October 18, 2000

FINAL LOCOMOTIVE SPECIFICATION

covering

Burlington Northern Santa Fe Railroad
Two Hundred Seventeen (217) SD70MAC
EMD Customer Code No. 0110
EMD Order No. 976814

Units 1 - 212: EMD Customer Code No. 0110
Units 213 - 217: EMD Customer Code No. 4151

I. GENERAL

General Motors Locomotive Specification 8152 covering the basic 4,000 horsepower SD70MAC locomotive, is amended by mutual agreement to include options and modifications detailed below. This locomotive is equipped with the following features:

EMD Cab Electronics ("ECE"), consisting of Rockwell Integrated Cab Electronics ("ICE") on units one through 169 or EMD's Functionally Integrated Railroad Electronics ("FIRE") on units 170 through 217, Microprocessor Air Brake, WhisperCab™, Electronic Unit Injection, Separate Aftercooling, complete IDP application, and Motor Driven 4-cylinder Air Compressor.

II. LOCOMOTIVE OPTIONS AND MODIFICATIONS

A. AIR SYSTEM

1. Air Brake

a. KNORR (NYAB) Microprocessor based Electro-Pneumatic Computer Control air brake system with Desk Top Controller with the following features and modifications. The air brake system shall include self diagnostics, remote sessions, and be LSI compatible.

Note: EMD Cab Electronics display to provide interface for air brake system set-up (replaces cutoff pilot valve, dual ported cutout cock and feed valve) provided.

b. EMD Cab Electronics safety control with light/horn panel in direct view of the engineer. External components to be included as follows:

(1) Two Cutler Hammer Part No. 10250ED1260 reset switches with yellow push button. Push buttons to be mounted on right hand and left hand ends of control console.

(2) No cut-out for this device is provided.

(3) No time delay provided for safety control brake applications.

(4) Alerter system control will be inhibited when in slow speed control at 5 mph or less.

(5) Safety control with following resets:

Throttle
Horn
Bell
Dynamic Brake
Reset Button
Reverser Handle Movement
Any brake application
Any "ECE" System Function Display Key
Manual Sanding

c. Train overspeed limit with 5 second time delay with a visual screen display indication and an auditory warning alarm (will be a part of the "ECE" system). Suppressible penalty with the following suppressible conditions:

- Automatic brake handle not in release position, or
- Air brake system set up for trail cut out service, or
- Brake pipe pressure below 20 psi.

Train overspeed limit set for 73 mph variable speed setting capability being included as part of ECE.

d. Penalty brake application provided with full service brake application and power knockdown.

e. Train break-in-two protection, including two No. 8 vent valves, controls the following functions:

(1) Power knockdown from any emergency, including elimination of excitation regardless of the position of control switches on any trailing units.

(2) Brake pipe charging is achieved through the CCB computer, whereby pressure is sensed by a transducer mounted on the pneumatic control unit (PCU).

f. Air End Connections

(1) Basic duplex air end connections.

(2) MU hoses on both sides of coupler for a total of four sets per locomotive. Application and release and actuating hoses to have HS-2 coupling. Ball valve and cutout cock valve handles must be approved by BN.

(3) Brake pipe located on right hand side of coupler when facing end plate, both ends.

(4) Main Reservoir equalizing pipe, independent application and release pipe, actuating pipe and brake pipe valves will be located at the side sill aft of the step wells.

g. Other Air Brake Modifications

(1) Independent brake cylinder pressure set for 72 psi, as read on display on control console.

(2) Nonremovable independent brake handle.

(3) Nonremovable automatic brake handle.

(4) The emergency brake valve will be located on the vertical portion of the wing on the helper's work station. Mounted in same location as order 936445.

(5) Provision for compatible operation with locomotive equipped with 6BL brakes not provided.

(6) Independent brake set-up ("lead" and "trail") provided by EMD's Integrated Cab display interface. Screen displayed "LEAD CUT IN", "LEAD CUT OUT", "TRAIL" and equalizing reservoir settings are controlled by display function keys. In the event of an ECE system failure while the brakes are set up for "LEAD CUT IN" or "LEAD CUT OUT", the brake system can be set to "TRAIL" by opening the air brake circuit breaker.

(7) The main reservoir supply to the brake charging is provided with a 19/64 charging orifice mounted on the PCU manifold.

(8) Automatic brake set-up ("pass", "freight", "out"), (feed valve/or/brake pipe) and settings shall be

provided for and controlled by display function keys, through EMD "ECE" and KNORR software.

(9) Brake pipe is "F" coupling and remainder are HS-2 couplings. Crimped Farrell type brake pipe hose - not banded specifically requested. Brake Pipe hose to meet AAR specification M-601-88.

(10) Brake pipe altered to include AAR standard 22" hose with "F" type coupling and WABCO Part Number 572869, EMD Part Number 8433293, non-vented self-locking type angle cock.

(11) DL 1/2 inch line filters in the actuating and independent application, and release pipes will be provided.

(12) Check valve in main reservoir equalizing line not to be provided.

(13) Main reservoir equalizing hoses include LS-4 couplings provided. Traditional ball valve and cutout cock valve handles to be approved by BNSF.

(14) The automatic brake valve and independent actuating brake valve exhausts are located below the cab floor.

