

**SPECIFICATION  
GRADER, ROAD, MOTORIZED  
FOR  
150 HP CLASS**

(THIS SPECIFICATION IS RELEASED FOR PROCUREMENT PURPOSES UNTIL REVISED OR RESCINDED.)

**SCOPE**

THIS SPECIFICATION COVERS AN ARTICULATED FRAME, FOUR-WHEEL DRIVE, FRONT-WHEEL STEERABLE MOTOR GRADER, WITH A DIESEL ENGINE AND A FULL POWER SHIFT TRANSMISSION.

**I. CLASSIFICATION**

THIS SPECIFICATION COVERS ONLY ONE SIZE OF ARTICULATED FRAME MOTOR GRADER.

**II. APPLICABLE STANDARDS**

THE FOLLOWING DOCUMENTS OF ISSUE IN EFFECT ON DATE OF THE INVITATION FOR BIDS SHALL FORM A PART OF THIS SPECIFICATION TO THE EXTENT SPECIFIED:

- J53 -MINIMUM PERFORMANCE CRITERIA FOR EMERGENCY STEERING OF WHEELED EARTHMOVING CONSTRUCTION MACHINES
- J386 -SEAT BELTS FOR CONSTRUCTION MACHINES
- J598 -SEALED LIGHTING UNITS FOR CONSTRUCTION AND INDUSTRIAL MACHINERY
- J872 -RESERVE TRACTIVE ABILITY TEST CODE
- J943 -SLOW-MOVING VEHICLE IDENTIFICATION EMBLEM
- J994 -ALARM BACK-UP--ELECTRIC PERFORMANCE, TEST, AND APPLICATION
- J1040 -ROPS
- J1047 -TUBING--MOTOR VEHICLE BRAKE SYSTEM, HYDRAULIC
- J1473 -BRAKE PERFORMANCE--RUBBER-TIRED EARTHMOVING MACHINES
- J1166 -SOUND MEASUREMENT--EARTHMOVING MACHINERY-OPERATOR-WORK CYCLE
- J1349 -ENGINE POWER TEST CODE--SPARK IGNITION AND COMPRESSEION IGNITION--NET POWER RATING

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SOCIETY OF AUTOMOTIVE ENGINEERS, INC. (SAE)  
400 COMMONWEALTH DRIVE  
WARRENDALE, PA 15096

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YEARBOOK  
TIRE AND RIM ASSOCIATION  
3200 WEST MARKET STREET  
AKRON, OH 44313

### III. REQUIREMENTS

#### A. GENERAL

THE GRADER SHALL BE OF CONVENTIONAL DESIGN AND HEAVY DUTY CONSTRUCTION. IT SHALL BE COMPLETE WITH ALL THE MANUFACTURER'S STANDARD INSTRUMENTS AND ACCESSORIES CUSTOMARILY FURNISHED WHETHER STIPULATED HEREIN OR NOT.

##### 1. STANDARD PRODUCT

THE GRADER OFFERED SHALL BE A NEW AND CURRENT STANDARD PRODUCTION MODEL OF LATEST DESIGN AND EQUIPPED AS SPECIFIED HEREIN. HOWEVER, WHERE BIDDER'S STANDARD UNIT EXCEEDS OUR MINIMUM SPECIFICATIONS, BIDDER IS TO FURNISH MODEL IN THE STANDARD CONFIGURATION. THE COMPONENT PARTS OF THE UNIT NEED NOT BE THE PRODUCT OF THE SAME MANUFACTURER. WHEN SPECIFIED AN ITEMIZED LIST OF STANDARD EQUIPMENT SHALL BE FURNISHED WITH THE INVITATION FOR BIDS.

##### 2. OPERATIONAL USE

THE GRADER SHALL PERFORM THE FOLLOWING TYPES OF WORK UNDER FULL CONTROL, FREE OF WEAVING ACTION OR OTHER CONDITIONS REQUIRING UNDUE OPERATOR EFFORT.

- a) NEW ROAD CONSTRUCTION
- b) GENERAL MAINTENANCES AND IMPROVEMENTS TO EXISTING ROADS
- c) COARSE AND FINE GRADING AND SPREADING
- d) HIGH AND LOW BANK SLOPING
- e) CLEARING SLIDES
- f) SCARIFYING
- g) DITCHING (INCLUDES RECONDITIONING OLD DITCHES AND CUTTING NEW DITCHES, WHICH AT TIMES WILL INCLUDE DEEP DITCHING)
- h) WINDROWING
- i) SNOW REMOVAL

THE GRADER SHALL BE CAPABLE OF CARRYING OUT ANY OF THE ABOVE OPERATIONS UNDER ALL TYPES OF CONDITIONS RANGING FROM LIGHT SOILS TO ROCKY MATERIALS.

THE GRADER SHALL BE FURTHER CAPABLE OF OPERATING ON MOUNTAIN ROADS OF LOW CONSTRUCTION STANDARDS HAVING SUSTAINED GRADES IN EXCESS OF 7% AND STEEP PITCHES UP TO 18%. IT SHALL OPERATE AT NOT LESS THAN 85% OF SEA LEVEL PERFORMANCE UP TO ALTITUDES OF 5,000 AT 60 DEGREES FAHRENHEIT.

COMPLETE MOLDBOARD ROTATION OF 360 DEGREES IS REQUIRED FOR GRADING IN BOTH FORWARD AND REVERSE.

##### 3. PERFORMANCE REQUIREMENTS

THE STATE REQUIRES PROOF THAT THE GRADER MEETS THE RESERVE TRACTIVE EFFORT REQUIREMENTS AS LISTED IN III.B. A COPY OF THE TEST RESULTS, CERTIFIED BY EITHER AN INDEPENDENT TEST FACILITY ACCEPTABLE TO THE STATE, OR THE BELVOIR RESEARCH AND DEVELOPMENT CENTER, FORT BELVOIR, VIRGINIA, OFFERED WITH THE INVITATION FOR BIDS WILL BE CONSIDERED AS ACCEPTABLE PROOF. OTHERWISE, A TEST MUST BE PERFORMED IN ACCORDANCE WITH SAE-J872, AND THE TEST RESULTS FURNISHED IN ACCORDANCE WITH THE TIME REQUIREMENTS AS SET FORTH IN THE INVITATION FOR BIDS. THIS TEST MUST ALSO BE CERTIFIED BY AN INDEPENDENT INDIVIDUAL WITH PROPER QUALIFICATIONS.

4. OCCUPATIONAL SAFETY AND HEALTH ACT

THE GRADER, COMPLETE WITH ALL ATTACHMENTS, SHALL COMPLY WITH THE FOLLOWING APPLICABLE OSHA STANDARDS AS NOTED BELOW:

29 CFR 1926.52-OCCUPATIONAL NOISE EXPOSURE

THE GRADER SHALL BE CONSTRUCTED AND ASSEMBLED SO THAT THE NOISE AT EAR LEVEL OF THE SEATED OPERATOR, WITH ALL DOORS, WINDOWS, AND VENTS OPEN; WHEN MEASURED IN ACCORDANCE WITH SAE-J1166--WORK CYCLE TEST, SHALL NOT EXCEED THE PERMISSIBLE NOISE EXPOSURE LIMITS OF THIS REGULATION FOR 8-HOUR OPERATOR EXPOSURE.

29 CFR 1926.600-EQUIPMENT

SAFETY GLASS FOR ENCLOSED CAB.

