAE Recommended Practice does not provide standards of performance.

2. ***References***

2.1 **Applicable Publications—**The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated the latest revision of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J175—Wheels—Impact Test Procedures—Road Vehicles
SAE J1982—Wheels for Passenger Cars and Light Trucks

3. ***Definitions*—**For terms and definitions specific to passenger car, light truck, and multipurpose vehicle wheels please refer to SAE J1982.

3.1 **Frontal Impact Test Fixture—**Test fixture for evaluating the frontal (radial) impact performance of wheel and tire assemblies.

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3.2 Drop Mass—The mass acting through the striker.

3.3 Striker—The shaped projection bolted to the pendulum that impacts the wheel and tire assembly.

3.4 Drop Height—The falling height of the drop mass. (The height of the striker mass center above the wheel hub center.)

3.5 Striker Mass Center—The intersection of the vertical axis through the fulcrum and the horizontal axis through the striker nose center with the pendulum hanging freely.

3.6 Wheel-holding Fixture—Fixture used to securely hold the wheel and tire assembly during testing.

3.7 Pendulum—The swing arm having a fulcrum at one end and the striker at the other end.

3.8 Bed Plate—A substantial member used to locate and clamp the holding fixture securely.

3.9 Frame—A substantial member used to support the fulcrum of the pendulum.

4. Test Procedure

4.1 Wheels and Tires for Tests—Only fully processed new wheels and tires intended for use on passenger car, light truck, or multipurpose vehicles should be used. (The test wheels and tires should not subsequently be used on a vehicle.)

4.2 Equipment—Road hazard test fixture (Figure 1) consisting of:

a. A 1828.8 mm (6 ft) pendulum having a drop mass of 54 kg as shown in Figure 2.
b. A rigid frame to support the pendulum.
c. A device for raising and releasing the pendulum.
d. A device for limiting the impact to one hit.
e. A very low friction (self-aligning ball bearing) fulcrum.
f. A striker (Figure 3).

Bed Plate for rigid support of the frame and the wheel-holding fixture.

Wheel-holding fixture having a spindle height that matches the height of the striker nose when the pendulum is in its free position. The stiffness of this fixture is very important; it should be no less stiff than the fixture detailed in Figure 4.

Gage for measuring the drop height.