(15) J1.6-16 relay valve function provided as part of the electronic air brake system.

(16) Full mechanical override for emergency brake application. Mechanical application of emergency brake shall be provided via the automatic brake handle on the desk-top mounted controller.

(17) Fiber optic communications between the desk mounted controller and the CCB computer to reduce EMI. RS422 interface between the CCB computer and the ECE system.

(18) Air brake processor power supply shall have an operating voltage range of 20 to 95 volts as a minimum.

(19) In the event of loss of power to the air brake processor/computer, the following sequence shall occur.

(a) Power Loss - Lead

- Immediate power and dynamic brake knock down
- Independent brake does not release
- Brake pipe vented at service rate
- DIT valve responds to automatic applications
- When brake pipe is below 20 psi: Brake cylinder pressure increases to 80 psi
- Emergency available if brake pipe is greater than 40 psi
- Locomotive must be used as trailing unit or towed dead in train

(b) Power Loss - Trail

- Independent brake does not release
- Immediate power and dynamic brake knockdown
- Brake pipe is not vented
- DIT valve responds to automatic brake applications
- Independent can be applied up to 45 psi
- Automatic brake can be bailed off to zero psi
- Emergency can be applied

(c) Restore Power - Lead

- 30 second delay after power restored

- Automatic handle to suppression for 10 seconds

- Automatic handle to release to recover brake pipe

(d) Restore Power - Trail

- Computer control restored when brake cylinder pressure is zero psi

(20) All enclosures and electrical connections located in the under floor/sub-assembly compartment shall be of water resistant design.

(21) Knorr air brake schematic, to be located on the Knorr Control Cabinet door.

(22) The following ergonomic air valve handles will be applied:

- Front sander air supply valve
- Cooling system drain valve
- Air compressor control valves (two)
- Radiator shutter valve
- Rear sander air supply valve
- Flange lubricator valve
- Fuel filter pressure relief valve
- Fuel filter drain valve

(23) Distributed power compatible micro air brake software provided on all units.

(24) Distributed power emergency magnet valve provided on all units. Energizing of wire to cause emergency brake application. Dump valve should be wired to ECE electrical equipment locker.

2. Air Compressor

a. Gardner-Denver 4-cylinder water cooled WLA compressor with freeze plugs, gear driven lube oil pump, full flow lube oil system, Dual Air Maze air filters, and improved lube oil emission reduction features.

b. Air Compressor Drive

Complete application of motor driven air compressor (MDAC) to be provided.

c. Partial synchronization provided such that motor driven air compressor (MDAC) equipped units will produce trainline synchronization signals, but will not react to them. Pressure transducer setting to be 130 - 140 psi.

d. Dual Air Maze Filter (Round Design) with forced air intake. Housing, part number 40037976, two (2) each.

e. Other Air Compressor Modifications

(1) Lube oil dipstick to replace dial gauge.

(2) AAR standard quick disconnect fitting (male type) for lube oil sampling with dust cap. (Must be a Hansen 2HK series with viton seals)

(3) Oil to be Turbine oil - 350 viscosity grade ISO 68.

3. Gauges and Fittings

a. EMD Cab Electronics display to provide the following air gauge functions:

(1) Brake pipe - Thermometer and Digital

(2) Brake Cylinder - digital

(3) Equalizing reservoir - Thermometer and digital

(4) Main reservoir - digital

(5) AFM flow indicator - digital

(6) End of train pressure

b. Test fittings are located on the front of the PCU manifold for purpose of calibrating display transducers.

c. Hansen 2HK Series quick disconnect provided for setting air compressor unloader switch limits.

d. Partial Provision for Electrically Controlled Pneumatic (ECP) brake on units #140 through unit 169. The partial includes #8 AWG twisted pair, two conductor trainline complete cable, shielded armored cable from the #1 end to #2 end.

The units that have "Partial Provision for Electrically Controlled Pneumatic (ECP) brake (Unit #140 through Unit #169) will have an aftermarket parts kit made available as a service release to be applied by the BNSF after delivery of the units. These parts kits will include all the material necessary to bring the units from "Partial Provision for Electrically Controlled Pneumatic (ECP) brake to "Full Provision for Electrically Controlled Pneumatic (ECP) brake.

Full Provision for Electrically Controlled Pneumatic (ECP) brake on unit 170 through the remainder of the order. The Full Provision for includes the Partial Provision for, inter-car connectors, ID Junction Box and associated wiring.

4. Main Reservoir

a. Filters - Two Salem 824-371 coalescent filters with bottom mounted 580H drain valves located after No. 1 and No. 2 main reservoirs, filter air for the auxiliaries and the brake respectively. Salem 580H drain valves on both 824 filters to be pneumatically operated.

b. Drain Valves and Actuation

(1) Salem 580H automatic drain valves on both main reservoirs.

(2) Blow-down of filters and automatic drain valves are actuated by air compressor.

c. Other Modifications

(1) All pneumatically operated drain valves must meet BN approved noise levels (db(A)) and safety requirements eg. air flow/pressure causing unsafe conditions. (Must not exceed 100 db(A) at arms length).

(2) The automatic blow down valve drain pipe must extend to the bottom of the fuel tank. The drain pipe will be cut to follow the contour on the bottom of the fuel tank.