29 CFR 1926.602-MATERIAL HANDLING EQUIPMENT

SEAT BELTS, BRAKES, HORN AND BACK-UP ALARM.

29 CFR 1926.1000-ROLLOVER PROTECTIVE STRUCTURES

CAB WITH INTEGRAL ROPS.

29 CFR 1926.145-SPECIFICATIONS FOR ACCIDENT PREVENTION SIGNS AND TAGS

SLOW MOVING VEHICLE EMBLEM.

**B. RESERVE TRACTIVE EFFORT**

PERFORMANCE SHALL BE BASED ON PULL IN POUNDS DELIVERED AT THE BLADE FOR MAXIMUM POWER CONDITIONS OF THE VARIOUS GEARS AT GOVERNED ENGINE SPEED OVER A DRY LEVEL CONCRETE SURFACE UNDER FULL THROTTLE. THE MAXIMUM BLADE HORSEPOWER POINT IN EACH GEAR SHALL FALL ON OR ABOVE A CURVE CONSTRUCTED THROUGH THE FOLLOWING POINTS:

<u>GROUND SPEED (MPH)</u>	<u>BLADE PULL (LBS.)</u>
2	16,450
3	11,600
4	8,400
5	6,700
6	5,700
7	4,800
8	4,200
9	3,800
10	3,400

THE BLADE PULLS SHALL BE OBTAINED WITH THE GRADER FULLY SERVICED AND AT ITS BASIC OPERATING WEIGHT.

**C. WEIGHT**

THE BASIC OPERATING WEIGHT OF THE GRADER SHALL BE DETERMINED IN A FULLY SERVICED CONDITION AND SHALL INCLUDE: A) FULL FUEL TANK, B) OIL AND LUBRICANTS AS REQUIRED FOR OPERATING CONDITION, C) FULL COOLING SYSTEM, D) COMBINATION ROPS AND CAB WITH ROPS MOUNTING BASES, E) OPERATOR AND F) COMPONENTS, ATTACHMENTS, OR ACCESSORIES AS SPECIFIED HEREIN. THE BASIC OPERATING WEIGHT SHALL EXCLUDE: A) THE SCARIFIER, B) OPTIONAL ATTACHMENTS OR ACCESSORIES NOT INCLUDED IN THIS SPECIFICATION, C) HYDRO INFLATION, AND D) WHEEL OR TIRE BALLAST. THE WEIGHT AS SPECIFIED ABOVE IS DEFINED AS THE BASIC OPERATING WEIGHT. THE SIZE GRADER COVERED BY THIS SPECIFICATION SHALL HAVE A BASIC OPERATING WEIGHT OF NO LESS THAN 29,000 POUNDS AND A MINIMUM WHEEL-BASE OF 233 INCHES.

(DISTANCE FROM THE CENTER OF FRONT AXLE TO THE CENTER LINE OF THE REAR MAIN TANDEM DRIVE AXLES.) NOT LESS THAN 65% NOR MORE THAN 75% OF THIS WEIGHT SHALL BE CARRIED BY THE TANDEM DRIVING AXLES. OVERALL HEIGHT OF GRADER NOT TO EXCEED 11'-2" WITH EXHAUST STACK REMOVED.

**D. MATERIALS**

MATERIALS SHALL BE AS SPECIFIED HEREIN. ANY MATERIALS NOT SPECIFICALLY MENTIONED SHALL BE OF A COMMERCIAL QUALITY BEST SUITED FOR THE PURPOSE INTENDED AS RECOGNIZED WITHIN THE INDUSTRY. MATERIALS SHALL NATURALLY RESIST OR BE PROTECTED TO RESIST THE HARMFUL EFFECTS OF DUST, MOISTURE, OR CORROSION.

**E. SAFETY**

ALL EXPOSED PARTS SUBJECT TO HIGH OPERATING TEMPERATURE OR ENERGIZED ELECTRICALLY SHALL BE LOCATED, INSULATED, ENCLOSED, OR GUARDED SO AS TO PREVENT HAZARDS TO OPERATING PERSONNEL. ALL MOVING PARTS WHICH ARE OF SUCH NATURE OR SO LOCATED AS TO BE A HAZARD TO OPERATING PERSONNEL SHALL BE ENCLOSED OR GUARDED. PROTECTIVE DEVICES SHALL NOT IMPAIR THE OPERATING FUNCTIONS. HANDLES AND NON-SKID STEPS SHALL BE OF SIZE, SHAPE, AND LOCATION TO PERMIT SAFE MOUNTING AND DISMOUNTING.

**F. EASE OF MAINTENANCE**

ALL MAJOR ASSEMBLIES AND INSTALLED ATTACHMENTS, IF ANY, SHALL BE ACCESSIBLE FOR MAINTENANCE, REPAIR, AND REPLACEMENT. ITEMS SUCH AS CONNECTORS, PLUGS, AND VALVES SHALL BE STANDARDIZED AS TO TYPE AND THE NUMBER OF SIZES SHALL BE HELD TO A MINIMUM. DRAINAGE OF COOLANT AND LUBRICANTS SHALL BE TO THE GROUND WITHOUT DRAINING ON ANY PART OF THE GRADER. DRAINS SHALL BE ACCESSIBLE WITHOUT THE REMOVAL OR ADJUSTMENT OF ACCESSORIES OR PARTS OTHER THAN ACCESS OPENING COVERS.

**G. STRESS LIMITATIONS**

THE STRESS IMPOSED ON MECHANICAL MEMBERS THROUGH NORMAL OR SHOCK LOADS AT MAXIMUM ENGINE TORQUE SHALL NOT CAUSE RUPTURE OF OR PERMANENT DEFORMATION OR UNDUE WEAR ON ANY MEMBER. STRUCTURAL MEMBERS SHALL BE SELECTED AND USED WHICH WILL WITHSTAND THE STRESSES IMPOSED BY OPERATION AT MAXIMUM BLADE PULL CONDITIONS FOR THE BLADE AND SCARIFIER WITHOUT PERMANENT DEFORMATION OR EXCESSIVE WEAR.

**H. ENGINE**

1. DIESEL ENGINE

THE ENGINE SHALL BE FULL DIESEL, TURBO CHARGED, LIQUID COOLED, MINIMUM 150 NET BRAKE POWER, MINIMUM SIX (6) CYLINDERS, AND OF THE COMPRESSION IGNITION TYPE, TWO OR FOUR-STROKE CYCLE, CAPABLE OF OPERATING ON COMMERCIAL DIESEL FUEL AS RECOMMENDED BY THE MANUFACTURER. THE ENGINE SHALL BE EQUIPPED WITH AN ADEQUATE AND EFFICIENT LUBRICATION SYSTEM AND FUEL INJECTION MECHANISM, HEAVY DUTY FUEL FILTER SYSTEM, AND A HEAVY DUTY FULL FLOW TYPE LUBRICATING OIL FILTER. THE ENGINE SHALL BE EQUIPPED WITH FUEL SETTING ADJUSTMENTS FOR OPERATION AT ALTITUDES OF 5,000 FEET AND ABOVE.

ENGINE SHALL HAVE DUAL HP RATING: 150 HP IN LOWER GEARS (1 - 2, OR 1 - 3) AND 180 HP IN HIGHER GEARS (3 - 6, OR 4 - 8). THESE HP RATINGS SHALL BE "RATED NET POWER" AS DEFINED IN SAE J1349.