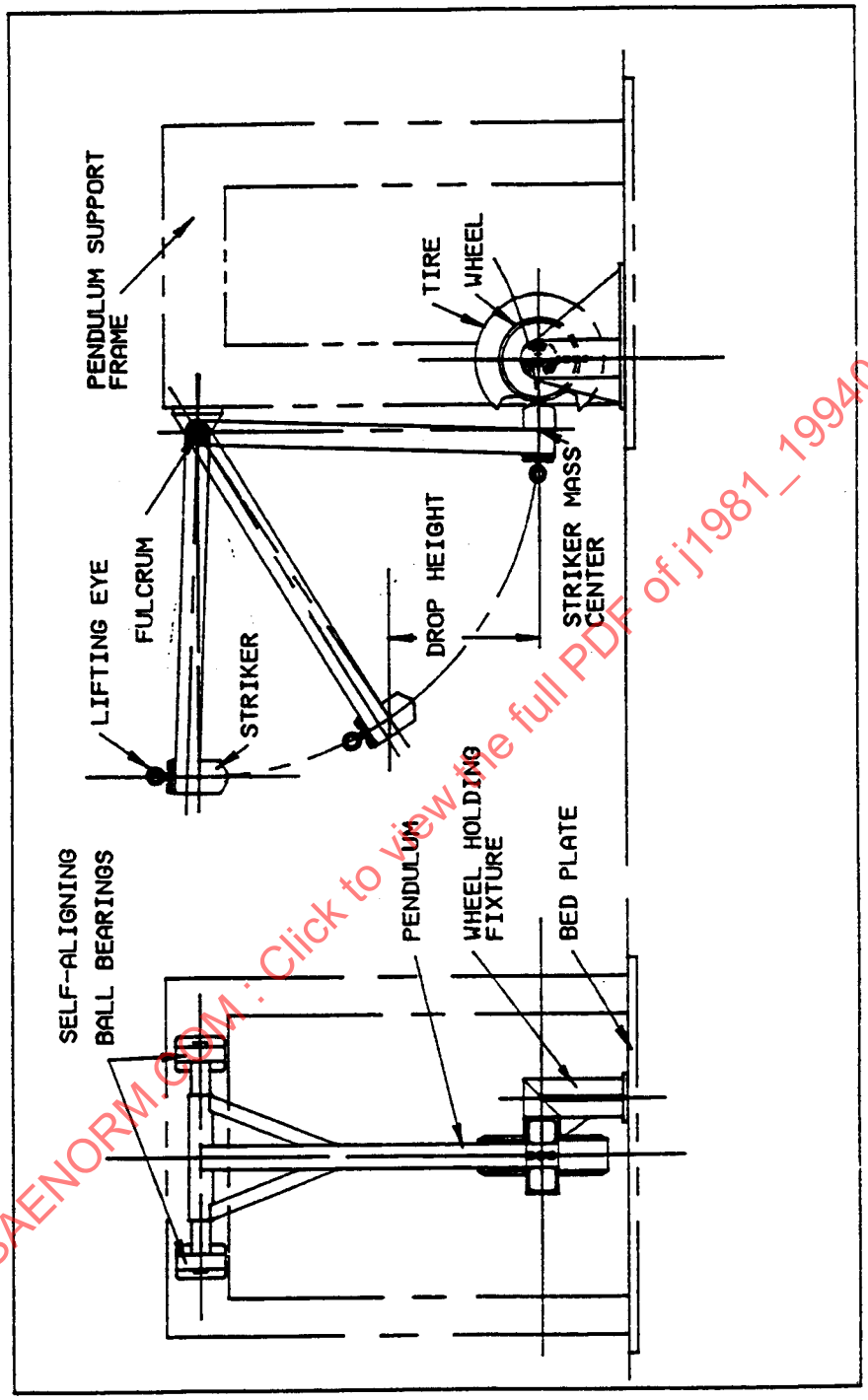

FIGURE 1—SAE J1981 ROAD HAZARD TEST FIXTURE

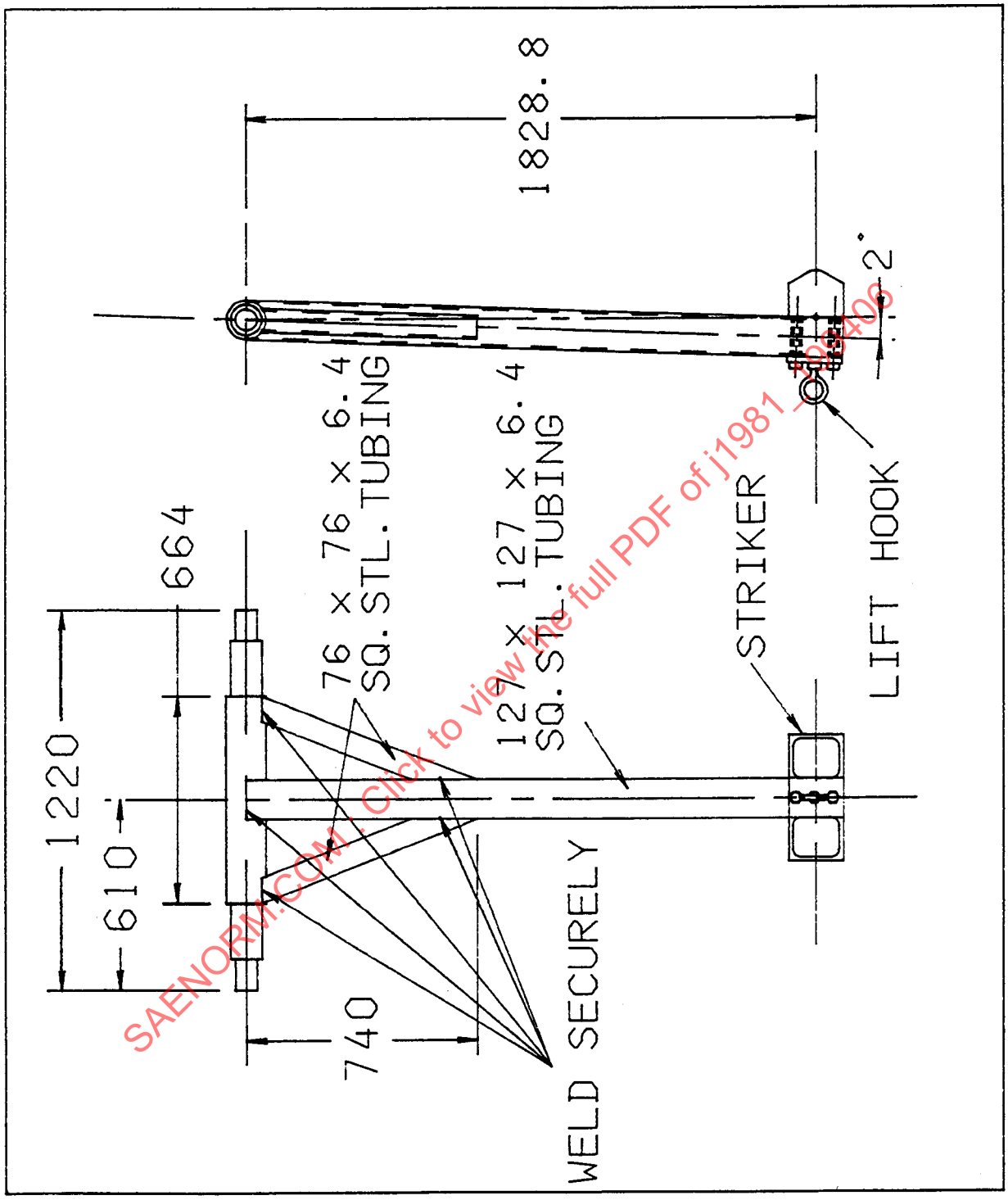

FIGURE 2—PENDULUM ASSEMBLY

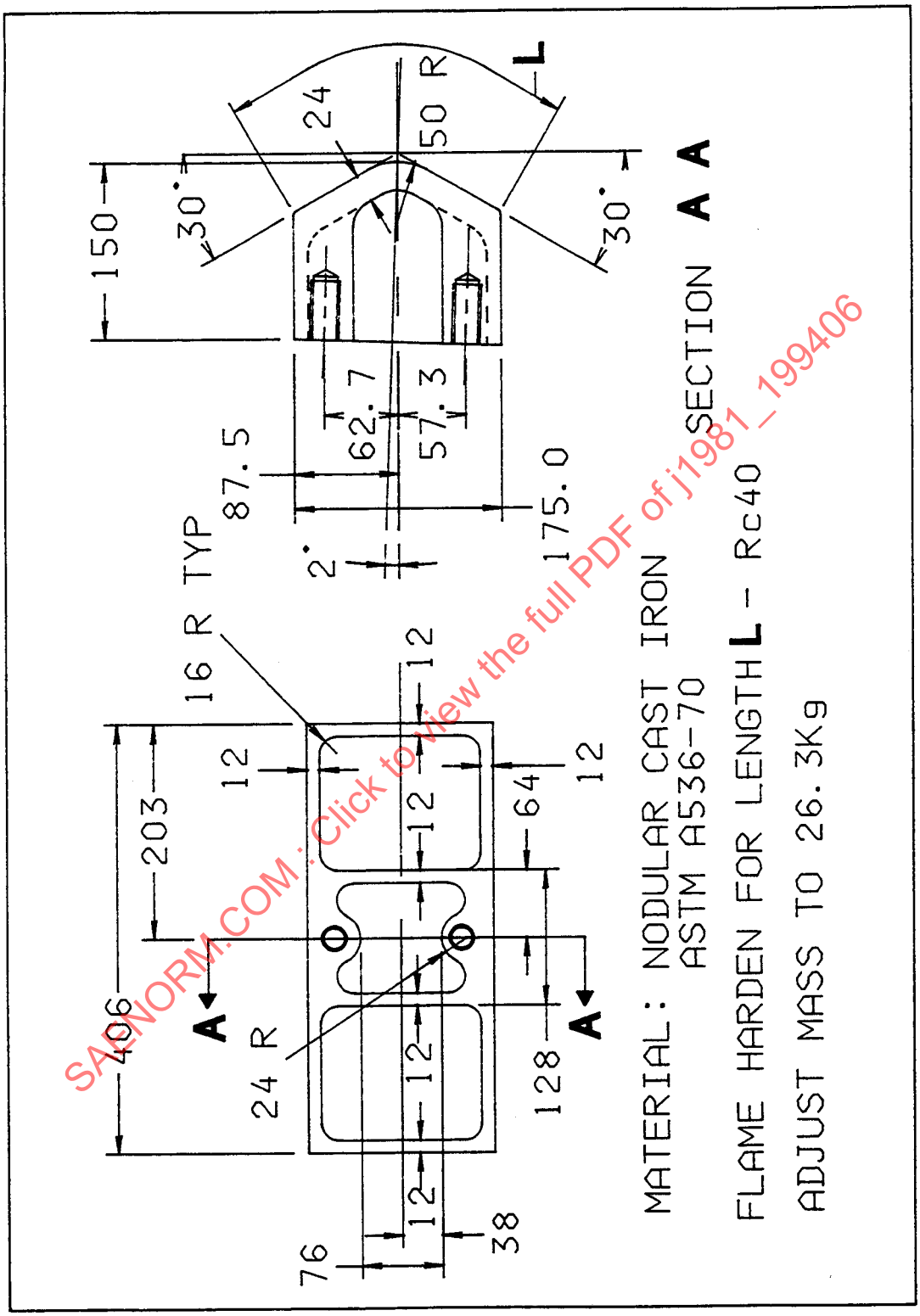

FIGURE 3—DETAIL OF STRIKER

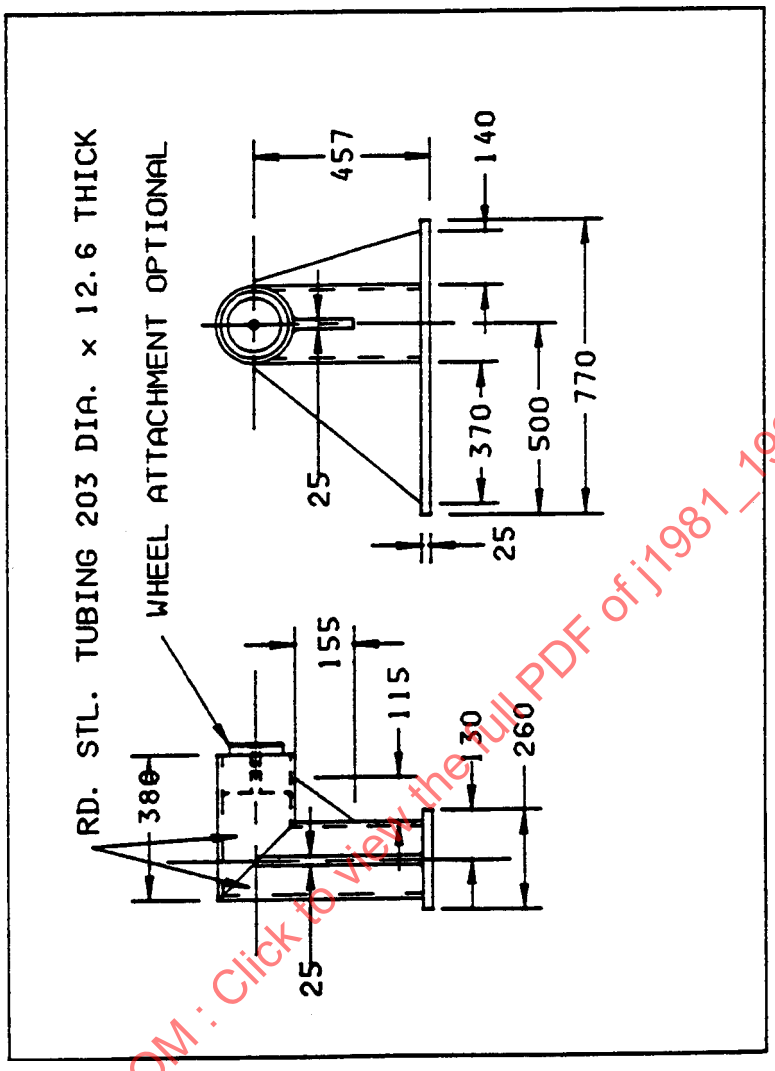

FIGURE 4—DETAIL OF WHEEL-HOLDING FIXTURE

4.2.1 EQUIPMENT CALIBRATION—The impact force on the wheel and tire assembly depends upon the length of the pendulum, the inertia of the pendulum, the shape of the striker, and the friction at the fulcrum. To calibrate the equipment to be sure that the impact force is always correct:

a. Confirm the pendulum length at 1828.8 mm (6 ft).
b. With the pendulum horizontal, check that the mass at the striker nose is 54 kg (Figure 5).
c. Measure the total swing mass of the pendulum (164 kg).
d. Confirm the included angle of the striker nose (120 degrees).
e. Confirm the nose radius of the striker (50 mm).