5. Warning Devices

a. Bell

Basic application (electronically activated). No electronic sound bells will be accepted. The bell is to be electrically operated with a switch. Provision is to be made that when the horn sounds, the bell will ring at the same time. The bell will continue ringing until manually shut off.

b. Horn

Nathan three-chime K3HAR4 horn located to long hood, (two bells forward and one reverse). The horn is to be located behind hatch assemblies and just ahead of the cooling fan hatch near the center of the locomotive to allow for clear access. The horn is to be electrically operated with a switch rather than pneumatically with a valve. Sound testing to insure compliance with FRA regulations will be conducted.

This must meet clearance requirements - reference J.10.

B. SANDING

1. Control

a. Basic inboard-outboard sanding equipment to be applied to locomotive.

b. Basic electric control only.

c. A wheel slip control system using a controlled creep concept to provide improved locomotive adhesion capability will be employed.

d. Automatic sanding initiated in emergency is basic.

e. BNSF Special - Sanding Control (Trainline points SC #11 & #23 and ES #5) Sand operation shall be indicated on the operators screen display whenever activated.

2. Switches and Lights

a. Manual (directional) sanding switch is basic non-latching type. Manual sanding to be automatically disabled at speeds above 12 mph.

b. Lead axle sanding switch is basic illuminated latching type. Manual lead axle sanding to automatically disable at speeds above 15 mph. Two (2) minute time out of the system required for lead axle sanding only.

3. Sand Traps and Related Devices

a. A total of eight (8) Salem 277-2 sand traps with rotary shutoff valve and quick disconnect fittings are provided.

b. Salem 500 BS relay valve will be provided (4 each).

4. Sand Box

a. Capacity

Sand box capacity of 26 cu. ft. per end. Clean out ports on outside.

b. BN Special front sand fills will be located on the top of the short hood sheet, one for each side/box. Sand fill lids shall open to the outboard sides of the locomotive (Includes an additional grab iron on cab roof).

c. The rear sand fill shall be at the top of the long hood, center line to the locomotive.

d. Round style sand fill covers will be provided.

e. Sand box areas to be dammed to contain spillage and prevent accumulation onto walkways.

5. Other Sanding Modifications

a. Automatic timed sanding from any emergency provided for thirty-seconds or to zero speed, whichever is longer.

b. Sand delivery rate to be tested for calibrated, consistent delivery of sand prior to shipment. Appropriate sand delivery rate to be determined by EMD. Testing of the system is a new BNSF requirement.

C. MULTIPLE UNIT CONTROL

Multiple unit control is provided. The following modifications/ features are provided.

1. Cables

a. G&G Locotronics MU cables, vendor P/N 77013327, required. Cables to be provided with No. 10 gauge wire to the No. 4 position in place of No. 12 gauge wire. The chain which semi-permanently mount the cable to the locomotive to have a removable link to facilitate changing out cables. Two dummy receptacles to be provided on each end.

b. Storage rack for second cable location not provided.

2. Receptacles

a. Single twenty-seven point Pyle National receptacle at each end.

(1) Pin assignments to be AAR standard with the following exceptions.

Trainline wire No. 4 to be #10 gauge wire instead of #12.

(2) Receptacles to be basic end-plate mounted arrangement.

3. Other

a. Rear MU ramp to be basic solid type.

b. Bendaway walkway supports to be provided.

c. Distributed power provided on all units. Distributed Locomotive Consist Processor (DLCP) provided inside ECE electrical equipment locker. ECE electrical equipment locker wiring to support DLCP provided.

D. DYNAMIC BRAKES

1. High capacity improved extended range radial grid type dynamic brake hardware to be provided with low speed capabilities. A combination tractive/braking effort meter will be provided as part of the "ECE" display.

a. Dynamic brake provided with 10 second delay in build up of dynamic brake braking effort.

b. Standard potential control trainlined.

c. "Grid Current" dynamic brake control provided on units 95 - 217.

2. Interlock

Specifically not required by the Burlington Northern Santa Fe.

3. Load Test Provision

Provision is made for load testing locomotive on its own dynamic brake grids.

4. Grid Protection Circuit

Special circuit is provided to nullify dynamic brake in response to grid blower motor failure.

5. Ground Relay Protection

Dynamic brake ground relay protection provided basically with dynamic brake modification.

6. Other Dynamic Brake Modifications

a. Continuous dynamic brake operation to be provided up to 20 PSI brake cylinder pressure.

b. Dynamic brake cutout switch on engine control panel, provided on units 1 - 169.

Three position dynamic brake cutout switch to be provided and located on engine control panel: "Cut Out Defective", "Cut In", and "Cut Out to Comply with Braking Effort Restrictions" per BNSF drawing No. 4A-20101, provided on units 170-217.

c. Note: The dynamic brake hatch must meet clearance - Specified as part of Item J.10.

E. ELECTRICAL CONTROL MODIFICATIONS

Motors are connected in permanent parallel across each invertor. There is one invertor for each truck. TA17-6/CA7B generator/ alternator is provided.

Microprocessor based Controlled Creep Wheel Slip System with K-band Speed Sensing Radar is provided basically.

1. Batteries

Batteries to be Surrette p/n 16CH-33P.