2. AIR CLEANER

THE AIR CLEANER SHALL BE THE DUAL ELEMENT TYPE (PRIMARY AND SAFETY DRY TYPE ELEMENTS) WITH A BUILT-IN PRECLEANER SECTION, AUTOMATIC DUST EJECTION, AND A PROGRESSIVE TYPE RESTRICTION INDICATOR. THE AIR CLEANER HOSE SHALL BE OF THE METAL OR HEAVY DUTY FLEXIBLE NON-COLLAPSIBLE TYPE, WITH METAL OR MOLDED RUBBER ELBOWS. WIRE REINFORCED HOSE IS NOT ACCEPTABLE. ALL CONNECTIONS SHALL BE BANDED. FILTER SHALL BE LOCATED INSIDE HOOD OR AT LOCATION PROTECTED FROM CONTAMINANTS THROWN BY TANDEM WHEELS.

3. ENGINE GOVERNOR

THE ENGINE SHALL BE EQUIPPED WITH A VARIABLE SPEED GOVERNOR OF THE ELECTRONIC, MECHANICAL, OR HYDRAULIC TYPE AND SHALL BE DRIVEN FROM THE ENGINE. PROVISIONS SHALL BE MADE FOR PERMITTING REGULATION OF THE GOVERNED SPEED-SETTING THROUGHOUT THE ENGINE LOAD RANGE WHILE THE ENGINE IS IN OPERATION.

4. COOLING SYSTEM

THE ENGINE COOLING SYSTEM SHALL BE MAXIMUM AVAILABLE FROM THE MANUFACTURER AND HAVE AN OPERATING AMBIENT TEMPERATURE RANGE OF -20 DEGREES FAHRENHEIT TO 125 DEGREES FAHRENHEIT. IT SHALL INCLUDE A HEAVY DUTY RADIATOR PROTECTED BY A GUARD, A FAN, A CIRCULATING WATER PUMP, AND A THERMOSTAT. THE COOLING SYSTEM SHALL BE PROTECTED WITH A PERMANENT TYPE ANTIFREEZE TO -20 DEGREES FAHRENHEIT TEMPERATURE.

5. ENGINE HOUSING

THE ENGINE SHALL BE PROTECTED WITH A METAL HOOD AND LOCKABLE SIDE PANELS. LOWER SIDE PANELS WILL NOT BE REQUIRED IF THE GRADER FRAME MEMBERS PROVIDE PROTECTION FOR THE ENGINE TO THE SATISFACTION OF THE PROCURING AGENCY.

6. ENGINE STARTING SYSTEM

THE GRADER SHALL HAVE A HEAVY DUTY ELECTRIC STARTING SYSTEM, AND KEYED IGNITION SYSTEM WITH TWO KEYS. THE ENGINE STARTING SYSTEM SHALL BE CAPABLE OF CRANKING THE ENGINE IN AN AMBIENT TEMPERATURE OF -20 DEGREES FAHRENHEIT.

THE DIESEL ENGINE SHALL START WITHIN APPROXIMATELY FIVE MINUTES AND BE READY FOR FULL-LOAD OPERATION WITHIN APPROXIMATELY 15 MINUTES IN AMBIENT TEMPERATURES FROM -20 DEGREES FAHRENHEIT TO 125 DEGREES FAHRENHEIT.

A CONCEALED ELECTRICAL DISCONNECT SWITCH TO PREVENT UNAUTHORIZED STARTING OF THE GRADER SHALL BE FURNISHED. SWITCH IS TO BE PROTECTED FROM ROAD SPLASH.

7. FUEL TANK(S)

THE MANUFACTURER'S STANDARD FUEL TANK(S) IS (ARE) ACCEPTABLE AND SHALL BE LOCATED SO AS NOT TO BE AFFECTED BY HEAT FROM THE ENGINE, EXHAUST PIPE, OR MUFFLER. THE FUEL TANK SHALL BE SUFFICIENT FOR A MINIMUM OF 8 HOURS CONTINUOUS OPERATION.

**I. POWER SHIFT TRANSMISSION**

THE POWER SHIFT TRANSMISSION SHALL PROVIDE FOR SHIFTING UNDER FULL ENGINE POWER THROUGH SUCCESSIVE FORWARD AND REVERSE GEAR RATIOS BY SELECTIVE ENGAGEMENT OF POWER ACTIVATED MULTIPLE-DISK CLUTCHES. A MINIMUM OF SIX (6) FORWARD AND TWO (2) REVERSE SPEEDS ARE REQUIRED.

GRADERS EQUIPPED WITH TORQUE CONVERTORS SHALL HAVE A POWER SHIFT MULTIPLE SPEED WITH GEAR REDUCTIONS SUCH AS TO KEEP THE TORQUE CONVERTOR WORKING EFFICIENTLY THROUGHOUT THE ENTIRE RANGE OF GRADER SPEEDS. THE TORQUE CONVERTOR SHALL HAVE A MEANS OF COOLING, AND THIS COOLING SHALL BE SUFFICIENT TO PREVENT OVERHEATING DURING EXTENDED FULL LOAD OPERATION OR ROADING.

IF A SINGLE PEDAL CONTROLS THE BRAKE AND CLUTCH ACTUATION, A HAND CONTROLLED VALVE SHALL BE PROVIDED IN THE TRANSMISSION CLUTCH DUMP CONTROL LINE TO ALLOW BRAKE ACTUATION WITHOUT DISENGAGING THE TRANSMISSION.

A HAND THROTTLE AND AN OVER-RIDING FOOT OPERATED ENGINE THROTTLE CONTROL PEDAL (ACCELERATOR/DECELERATOR) SHALL BE FURNISHED.

TRAVEL SPEEDS:

LOWEST GEAR SPEED-- FORWARD (MAX.)	4.0 MPH
HIGHEST GEAR SPEED-- FORWARD (MIN.)	18.0 MPH
LOWEST GEAR SPEED-- REVERSE (MAX.)	4.0 MPH
HIGHEST GEAR SPEED-- REVERSE (MIN.)	8.0 MPH

## **J. FINAL DRIVE**

ALL SHAFTS, GEARS, SPROCKETS, CHAINS, BEARINGS, ETC, SHALL BE OF SUFFICIENT STRENGTH AND CAPACITY TO SAFELY TRANSMIT FULL POWER OF THE ENGINE TO THE DRIVING WHEELS. ALL GEARS AND SPROCKETS ARE TO BE MACHINE CUT. DRIVE GEARS SHALL RUN IN AN OIL BATH, AND ALL DRIVING MECHANISMS SHALL BE FULLY ENCLOSED AND PROTECTED AGAINST LUBRICANT LEAKAGE, DUST, MUD, AND WATER. TANDEM HOUSING SHALL BE SEALED AND CONTAIN SEPARATE LUBRICANT.

THE TANDEM FRAMES SHALL BE MOUNTED ON AND PIVOT ABOUT THE DRIVING AXLE SO THAT EQUAL WEIGHT IS CARRIED ON ALL FOUR WHEELS WHEN OPERATING OVER ROUGH TERRAIN WITHOUT AFFECTING THE EVENNESS OF THE BLADE CUT. TANDEM OSCILLATION SHALL BE NOT LESS THAN 20 DEGREES FROM THE HORIZONTAL IN EITHER DIRECTION. A STOP SHALL BE PERMANENTLY ATTACHED TO THE GRADER TO LIMIT OR PREVENT TANDEM OSCILLATION OR IN LIEU OF A STOP, LIFTING ATTACHMENTS MAY BE LOCATED AT THE CENTER OF THE TANDEM TO PREVENT TANDEM CASE OSCILLATION OR DAMAGE TO THE GRADER DURING LOADING AND SHIPMENT.