f. Confirm that there is no friction or binding of the fulcrum by measuring the velocity of the striker at 5 degrees before bottom dead center when released from the horizontal position (23.33 km/h).
g. With the pendulum hanging freely, check that the striker mass center, used to measure the drop height, is located at the intersection of the vertical centerline through the fulcrum and the horizontal centerline through the striker nose (Figure 5).

4.3 Procedure—When running the impact test all necessary precautions must be taken to provide a safe operation.

Before the test, examine and measure the test wheel and the test tire and record all the criteria to be evaluated.

Mount the test wheel to the wheel-holding fixture and locate the assembly so that both the wheel flanges are just touching the striker with the pendulum in the free hanging position. The centerline of the rim should also be aligned with the centerline of the pendulum and striker. Clamp the wheel-holding fixture securely to the bed plate.

Mount the test tire to the test wheel and inflate to the required test pressure. Reinstall the tire and wheel assembly to the holding fixture and tighten the wheel fasteners to the specified torque.

Raise the striker to the predetermined drop height. (Height of the striker mass center above the wheel hub center.)

Allow the pendulum to fall freely from this predetermined height. (A mechanism may be operational that will prevent any rebound impacts.)

After the single impact remove the wheel and tire assembly from the wheel-holding fixture and dismount the tire.

Examine and remeasure the test components and record any changes to the criteria being evaluated.

5. Performance Criteria—It is not within the scope of this document to determine levels of performance since correlation with field performance depends on variables other than the wheel and tire assembly. The greatest value of this test is to determine the threshold at which damage begins to occur and relate this to field performance of individual vehicles.