2. Auxiliary Generator

18KW AC full voltage operation at low idle (200 rpm). The auxiliary generator will be accompanied by a high efficiency traction motor blower system.

3. Truck Cut-outs

A modification is provided to permit locking out any one truck. This modification automatically reduces horsepower so that the remaining motors on the other truck are not overloaded.

4. Ground Relay Reset

Microprocessor controlled automatic ground relay reset is provided.

5. Other Control Modifications

a. Battery box located in long hood.

b. Protection guard will be applied over the red area of the high voltage cabinet to protect personnel from possible electrical shock.

c. Horn/bell control will be set up so that the bell is activated whenever the horn is sounded. Bell operation will be terminated from a horn activation with a manual activation of the bell switch. Bell must also operate independent of the horn.

d. Turbocharger soak back pump connected ahead of battery knife switch.

e. A three position Isolation Switch allowing dynamic brake operation while unit is isolated is required. The third position allows dynamic brake operation only.

6. Microprocessor provides control or diagnostics for:

a. Dynamic Brakes with full speed range capabilities

On remote unit, dynamic brake knockdown will occur immediately from any emergency or penalty.

b. Dynamic Brake Cutout

c. Dynamic brakes - (See Item D.1.)

d. Grid protection

e. Self load test

f. Sixth throttle knockdown - (Basic)

g. Filter blower circuit breaker indication

h. Starter motor thermal overload - (Basic)

i. Engine air filter restriction - (Basic)

j. Automatic ground relay reset

k. Two speed cooling fans

l. Engine temperature probe provided.

m. EMD's Slow speed control system including dynamic brake feature included on units 95 through 217.

EMD's slow speed control system with operation permitted in power mode only, provided on units 1 through 94 (Pacesetter compatible load sharing both lead and trail operation). Speed during slow speed control operation shall be controlled by a rocker switch located on the control console.

n. 42 inch wheels - (Basic)

o. 85:16 Gear Ratio - (Basic)

p. Engine purge control

q. Partial air compressor synchronization

r. Truck cut-outs (three motors/truck).

s. Locked unpowered wheel detection - Note that the battery knife switch and LCC, and TCC circuit breakers must be engaged for this function to be operable.

t. Flange lube circuit, control, and/or operational detection shall be indicated and controlled by the function keys and flat screen display. The control system shall be adjustable as to how many feet or wheel revolutions per activation of the system. Change to the system settings must be authorization coded. Curve sensing Gyro not required.

u. Glass heater indicated and controlled by the function keys and flat screen display.

7. The microprocessor display and keyboard are to be flush mounted in the console as part of the "ECE" system. Cab layout drawing to be reviewed by BNSF prior to construction.

Note: All cab Electronics must meet recommendations as outlined to the AAR in the "LSI" drafts for LSI architecture and display specifications drafted August 1992 for "ECE" as minimum requirements.

8. Distributed power provided on all units.

a. Distributed power compatible EM2000 software provided.

b. Distributed power compatible ECE software provided.

c. Distributed power trainline control relays as required to control the following trainlines from EM2000:
- Engine Run (16T)
- Generator Field (6T)
- D Valve (3T)
- C Valve (7T)
- B Valve (12T)
- A Valve (15T)
- Slow Speed Control (1T)
- Forward (8T)
- Reverse (9T)
- Dynamic Brake (21T)
- DB Setup (17T)
- Manual Sand (23T)

d. Third DIO 300 required for additional trainline control.

9. Partial Provision for Electrically Controlled Pneumatic (ECP) brake on units #140 through unit 169.

The Partial Provision for includes #8 AWG twisted pair, two conductor trainline complete cable, shielded armored cable from the #1 end to #2 end.

The units that have "Partial Provision for Electrically Controlled Pneumatic (ECP) brake (Unit #140 through Unit #169) will have an aftermarket parts kit made available as a service release to be applied by the BNSF after delivery of the units. These parts kits will include all the material necessary to bring the units from "Partial Provision for Electrically Controlled Pneumatic (ECP) brake to "Full Provision for Electrically Controlled Pneumatic (ECP) brake.

Full Provision for Electrically Controlled Pneumatic (ECP) brake on unit 170 through the remainder of the order. This Full Provision includes the Partial Provision for, inter-car connectors, application of circuit breaker, mounting provisions for the Trainline Power Supply and Trainline.

Communication Controller, and wiring between the following component mounting areas:

- Electrical cabinet to the Trainline Power Supply (TPS)
- TPS to the ID Junction Box
- Operator Interface Unit (OIU) to the Trainline Communication Controller (TCC)
- TCC to the Computer Controlled Brake Equipment (CCB)

F. ENGINE MODIFICATIONS

Basic 16-710G3C-ES engine provided.

1. Filters

a. Primary (carbody filters)

(1) Basic inertial separator, providing filtered air to engine filter and generator-motor blower.

(2) Inertial blower motor protection

Basic circuit breaker prevents motor overload. Microprocessor panel displays the tripped circuit breaker fault.

b. Engine air filters - AAF fiberglass bag disposable type. Microprocessor panel displays restriction indication.

c. Other Filter Modifications

Farr Model 200 primary fuel filters, including model 400 two stage filter element assembly..

2. Oil Pan Capacity

Increased capacity (436 gallon) oil pan provided.