THE DIFFERENTIAL SHALL INCLUDE EITHER "NO-SPIN," OR AN OPERATOR CONTROLLED HYDRAULICALLY OPERATED LOCK-UNLOCK.

### **1. FRONT AXLE**

THE FRONT AXLE ON THE GRADER SHALL BE PIVOT-MOUNTED AND OF SOLID STRUCTURAL QUALITY STEEL BAR OR TRUSS CONSTRUCTION, FITTED WITH LEANING-TYPE WHEELS AND OPERATING MECHANISMS. THE WHEEL TILTING MECHANISM SHALL ELIMINATE LOCKING AND JUMPING. THE LEANING-WHEEL MECHANISM SHALL LEAN THE WHEELS NOT LESS THAN 15 DEGREES TO THE RIGHT AND LEFT OF VERTICAL. POSITIVE MEANS SHALL BE PROVIDED TO PREVENT TIRES FROM RUBBING WHEN IN THE LEANING POSITION.

FRONT WHEEL HUBS SHALL NOT EXTEND BEYOND THE TIRE LINE.

## K. ELECTRICAL SYSTEM

A COMPLETE ELECTRICAL SYSTEM SHALL BE FURNISHED WHICH INCLUDES STARTING BATTERY(IES), HEAVY DUTY ALTERNATOR (MINIMUM 1200 WATTS), WITH VOLTAGE CONTROL, STARTER, HORN, AND ALL LIGHTS AS HEREIN SPECIFIED. THE VOLTAGE RATING OF THE ELECTRICAL SYSTEM SHALL BE THAT REGULARLY FURNISHED BY THE MANUFACTURER AS STANDARD EQUIPMENT. AN AUXILLARY POWER DISTRIBUTION PANEL WITH A MINIMUM OF FOUR (4) 12-VOLT OUTLET TERMINALS SHALL BE PROVIDED. CIRCUIT FOR EACH TERMINAL IS TO BE RATED AT 15 AMPS, AND EACH CIRCUIT IS TO BE INDIVIDUALLY FUSED. POWER DISTRIBUTION PANEL,, TERMINALS, AND OTHER CIRCUIT COMPONENTRY ARE TO BE FULLY SUITED AND INTENDED FOR INSTALLATION IN HEAVY EQUIPMENT.

### 1. WIRING

ALL WIRING SHALL BE ENCLOSED IN A HARNESS FORMED OF NON-METALLIC LOOM OR BY WRAPPING WITH PLASTIC ELECTRICAL INSULATION TAPE AND SECURELY ANCHORED TO THE FRAME IN PROTECTED LOCATIONS. ANY WIRING IN EXPOSED LOCATIONS THAT IS SUBJECT TO DAMAGE IN NORMAL USE SHALL BE ENCLOSED IN CONDUIT. ALL ELECTRICAL WIRING BETWEEN THE ENGINE AND ALTERNATOR TO OTHER PARTS OF THE SYSTEM SHALL BE CONNECTED BY A PLUG TYPE DISCONNECT BLOCK WITH A PRONG AND A RECEPTACLE CONFIGURATION SUCH THAT IT WILL FIT TOGETHER ONLY ONE WAY, OR OTHERWISE COLOR CODED OR IDENTIFIED TO PREVENT INCORRECT ELECTRICAL CONNECTIONS FROM BEING MADE, AND LOCATED CONVENIENT TO THE ENGINE.

### 2. LIGHTING EQUIPMENT

THE GRADER SHALL BE EQUIPPED WITH TWO SEALED BEAM HALOGEN HEADLIGHTS, WITH HIGH-LOW BEAM SWITCH OPERATED FROM THE CAB. HEADLIGHTS SHALL BE LOCATED WITHIN THE FIRST 2' OF THE EXTREME FRONT OF THE GRADER, APPROXIMATELY 42" APART, IN A POSITION THAT DOES NOT AFFECT THE SCARIFIER OR ANY OTHER GRADER FUNCTION. HEADLIGHTS SHALL NOT PROTRUDE BEYOND THE ACCESSORY MOUNTING PLATE.

SEPARATE FRONT (AMBER) AND REAR (RED) TURN SIGNALS SHALL BE FURNISHED. LAMPS TO BE MOUNTED WITHIN THE WIDTH OF THE CAB ON THE FRONT AND REAR, OR REAR LAMPS MAY BE MOUNTED WITHIN THE WIDTH OF THE RADIATOR OR ENGINE HOUSING. ALL LAMP SOCKETS TO BE BRASS OR OTHER CORROSION RESISTANT MATERIAL. THE TURN SIGNALS SHALL INCORPORATE A HEAVY DUTY MOTORIZED OR TRANSISTORIZED FLASHER. IN ADDITION TO THE TURN SIGNAL SWITCH, THERE SHALL BE PROVIDED A SEPARATE OPERATOR CONTROLLED WARNING SIGNAL SWITCH WHICH WILL CAUSE ALL FOUR TURN SIGNALS TO FLASH SIMULTANEOUSLY TO INDICATE THE PRESENCE OF A VEHICULAR HAZARD.

A SEALED BEAM HALOGEN WORK LIGHT SHALL BE PROVIDED ON EACH SIDE OF THE FRONT LOWER SECTION OF THE CAB. THE WORK LIGHTS SHALL BE SWIVEL MOUNTED TO FACILITATE LIGHTING OF THE BLADE WORKING AREA.

A SEALED BEAM BACK-UP LIGHT SHALL BE PROVIDED. OTHER LIGHTS TO BE PROVIDED SHALL CONSIST OF TAIL-STOP LIGHTS MOUNTED AS FAR APART AS PRACTICAL, AN INSTRUMENT DASH LIGHT, AND AN INTERIOR CAB LIGHT.

### 3. HORN

A WARNING HORN SHALL BE FURNISHED AND MOUNTED AT THE FRONT OF THE OPERATOR'S COMPARTMENT, WITH THE HORN SWITCH WITHIN EASY REACH OF THE OPERATOR. IN ADDITION THERE SHALL BE PROVIDED AN INDEPENDENTLY

CONTROLLED REVERSE SIGNAL ALARM HORN THAT SOUNDS WHEN THE GRADER IS SHIFTED INTO REVERSE GEAR.

4. SWITCHES AND CIRCUIT BREAKERS

ALL LIGHTS SHALL BE CONTROLLED FROM HEAVY DUTY SWITCHES MOUNTED ON THE INSTRUMENT PANEL. ALL CIRCUITS SHALL BE PROTECTED BY RE-SET CIRCUIT BREAKERS OR FUSES, AS PER MANUFACTURER'S STANDARD. THE LIGHTING CIRCUITS SHALL BE SO SYSTEMATIZED THAT WHEN A SHORT OCCURS, ENGINE SHUT DOWN WILL NOT OCCUR.

5. BATTERY(IES)

THE BATTERY(IES) SHALL BE THE TYPE FOR HEAVY DUTY DIESEL ENGINE STARTING WITH MAXIMUM CCA CAPACITY AVAILABLE FROM THE MOTORGRADER MANUFACTURER. THE BATTERY(IES) SHALL BE MOUNTED IN A METAL BOX OR FRAME ADEQUATELY PROTECTED FROM VIBRATION, ENGINE HEAT, AND THE ELEMENTS AND SHALL BE PROVIDED WITH A HOLD DOWN DEVICE, OR DEVICES. THE BATTERY (IES) SHALL BE EASILY ACCESSIBLE FOR SERVICING AND SHALL BE FURNISHED WITH ELECTROLYTE INSTALLED. BATTERY TERMINALS SHALL BE PROVIDED WITH CORROSION PROTECTION, SUCH AS SPRAY-ON OR JELL TYPES.

**L. WHEELS, TIRES, AND FENDERS**

1. WHEELS

GRADER TO BE PROVIDED WITH SIX WHEELS, TWO WHEELS ON THE FRONT AXLE AND FOUR WHEELS ARRANGED IN TANDEM ON THE REAR AXLE WITH DRIVE ON ALL FOUR TANDEM WHEELS. WHEELS SHALL BE OF ALL-METAL CONSTRUCTION WITH TIRE AND RIM ASSEMBLY INTERCHANGEABLE ON ALL WHEELS.

2. TIRES

BOTH FRONT AND REAR TIRES SHALL BE NON-DIRECTIONAL TUBELESS TYPE RADIAL AND SHALL BE SIZE 14:00 X24, 12-PLY RATING. TIRES TO BE MOUNTED ON 10" WIDE RIMS. RIMS, VALVES, AND CAP TO CONFORM TO THE STANDARDS OF THE TIRE AND RIM ASSOCIATION. TIRES AS FURNISHED SHALL BE CAPABLE OF ACCOMPLISHING TO THE STATE'S SATISFACTION ALL WORK LISTED IN SECTION III.A.2, "OPERATIONAL USE," ABOVE. ANY OTHER SPECIAL TIRE REQUIREMENTS WILL BE SPECIFIED IN THE INVITATION FOR BIDS.

3. FENDERS

EACH UNIT SHALL BE FURNISHED WITH FITTINGS FOR MOUNTING A COMPLETE SET OF REMOVABLE FENDERS, INCLUDING THOSE FOR LEFT AND RIGHT FRONT TIRES AND LEFT AND RIGHT TANDEM AXLE TIRES. TWO (2) BOLT-ON STEPS SHALL BE PROVIDED WITH EACH GRADER, ONE (1) FOR EACH SIDE, MOUNTABLE AT REAR FENDER MOUNTING LOCATIONS WHEN FENDERS ARE REMOVED. FENDERS SHALL BE MANUFACTURED SUCH THAT THEY ARE INTERCHANGEABLE AMONG UNITS FURNISHED. WHEN SPECIFIED IN THE INVITATION FOR BIDS, A COMPLETE SET OF REMOVABLE FENDERS SHALL BE FURNISHED.

**M. BRAKING SYSTEMS**

THE SERVICE BRAKES SHALL BE ANY ONE OF THE FOLLOWING TYPES:

- DRUM TYPE AT ALL FOUR DRIVE WHEELS
- WET DISC TYPE AT ALL FOUR DRIVE WHEELS
- WET DISC TYPE IN-BOARD ON EACH TANDEM MAIN DRIVE AXLE

THE SERVICE BRAKES SHALL BE FOOT CONTROLLED, EITHER AIR, AIR OVER HYDRAULIC OR FULL HYDRAULIC POWER ACTUATED. AN EMERGENCY STOPPING SYSTEM AND A PARKING SYSTEM SHALL BE PROVIDED. ALL BRAKE LINES AND HOSES SHALL CONFORM TO SAE-J1047.

THE SERVICE BRAKE SYSTEM SHALL INCORPORATE A STORED ENERGY SOURCE, AN ACCUMULATOR, OR OTHER MEANS TO EFFECTIVELY ALLOW FULL OPERATOR APPLICATION OF THE SYSTEM IN THE EVENT ANY OF THE FOLLOWING FAIL: THE ENGINE, HYDRAULIC OR AIR PUMP.

IN ADDITION TO THE ABOVE REQUIREMENTS, THE SERVICE BRAKING, EMERGENCY STOPPING, AND PARKING SYSTEMS SHALL CONFORM TO THE REQUIREMENTS OF SAE-J1473.

#### **N. CONTROLS**

CONTROLS FOR STEERING AND OPERATING THE GRADER, INCLUDING THE LEANING OF THE FRONT WHEELS, SHALL BE OF THE FULL HYDRAULIC TYPE. THE CONTROLS SHALL PERMIT SIMULTANEOUS OPERATION OF AT LEAST THREE FUNCTIONAL COMPONENTS WITHOUT APPRECIABLE LOSS OF COMPONENT SPEED OR POWER. THE HYDRAULIC SYSTEM SHALL BE CAPABLE OF PROVIDING A MOLDBOARD LIFT SPEED OF AT LEAST 3 " PER SECOND.

LINKS, CAMS, GEARS, ETC, IN THE CONTROL MECHANISMS SHALL WITHSTAND THE MAXIMUM STRESSES IMPOSED UPON THE MUNDER NORMAL OPERATING CONDITIONS. BALL JOINTS AND SPLIT BEARINGS SHALL BE PROVIDED WITH SHIMS OR OTHER MEANS OF ADJUSTING FOR WEAR AND SHALL BE EQUIPPED WITH HIGH-PRESSURE LUBRICATION FITTINGS. UNIVERSAL JOINTS IN THE CONTROL SHALL BE THE SEALED TYPE. THE CONTROLS SHALL HAVE APPROXIMATELY EQUIVALENT OPERATING SPEED IN EACH DIRECTION.

THE HYDRAULIC SYSTEM SHALL BE PROTECTED AGAINST THE ENTRANCE OF DIRT OR OTHER FOREIGN MATERIAL AND SHALL BE COMPLETE WITH ALL OPERATING ACCESSORIES INCLUDING AN EFFICIENT FILTER ACCESSIBLE FOR CLEANING AND REPLACEMENT. HIGH PRESSURE LINES SHALL BE SUITABLE AND RATED FOR THE SYSTEM DESIGN PRESSURE. THE HYDRAULIC CONTROL SYSTEM SHALL BE EQUIPPED WITH A PRESSURE RELIEF VALVE AND AN OVERLOAD RELIEF WHICH WILL AUTOMATICALLY RESET ITSELF WHEN OVERLOAD IS CLEARED, OR PRESSURE-COMPENSATED SYSTEM.

WHEN REQUIRED IN THE INVITATION FOR BIDS, THE UNIT SHALL BE EQUIPPED WITH CAB MOUNTED CONTROL VALVES (MINIMUM THREE (3) UNLESS OTHERWISE SPECIFIED) AND SUFFICIENT PLUMBING TO OPERATE A SLOPE GRADER ATTACHMENT, WHEN THE SLOPE GRADER ATTACHMENT ITSELF IS ALSO TO BE INCLUDED, THE NUMBER OF CONTROL VALVES FURNISHED SHALL BE THAT WHICH IS REQUIRED TO OPERATE THE MODEL OF SLOPE GRADER INCLUDED. THE PLUMBING SHALL BE TERMINATED IN QUICK-DISCONNECT FITTINGS THAT MEET ISO 7241-1B.