3. Engine Turning Bar of Jack

None required.

4. Fuel Oil Preheater

Young mechanical heat exchanger, (60,000 BTU), with automatic thermostat control (AMOT valve). (BASIC)

5. Bolt-On Stubshaft

Bolted on accessory end engine crankshaft stubshaft provided.

6. Other Engine Modifications

a. Turbocharger screen and trap inspection cover.

b. Basic quick disconnect fitting on Michiana lube oil tank and water tank will be equipped with dust cap.

c. Seven and one half (7.5) G.P.M. AC fuel pump and three (3) G.P.M. turbo soakback pump provided basically.

d. Two (2) speed cooling fans.

e. 200 rpm full time low engine idle provided basically. Includes ability to raise engine speed to throttle 2 when sensing 135° F falling engine water temperature. Customer specifically requests 135° F temperature setting in place of basic 110° F setting.

f. Lube oil sampling valve with BNSF special cover provided. EMD to provide modified covers.

g. Engine purge control provided.

h. Starter motor thermal overload protection provided.

i. Mechanical bonded 8 row radiators provided.

j. 20 psi cooling system water fill pressure cap - (BASIC).

k. 10 element lube oil filter provided - (Basic)

l. Engine cylinder head to be equipped with hardened valve guides and machined valve keepers - (Basic)

m. Liquid filled engine lube oil gauge specifically not required by BNSF.

n. Aeroquip eductor air line required.

o. Electronic engine control system (EMDEC) - (BASIC)

p. EMD top deck cylinder cover "support assembly" (40044044) will be provided.

q. One piece top deck cover seal be provided.

r. Separate aftercooling (BASIC)

s. Prime PM5196 automatic cooling system drain arrangement includes modification to accommodate reclamation system. Instructions to drain cooling system are located in the cab and inside the carbody door at the engine start location. Reference EDL 52665.

t. Flexible hose used for left bank aftercooler water inlet.

G. TRUCKS

1. Basic Radial HTCR single shoe truck design with the following features and modifications:

2. Wheel/Axle/Gear

a. Gear Ratio - 85:16 gear ratio provides maximum speed of 70 miles per hour and a minimum continuous speed of 9.2 miles per hour.

b. Axles

Special axle for roller support bearings Grade "F" axles with 6-7/8" journal diameter provided, modified for traction motor roller support bearings.

c. Wheels

Forty-two (42) inch diameter wrought or cast steel wheels of AAR standard 1B profile with "B" hardness range, thirty-eight (38) inch diameter witness groove is basic, hub stamped.

3. Journal Boxes/Adapters

a. Locomotive is equipped with Timken GG, grease lubricated taper roller bearings. The Timken GG bearing is provided with the HDL seal.

b. Two-piece journal bearing adapter application will be provided.

4. Brake Rigging

EMD pin type slack adjusters.

5. Huck Fasteners

Basic at various places on the radial truck.

6. Traction Motor Modifications

a. Sealed greased type traction motor roller support bearings provided.

b. Traction motor and rotor serial numbers.

c. Must furnish motor drawings and assist in developing new tooling and remanufacturing specification and requirements to rework worn, failed or needing repair motors.

7. Other Truck Modifications

a. Alloy single coil journal box springs are basic.

b. Oil type gear case (Oil Specification: Mobil RL1552-1J provided).

c. Brake shoe key EMD Part No. 8100136 to be provided at the specific request of the Burlington Northern Santa Fe.

H. CAB MODIFICATIONS

The SD70MAC WhisperCab™ will be provided.

1. Cab Seats

a. Cab Seat Details

Note: BNSF to specify seat vendor. Cab seat design or manufacturing changes which affect physical dimensions, seat operation, or seat comfort are to be approved by BNSF.

(1) "A-Pass" Units 1 - 169:

Two deluxe pedestal mounted cab seats, with armrests, includes floor mounted spring assisted pedestal from Seats Inc. (Vendor Part No. 176025). Seats to include anti-theft feature. Seat assembly to be brown vinyl from Seats Inc. (Vendor Part No. 176024). Seats located at Engineer's console and conductor's work station.

"B-Pass" Units 170 - 217:

Seats Inc. (Supplier Part No. 176612-6; GM Part No. 40086840) seats located at Engineer's console and Conductor's workstation. Seat design includes a high back railroad seat with double recline back adjustment, 2-way adjustable lumbar, adjustable 22 inch wide cushion, heavy duty front adjustable arm rests with flip up feature (Delete armrests supplier part no's. 303886 and 305706, Add armrests set supplier part no. 177125-ZN49), seat covered in 45 ounce brown vinyl with ABS plastic back protector. Floor mounted spring assisted pedestal from Seats Inc. (Vendor Part No. 176025) provided. Seats to include anti-theft feature.

(2) One auxiliary seat from Seats Inc. (Vendor Part No. 169006-064064N), mounted on pedestal from Seats Inc. (Vendor Part No. 176025), with no arm rests, provided at the number two position on conductors side. Seat color to be brown vinyl. Seat to include anti-theft feature.

b. 40048621 jump seat provided and mounted on the center lower high voltage cabinet door. Seat to be brown vinyl to match control console.

c. Seat installation and adjustment ranges must be approved by BNSF.

d. Engineer's seat to be mounted on a raised platform and include an additional step light.

e. Conductors' seats to be mounted on a raised platform.