WHEN REQUIRED IN THE INVITATION FOR BIDS, THE UNIT SHALL BE EQUIPPED WITH CAB MOUNTED CONTROL VALVE (WITH FLOAT DETENT) AND SUFFICIENT PLUMBING TO OPERATE A VEE-PLOW AT THE FRONT OF THE FRAME. THE PLUMBING SHALL BE TERMINATED IN QUICK-DISCONNECT FITTINGS THAT MEET ISO 7241-1B.

#### **O. MAIN FRAME**

THE MAIN FRAME SHALL BE CONSTRUCTED OF STRUCTURAL STEEL. THE CONFIGURATION SHALL BE CONTINUOUS WELDED BOX BEAM IN COMBINATION WITH STRUCTURAL SHAPES AND PLATES. A MANUFACTURER'S DRAWING, CERTIFIED BY THE MANUFACTURER, SHOWING A CROSS SECTION OF THE MAIN FRAME BETWEEN SCARIFIER AND BLADE LIFT CYLINDERS SHALL ACCOMPANY THE BID, OR OTHERWISE IS DUE WITHIN FIVE (5) DAYS OF REQUEST. THE MAIN FRAME SHALL BE GUARANTEED AGAINST DEFECTIVE WORKMANSHIP

AND MATERIALS, AND AGAINST BREAKAGE UNDER NORMAL OPERATING CONDITIONS, FOR AS LONG AS NC DOT (OR OTHER ORIGINAL OWNER, AS APPLICABLE) OWNS THE GRADER.

**P. CIRCLE AND MOLDBOARD**

THE MOLDBOARD CIRCLE AND DRAWBAR ASSEMBLY SHALL BE SUCH AS TO PERMIT THE GRADER TO PERFORM ALL OPERATIONS SPECIFIED HEREIN AND SHALL BE ATTACHED TO THE FRAME BY A SWIVEL HITCH. THE MOLDBOARD SHALL BE EQUIPPED WITH A HYDRAULICALLY OPERATED SIDESHIFT TO THE RIGHT AND LEFT OF CENTER POSITION. MOLDBOARD CONTROLS SHALL PROVIDE RAISE, LOWER, AND DETENTED FLOAT POSITIONS. ACTIVATION OF MOLDBOARD FLOAT BY CONVENIENT DASH-MOUNTED SWITCH IS ALSO ACCEPTABLE. CIRCLE DRIVE SYSTEM SHALL BE PROTECTED BY A SLIP TYPE CLUTCH IN THE DRIVE ASSEMBLY, AND/OR THE CIRCLE HYDRAULIC CIRCUIT SHALL BE PROTECTED BY A RELIEF VALVE.

1. MOLDBOARD ASSEMBLY

THE MOLDBOARD SHALL BE CONSTRUCTED OF MEDIUM CARBON OR ALLOY STEEL SECURELY MOUNTED AND DESIGNED TO GIVE A ROLLING TUMBLE TO MATERIALS. IT SHALL BE SHIFTABLE TO THE RIGHT OR LEFT OF THE CIRCLE KNEES WITHOUT THE OPERATOR LEAVING HIS PLATFORM. MINIMUM MOLDBOARD DIMENSIONS TO BE AS FOLLOWS:

LENGTH	13'
WIDTH (MEASURED ALONG CURVE)	2'
THICKNESS	3/4"
CUT BELOW LEVEL GROUND	10"
LIFT ABOVE LEVEL GROUND	16"
REACH OUTSIDE TIRE LINE INCLUDING CIRCLE SHIFT: LEFT	60"
RIGHT	75"
RIGHT BANK CUTTING ANGLE	90 DEGREES
LEFT BANK CUTTING ANGLE	90 DEGREES

MOLDBOARD IS TO BE EQUIPPED WITH PUNCHINGS FOR STANDARD REPLACEABLE CUTTING BLADES AND REPLACEABLE END BITS. BLADES AND END BITS SHALL BE 3/4" (MIN.) WEAR-HARDENED REPLACEABLE TYPE OF ALLOY OR HIGH CARBON STEEL HAVING A HIGH RESISTANCE TO WEAR AND ABRASION. ALL HOLES FOR CUTTING EDGES SHALL BE DRILLED OR PUNCHED TO ACCOMMODATE A STANDARD 5/8" PLOW BOLT WITH HEX NUT. THE MOLDBOARD CIRCLE AND SIDE SHIFT SHALL BE PROVIDED WITH NON-FERROUS WEAR SURFACES TO REDUCE MAINTENANCE AND WEAR. A HYDRAULICALLY OPERATED POWER TILT MOLDBOARD SHALL BE FURNISHED.

2. MOLDBOARD ROTATION

THE DESIGN OF THE MOLDBOARD SHALL BE SUCH THAT FULL 360 DEGREES ROTATION CAN BE OBTAINED WITH THE BLADE SLIGHTLY RAISED WITHOUT MANIPULATION OF CONTROLS OTHER THAN POWER SHIFTING TO CLEAR TIRES, SCARIFIER BLOCK (WITHOUT TEETH), TRANSMISSION OR OTHER INTEGRAL PARTS OF THE MACHINE.

3. MOLDBOARD OPERATING RANGE

THE NORMAL OPERATING RANGE SHALL BE CONTROLLED FROM THE OPERATOR'S PLATFORM AND SHALL BE NOT LESS THAN FROM A POSITION OF DITCHING FORWARD AND BACKWARD ON EITHER SIDE OF THE GRADER TO A BANK-SLOPING POSITION OF 90 DEGREES ON BOTH THE RIGHT AND LEFT SIDES WITHOUT REMOVING SCARIFIER.

4. MOLDBOARD POSITIONING--BANK-SLOPING

FOR BANK-SLOPING POSITIONS OF 45 DEGREES OR MORE, THE LOWER POINT OF THE BLADE AT GROUND LEVEL SHALL BE AT, OR OUTSIDE OF, THE OUTSIDE LINE OF THE TIRES SO THAT A SMOOTH CUT TO THE BOTTOM OF THE SLOPE MAY BE OBTAINED WITHOUT PLACING THE WHEELS ON THE SLOPE.

5. ACTUATING MECHANISM INTERFERENCE

NO MOVEMENT OR COMBINATION OF MOVEMENTS OR ADJUSTMENTS OF THE MOLDBOARD ASSEMBLY, WHEN OPERATED IN ACCORDANCE WITH THE MANUFACTURER'S OPERATION AND MAINTENANCE MANUALS, SHALL CAUSE ANY PART OF THE ACTUATING MECHANISM TO CONTACT ANY STRUCTURAL MECHANISM OR STRUCTURAL PART OF THE GRADER IN SUCH A MANNER AS TO DAMAGE THE STRUCTURE OR MECHANISM. ELECTRIC LIMIT SWITCHES TO PROVIDE THIS PROTECTION WILL NOT BE PERMITTED.

6. CIRCLE ASSEMBLY AND MOLDBOARD RIGIDITY

THE CIRCLE ASSEMBLY AND MOLDBOARD SHALL WITHSTAND THE STRESSES IMPOSED WITHOUT DAMAGE OR PERMANENT DEFORMATION WHICH WOULD AFFECT THE OPERATIONAL CHARACTERISTICS OF THE GRADER.

7. BLADE DRIFT

THE GRADER BLADE SHALL NOT LOWER ITS POSITION MORE THAN 1/4" PER HOUR WHEN THE BLADE IS IN THE RAISED POSITION AND ALL CONTROLS ARE IN NEUTRAL AND WITH ENGINE OFF.

**Q. SCARIFIER**

A SCARIFIER SHALL BE FURNISHED WITH EACH GRADER UNLESS OTHERWISE STATED IN THE INVITATION FOR BIDS. THE SCARIFIER SHALL BE OF THE V-TYPE, HYDRAULIC POWER CONTROL OPERATED AND SHALL BE EQUIPPED WITH REMOVABLE TEETH HAVING REPLACEABLE POINTS. MINIMUM REQUIREMENTS SHALL BE AS FOLLOWS:

CUTTING WIDTH	46"
NUMBER OF TEETH	9
WEIGHT	1,200 LBS.

INSTALLED SCARIFIER MUST ALLOW GRADER TO DITCH WHEN IN RAISED POSITION AND SHALL NOT PREVENT 360 DEGREE ROTATION OF THE MOLDBOARD. A SWINGING SCARIFIER WILL NOT BE ACCEPTABLE.

**R. ROPS CAB**

THE GRADER SHALL BE FURNISHED WITH A LOW PROFILE ROPS CAB, CONFORMING TO SAE J-1040.

THE CAB SHALL BE COMPLETELY ENCLOSED, WITH DOORS ON EACH SIDE, CONSTRUCTED OF HEAVY GAUGE MATERIAL AND EQUIPPED WITH TINTED SAFETY GLASS TO PROVIDE 360 DEGREES VISIBILITY. ALL CONTROLS FOR STEERING AND OPERATING THE GRADER SHALL BE MOUNTED INSIDE THE CAB. THE DOORS SHALL HAVE FASTENERS TO HOLD THEM IN THE OPEN POSITION, AND KEYED LOCKS.

THE WINDSHIELD, REAR WINDOW, AND LEFT AND RIGHT LOWER FRONT WINDOWS SHALL BE PROVIDED WITH ELECTRICALLY OPERATED WINDSHIELD WIPERS. AN ADJUSTABLE REARVIEW CONVEX MIRROR SHALL BE PROVIDED AND MOUNTED INSIDE THE CAB TO AFFORD A CLEAR VISION TO THE REAR OF THE GRADER. A WEST COAST TYPE MIRROR OR CONVEX MIRROR OF SIMILAR SIZE IS TO BE MOUNTED ON THE LEFT SIDE OF THE CAB.

THE CAB SHALL HAVE A HOT WATER HEATER WITH A MULTIPLE SPEED MOTOR, AND A WINDSHIELD DEFROSTER FAN. THE HEATER SHALL HAVE ADEQUATE CAPACITY TO MAINTAIN AN INSIDE CAB TEMPERATURE OF APPROXIMATELY 60 DEGREES FAHRENHEIT WITH AN AMBIENT TEMPERATURE OF +10 DEGREES FAHRENHEIT AND TO CLEARLY DEFROST AT LEAST 75% OF THE FRONT, REAR, AND SIDE CAB WINDOWS. SHUT-OFF VALVES SHALL BE PROVIDED AT THE ENGINE CONNECTIONS.

THE INSTRUMENT PANEL SHALL BE LOCATED CONVENIENT TO THE SEATED OPERATOR. THE MANUFACTURER'S STANDARD INSTRUMENTATION SHALL BE FURNISHED BUT SHALL INCLUDE A POSITIVE MEANS OF MONITORING VITAL SYSTEMS INCLUDING AS A MINIMUM: ENGINE OIL PRESSURE, ENGINE TEMPERATURE, ELECTRICAL SYSTEM, TORQUE CONVERTER TEMPERATURES AND TRANSMISSION PRESSURE (IF APPLICABLE), AND HYDRAULIC OIL TEMPERATURE. WARNINGS (AUDIO OR LIGHT) ARE REQUIRED ON ENGINE OIL PRESSURE, ENGINE WATER TEMPERATURE, TRANSMISSION OIL PRESSURE, AND BRAKE OPERATING PRESSURE.

THE OPERATOR'S POSITION SHALL INCLUDE THE FOLLOWING: SEAT FULLY CUSHIONED OF THE FULL SUSPENSION TYPE, VINYL OR FABRIC COVERED, VERTICAL AND HORIZONTAL ADJUSTMENTS, PADDED ARMRESTS, AND A SEATBELT.

CAB AIR-CONDITIONING, FACTORY-INSTALLED, IS REQUIRED. THE AIR-CONDITIONING SYSTEM AS PROVIDED MUST BE OF A CAPACITY SUFFICIENT TO ADEQUATELY COOL THE INTERIOR OF THE CAB DURING THE EXPECTED CONDITIONS OF HEAT AND HUMIDITY ANYWHERE WITHIN THE STATE OF NORTH CAROLINA THROUGHOUT THE SUMMER SEASON. PARTS AND SERVICE FOR THE AIR-CONDITIONING SYSTEM ARE TO BE READILY AVAILABLE, BOTH DURING AND AFTER THE WARRANTY PERIOD, THROUGH THE LOCAL GRADER DEALERSHIP.

#### **S. EQUIPMENT AND ACCESSORIES**

THE GRADER SHALL BE FURNISHED WITH THE FOLLOWING EQUIPMENT AND ACCESSORIES:

1. MANUFACTURER'S STANDARD COMMERCIAL REAR MOUNTED DRAWBAR, PIN, AND RETAINER.
2. SPECIAL TOOLS AND GREASING EQUIPMENT NORMALLY REQUIRED FOR SERVICING THE GRADER.
3. A METAL TOOL BOX (OR COMPARTMENT) WITH HASP.
4. A VANDALISM PROTECTION KIT TO INCLUDE LOCKING TYPE CAPS FOR ALL EXPOSED FILLER CAPS AND OIL DIPSTICK.
5. TRANSMISSION GUARD.
6. ARTICULATION POSITION INDICATOR.
7. ENGINE HOURMETER (ENGINE OIL PRESSURE OR ALTERNATOR ACTIVATED).
8. AIR CLEANER RAIN CAP.
9. AIR FILTER SERVICE INDICATOR.
10. COLD WEATHER STARTING AID (SUCH AS GLOW PLUGS, ETHER CANISTERS, OR INDUCTION AIR HEATER)
11. ENGINE BLOCK HEATER, THERMOSTAT CONTROLLED WHERE NECESSARY TO PREVENT RISK OF OVERHEATING.
12. DEFLECTOR TYPE EXHAUST STACK.
13. MUFFLER.
14. IN LINE FUEL HEATER LOCATED PRIOR TO FUEL FILTER.
15. TACHOMETER.
16. FUEL GAUGE (DIAL TYPE, LOCATED IN CAB).
17. CIGAR LIGHTER, 12-VOLT, IN OPERATOR'S PANEL.
18. AM/FM RADIO, INSTALLED COMPLETE WITH ANTENNA.
19. ONE (1) FIRE EXTINGUISHER, 5 LB., TYPE BC, RECHARGEABLE, METAL DISCHARGE VALVE, APPROPRIATELY MOUNTED IN THE CAB.