2. Refrigerator

a. EBCO Model ER2-1-RR refrigerator with EBCO transformer P/N 027242-001 to be provided. Refrigerator to be positioned so that door will open to the stairwell. (Note: Oasis is the trade name of this style of refrigerator.)

b. Cup dispenser not required.

3. Speed Indicator/Recorder

a. EMD Cab Electronics speed indicator with distance counter and event recorder with the following features and modifications:

(1) Event recorder medium will be credit card memory.

A-Pass (Units 1 - 169):
The following events will be recorded:

Channel	Type Of Parameter	Measurement
1	Elapsed time	Continuous
2	Distance	Continuous
3	Speed	Continuous
4	Tractive Effort	Continuous
5	Throttle - Positions (idle & 1-8),	Steps
	dynamic brakes	On/Off
6	Automatic Brakes: released, brake pipe in one pound increments, PC Open and engineer initiated emergency	Steps

7	Direction of Travel	On/Off
8	Locomotive Brakes	On/Off
9	Horn	On/Off

B-Pass (Units 170 - 217):
The following events will be recorded:

Type of Parameter	Measurement
Time and date	Continuous
Locomotive initials and number	
Speed and distance	Continuous
Brake pipe pressure	
Brake cylinder pressure	
Equalizing Reservoir Pressure	
End-of-train pressure	
Amperage / tractive effort	Continuous
Brake pipe flow	
Throttle Position	Stop, Idle, 1 - 8
Dynamic Brake Position	Setup, DB Percentage
Reverser position-forward, centered, reverse	
PCS open	
Engineer initiated emergency	
Sanding auto/manual	
Wheel slip	
Alertor alarm	
E.O.T. communication status	
E.O.T. moving	
E.O.T. battery	
E.O.T. marker (light)	
E.O.T. valve failure	
Automatic brake - Freight/Passenger/Cut-Out	
Independent brake - lead/trail	
Automatic brake valve handle positions - re/ser/sup/emerg	
Locomotive air brake health	
Overspeed penalty brake application	
Dynamic brake warning	
Emergency brake application	
Locomotive computer/air brake generated penalty brake application	
Distributed power lead/remote	
Locomotive isolation switch Run/Isolate/DB-only or operating mode	
Dynamic brake-setup/derated/start/cut-out	

Traction motor or inverter cutout
Locomotive brake bail-actuate

(2) Recorder and download format per BNSF approved Rockwell IER specification provided on units one through 169. On units 170 through 217, recorder and download format per BNSF approved GM FIRE Business Decision Document (BDD). Download of the event recorder can be accomplished through a SRAM credit card or laptop computer hook-up to an RS-232 port.

(3) Second digital speed indicator to be mounted in the plate provided for "ECE" flat screen display, within the normal viewing range of the conductor.

(4) Mounting provision only for a third "ECE" flat screen display to be provided on Conductor's console, no cabling or software provided.

(5) Speed signals required for EMD Cab Electronics, recorders, indicators, control functions, etc., will be sourced from the A/C traction motors, magnetic pick-up sensors and sent to the required devices through the "ECE" and/or EMD control systems.

b. Distributed power provided on all units. Additional parameters to be recorded by ECE on these units.

(1) DP Enabled

(2) DP Linked

(3) Lead/Remote

4. Temperature Control

a. Central electric forced air cab heating/air conditioning system provided with distribution ducts and individual louver control. Requires 18 KW AC auxiliary generator.

b. Central air conditioning to be provided.

c. Subbase mounted fresh air makeup blower with filter and with a switch on the engine control panel provided.

d. Air conditioning, heating performance requirements:

(1) A/C: (30,000 BTU) at 110° F ambient, cab will maintain 80° F.

(2) Heating: (11.25 kW) at -40° F ambient, cab will maintain 50° F.

(3) Central heating/air conditioning system will furnish 10% filtered make up air.

(4) Return air is filtered.

(5) Air conditioning compressor is a serviceable hermetic type, no exposed rotating shaft seals.

(6) Drain line routes air conditioning condensate down condenser air flow stream for discharge underneath locomotive underframe.

(7) Diagnostics of the HVAC system will be provided via a remote port accessible from the cab.

5. Cab Flooring

Vinyl covered acoustical floor mat on steel subfloor with three piece trap door. BNSF requires all subfloor access doors must weigh less than 40 lbs.

6. Awnings

Full length fiberglass folding awnings provided on both sides of cab.

7. Wind Deflectors

Prime SC-875-28 wind deflectors with full length mirror, front only, on both sides of cab.

8. Doors, Windows, Glass

a. Cab door lock identification

(1) Basic door locks

(2) Key code for door locks to be "B1"

b. Cab Windows

(1) Rubber seal mounted, heated certified glass on all front windows.

(2) Non-preframed standard certified glass for rear windows.

(3) Federally mandated high impact window material is required and will be applied.

(4) Electric windshield defroster controlled and indicated through the "ECE"/EM2000 processor controls.

(5) Side windows will be the R. E. Jackson 4 glass panel side sash assembly. Outboard panels to be in a fixed stationery position, inboard panels to be movable. Side sash assemblies will be equipped with tinted glass.