20. FRONT FRAME MOUNTED RECOVERY HOOK WHICH DOES NOT INTERFERE WITH MOUNTING A FRONT VEE PLOW.

**T. COLOR AND FINISH**

ALL EXPOSED METAL PARTS OF THE GRADER SHALL BE CLEANED OF ALL MILL SCALE, RUST, GREASE, ETC, THEN PRIMED AND UNDERCOATED WITH A RUST RESISTANT PAINT IN ACCORDANCE WITH THE ACCEPTABLE SHOP PRACTICE. THE FINISH COAT SHALL BE DEPARTMENT OF TRANSPORTATION, DIVISION OF HIGHWAYS, YELLOW, MOLINE MPM #11-Y169A, OR ITS ACCEPTABLE EQUIVALENT. INTERIOR OF THE CAB SHALL BE A NON-GLARE COLOR.

**U. WORKMANSHIP**

THE FINISHED PRODUCT SHALL REPRESENT A MACHINE THAT IS GENERALLY RECOGNIZED IN THE TRADE AS A FINISHED, FIRST CLASS WORKMANLIKE JOB. ALL PARTS, COMPONENTS, AND ASSEMBLIES OF THE GRADER INCLUDING CASTING, FORGINGS, STAMPINGS, BEARINGS, MACHINED SURFACES, AND WELDED PARTS SHALL BE CLEAN AND FREE FROM SAND, DIRT, FINS, PITS, SCALE, AND OTHER HARMFUL EXTRANEIOUS MATERIAL. EXTERNAL SURFACES SHALL BE FREE OF BURRS, SHARP EDGES, AND CORNERS EXCEPT WHERE EDGES ARE REQUIRED.

**IV. WARRANTY**

THE CONTRACTOR WARRANTS TO THE OWNER THAT ALL GRADERS FURNISHED UNDER THIS SPECIFICATION WILL BE NEW, OF GOOD MATERIAL AND WORKMANSHIP, AND AGREES TO REPLACE PROMPTLY ANY PART OR PARTS WHICH BY REASON OF DEFECTIVE MATERIAL OR WORKMANSHIP SHALL FAIL UNDER NORMAL USE, FREE OF NEGLIGENCE OR ACCIDENT, FOR A MINIMUM OF 24 MONTHS FROM DATE PUT IN OPERATION. THE WARRANTY SPECIFICALLY EXEMPTS TIRES, BATTERIES, FAN BELTS, BLADES, END BITS, SCARIFIER TEETH AND POINTS, ALL OF WHICH SHALL CARRY A MINIMUM OF 12 MONTHS WARRANTY OR MANUFACTURER'S STANDARD WARRANTY IF LONGER, EXCLUDING NORMAL WEAR AND TEAR. SUCH REPLACEMENT SHALL INCLUDE ALL PARTS, LABOR, AND TRANSPORTATION COSTS TO THE LOCATION WHERE EQUIPMENT IS DOWN, FREE OF ANY CHARGE TO THE STATE.

UNDER SAME CONDITIONS AS ABOVE, THE POWER TRAIN (ENGINE, TRANSMISSION, TORQUE CONVERTOR, AND FINAL DRIVE) SHALL BE COVERED FOR AN ADDITIONAL PERIOD OF AT LEAST 36 MONTHS. ANY PERIODIC INSPECTIONS WHICH MAY BE PERFORMED BY THE CONTRACTOR OR HIS REPRESENTATIVE SHALL BE WITHOUT CHARGE TO THE OWNER.

DURING THE WARRANTY PERIOD, THE STATE RESERVES THE RIGHT TO ASSESS THE CONTRACTOR A PENALTY OF \$100.00 PER DAY FOR FAILURE TO FURNISH THE NECESSARY PARTS OR SERVICES COVERED BY THE WARRANTY WITHIN FIVE (5) WORKING DAYS.

**V. SERVICE, PARTS, MANUALS, AND LINE SETTING SHEET**

THE CONTRACTOR SHALL FURNISH A QUALIFIED REPRESENTATIVE TO INSTRUCT THE OWNER'S OPERATOR(S) IN THE OPERATION AND MAINTENANCE OF THE EQUIPMENT FOR A MINIMUM PERIOD AS SPECIFIED IN THE INVITATION FOR BIDS.

OPERATOR'S MANUALS, SHOP MANUALS, PART BOOKS, AND LINE SETTING SHEET SHALL BE FURNISHED AS SPECIFIED IN THE INVITATION FOR BIDS.

**VI. ACCEPTANCE EVALUATION AND QUALITY ASSURANCE**

THE PURCHASING AGENCY RESERVES THE RIGHT TO EVALUATE ANY IMPROVEMENTS MADE BY THE GRADER MANUFACTURER WHICH MAY NOT BE INCLUDED IN HIS LATEST AVAILABLE PUBLIC ADVERTISEMENTS. THE ACCEPTANCE OR REJECTION WILL BE BASED ON JUSTIFICATION FOR THE IMPROVEMENT AND SUBSTANTIATING SERVICE PERFORMANCE.

UPON RECEIPT OF EACH GRADER AT THE RECEIVING POINT, THE PURCHASER OR HIS AUTHORIZED REPRESENTATIVE SHALL ARRANGE FOR AN ACCEPTANCE INSPECTION FOR COMPLIANCE WITH THIS SPECIFICATION.

THE CONTRACTOR SHALL FURNISH A PILOT MODEL FOR INSPECTION, TESTS AND POSSIBLE MODIFICATION AND/OR ADJUSTMENTS OF ATTACHMENTS IN ACCORDANCE WITH THIS SPECIFICATION.

#### **VII. DELIVERY AND PAYMENT**

DELIVERY OF AND PAYMENT FOR GRADERS PURCHASED UNDER THIS SPECIFICATION SHALL BE IN ACCORDANCE WITH THE TERMS AND CONDITIONS OF THE INVITATION FOR BIDS. DELIVERY SHALL BE MADE FOB TO THE POINT OF DESTINATION STATED IN THE PROPOSAL FORM, COMPLETELY SERVICED AND READY FOR OPERATION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY PACKING, PACKAGING, OR PROTECTION REQUIRED TO INSURE SAFE DELIVERY IN AN UNDAMAGED CONDITION.

#### **VIII. ORDERING DATA (FOR PROCUREMENT USE ONLY)**

PURCHASERS SHOULD EXERCISE ANY DESIRED OPTION OFFERED HEREIN AND SHOULD SPECIFY THE FOLLOWING IN THE REQUISITION AND INVITATION FOR BIDS:

1. TITLE, NUMBER, AND DATE OF THIS SPECIFICATION.
2. IF A SCARIFIER IS NOT REQUIRED.
3. IF FRONT AND/OR REAR WHEEL FENDERS ARE REQUIRED.
4. IF WINDSHIELD WASHER/S IS/ARE REQUIRED.
5. THE NUMBER OF CIMA SAFETY MANUALS REQUIRED.
6. NUMBER OF SETS OF OPERATOR MANUALS TO BE FURNISHED AND IF LINE SETTING SHEET IS REQUIRED.
7. IF ITEMIZED LIST OF STANDARD EQUIPMENT IS REQUIRED.
8. AMOUNT OF TRAINING REQUIRED.
9. ADDITIONAL TIRE REQUIREMENTS
10. IF CONTROL VALVES (STATE NUMBER OF VALVES NEEDED) AND PLUMBING FOR A SLOPE GRADER ATTACHMENT ARE REQUIRED.
11. IF CONTROL VALVE AND PLUMBING FOR A VEE-PLOW ARE REQUIRED.

\*\*\*\*\*END OF SPECIFICATION\*\*\*\*\*