(6) EMD basic mirror arrangement for operator to view R/F nose ladder area provided.

c. Armrests

Kidney pads and armrests on side wall below window on both sides.

9. Controller

Single lower control console. Single control for power and dynamic brake. Throttle and air brake controllers to be tilted.

10. Cab Features

a. EMD Cab Electronics screens feature the following information:

(1) Tractive/Braking effort meter, analog bar graph representation shall appear on the display screen.

(2) Throttle handle position indicator - Bar graph

(3) Dynamic brake handle position indicator - Bar graph

(4) Reverser position - Text

(5) Unit Number - Digital Display

(6) Push-to-test light replacement; including wheel slip, PCS OPEN, Brake warning, Sand Indications.

(7) Speed indicator

(8) Fuel level indicator

(9) Remote session capability provided.

b. Full width upper console

(1) Radio to be located in upper console.

(2) A light horn box (AVU) will be mounted center to the cab in the overhead console. The light horn box Rockwell #822-0728-001 / EMD #40046542, is equipped with Yellow LED's for the light indicators. Also an alerter light indication will be shown on the flat screen display of the "ECE" system. The light indicator in the "ECE" system shall be equipped with a visual digital count timer in the window. The window shall be red per AAR LSI Display Specification version 3.0 released January of 1993.

c. Engineer's console

(1) Push button sanding switches provided.

(2) Desk top - Brown Kydex overlay

(3) Stainless Steel writing surface with clip provided.

(4) Two "ECE" display screens - provided.

(5) Recess to be provided in engineer's console to accommodate food and beverage items.

(6) Nameplate provided to inform engineer of AC traction system and to describe the differences compared to traditional DC systems.

(7) Engineer's lower console to include an adjustable foot rest.

(8) Lead sanding, sanding, bell and horn push-buttons to be back lit and equipped with dimmer control.

(9) Slide switches on console to be back lit and equipped with dimmer control.

(10) Slow speed switch to be located at the top of the engineer's console above the lead sanding, sanding, bell and horn push button switch group.

d. Helper's Work Station

(1) Helper's work station will be 30" high.

(2) Desk surface of helper's work station will be provided with a brown Kydex overlay.

(3) Helper's workstation to include an adjustable footrest.

11. Other Cab Modifications

a. Power Parts cab card holders:

Power Parts card holder part number PPC 25288.

b. Helper's Work Station full width (over refrigerator) with melamine writing surface. Work station to include wing. Storage shelf will be provided under this workstation.

c. First aid kit to be recessed and integrated into helper's console. Door of first aid kit to be identified with appropriate label.

d. Towel dispenser "BNSF Spec INCA 197000" - located in equipment vestibule.

e. Toilet tissue holder provided. (See Item II.J.7.b.)

f. Hand cleaner dispenser Part No. 40021110 provided and located in equipment vestibule.

g. Remote horn button for the conductor mounted under the desk in the shelf space, to the right side.

h. Trash bag holder clip to be applied to the outside of high voltage cabinet door.

i. Sunvisors to be brown - to match seats. (quantity four)

j. BNSF style door holder applied to right side cab door.

k. Minimum of four (4) each coats hooks are required located on the HVC doors to the rear of the operator compartment.

l. High Voltage cabinet door interlock system provided to protect personnel from possible DC link capacitor voltage.

m. All locomotive cab openings are to be sealed to the extent that will prevent water from entering the cab when operating through BNSF wash facilities.

n. Apply velcro strap broom holder in front nose area of locomotive.

I. RADIO

1. Complete application of Motorola Clean Cab radio MBR43KME1170AD with VKN 4125 Power Cable. EMD to provide radios preprogrammed to Burlington Northern Santa Fe frequencies.

a. Engineer's Console includes:

(1) TLN 6489 Cradle Assemblies

(2) Telephone Components Company hand set, Part Number TG4AAR(D)PBTS,2A provided on all units.

b. Helper's Work Station:

(1) DTMF pad with rear handset connector hangout provided and located in upper right side accessory panel of helper's workstation. Handset connection recessed on panel to minimize theft.

(2) TLN 6489 Cradle Assembly

(3) Telephone Components Company hand set, Part Number TG4AAR(D)PBTS 2A provided on all units.

c. Radio antenna incorporated into Radome application (see Section II.I.6)

d. Electronic Supply Company SP-22 Speaker Assemblies per previous ATSF order 956608.

2. Front-End-EOT Device:

a. A front end or EOT transceiver will be included as part of the "ECE" package.

Locomotives 976814-001 through 976814-169 are to be equipped with Pulse Model: TLK-LCU-08, Pulse Part No.: 17123, EMD Part No.: 40041416.

Locomotives 976814-170 through 976814-217 are to be equipped with Pulse Model: TLK-LCU-09, Pulse Part No.: 17129; EMD Part No.: 40080325.

This system shall accept either types of device applied to the rear of a train, a Dual Mode/telemetry, with the ability to apply and emergency brake application from the lead locomotive or a single mode EOT, that send data from the rear of train only. A locomotive initiated emergency brake application will automatically result in a request for a dual mode EOT to also activate an emergency brake application. Bilingual AAR & Pulse protocol formatting is required.

b. EOT Antenna incorporated into Radome application (see Section II.I.6.).

3. Cab Intercom System

NOTE: This requirement has been specifically deleted by BNSF.

4. Other Radio and Communication Requirements

a. All coax cable will be Belden 8237 with AMP 330830 PL-259 connectors.

b. Provision for GPS incorporated into Radome application.

c. Provision for work order/train order incorporated into Radome application.

5. Distributed Power Equipment

a. Complete application of distributed power provided on all units.

(1) Antennas incorporated into Radome application (see Section II.I.6).

(2) Harris data radio package cabled to distributed power antenna's and ECE electrical equipment locker. Separate data radio circuit breaker to be provided.

6. Rockwell or GE Harris 8-element radome antenna to be provided.

J. CARBODY

1. Hood Arrangement

Wide SD70MAC profile short hood. Short hood end of the locomotive is considered the front.

Window provided in front locomotive nose door.

2. No. 1 (front) End Arrangement

a. Snow Plow Arrangement

(1) EMD "large" snowplow pilot with reinforcing. Grab irons on snowplow must be at least 14" long land mounted per FRA requirements.

(2) Snowplow MU hose doors specifically deleted. Opening to have rounded edges to prevent chafing of the MU hoses.

b. Anti-climber arrangement provided. Side uncoupling lever arrangement provided, per FRA requirements.

c. Increased collision strength low short hood to meet or exceed all FRA requirements.

d. Side footboard arrangement per FRA requirements provided. 24 inch sidestep with EMD standard 16 inch bottom clearance.

e. Special BNSF end plate supports at No. 1 end of units.

3. No. 2 (rear) End Arrangement

a. Basic pilot/hose storage rack assembly.

b. Side uncoupling arrangement, per FRA requirements provided.

c. Side footboard arrangement, per FRA requirements provided. 24 inch sidestep with EMD standard 16 inch bottom clearance.

d. BNSF type knuckle storage rack provided. Knuckle storage rack requires permanent markings to indicate type of knuckle stored in rack (eg. "F" helper's side and "E" operator's side of locomotive). The storage racks shall be mounted as high as possible without causing any interference.

4. Coupler/Draft Gear

NC390 draft gear with high strength "F" coupler, F8306 and high strength knuckle, F111HTS.

5. Lights

a. The basic complement of lights is supplemented with the following lights and lighting modifications:

(1) Stationary lights with soft rubber shades required on each side of cab, recessed in ceiling over engineer's seat, conductor's seat, brakeman's seat, total of (3) lights.

Two black shade spot lights mounted under the overhead console, one over the engineer's clip board area, and one over the conductor's workstation. Lights to have on/off switch and dimmer rheostat.

Flood lighting in center of cab required with integral control switch. Adequate floor lighting required.

(2) Class lights are not required.

(3) 74 volt light in filter room.

(4) Step lights - (Ground light type)

(5) Ditch lights are required with the following specifications:

(a) Ditch lights will be on with headlight in the medium or bright position only. The ditch light will be controlled by the front headlight switch. When the front headlight switch is in the "off" or dim position, the ditch lights will be off. A separate ditch light switch will not be applied.

(b) Lights shall be 350 watt, 74 volt, par 56 sealed beam lamps.

(c) Lights to be mounted on the front platform "deck". The lights will aim so they cross over to the opposite side of the track. Light

beams should cross 400 feet ahead of the locomotive and strike the rail 800 feet ahead of the locomotive. Ditch light service lens cover will be hinged inboard.

(6) Detailed specifications for all lighting including, headlights shall be furnished to BNSFRR medical and safety department and shall include associated luminance values.

(7) 350 watt twin sealed beam headlights provided No. 1 and No. 2 end. No. 1 end headlights to be located on short hood nose.

6. Fire Extinguishers

Two (2) Kidde Model #466207 dry chemical fire extinguishers to be provided. One mounted in the equipment vestibule, the other to be mounted in the long hood near the air compressor. Fire extinguisher in the equipment vestibule should be mounted so as to provide sufficient doorway clearance with extinguisher mounting bracket in the open position.

7. Toilet

a. Microphor chlorinated stainless steel toilet with external control box flush mechanism, part number 93983. Similar to the application provided on SD75I order 966740.

(1) Gray exterior enamel bonded coating on stainless steel toilet.

(2) Water supply tank is plastic.

(3) Toilet is provided with improved chlorinator.

(4) Temperature controlled heat strip and /or insulation around toilet drainline down to side sill provided to prevent freezing.

b. Toilet tissue dispenser, EMD P/N 40076378 (United Receptacle Model #UDR30).

c. Toilet compartment to include drain hole in floor for cleaning.

d. The toilet compartment will be equipped with a negative pressure forced air ventilation's system. The air shall be heated and/or cooled as appropriate and exhausted out of the locomotive.

8. Lifting and Jacking Devices

a. Jacking pad/cable sling

Basic arrangement only, consisting of four combination sling jacking pads welded to the underframe side sills, near the longitudinal bolster centers.

b. Supplemental lifting eyes

Lifting eyes in the end sheets at all four (4) corners.

9. Locomotive Weight

Nominal loaded weight including all modifications and supplies is 415,000 lbs. Manufacturing tolerance plus or minus 5,000 lbs. Locomotive weight to be equalized between trucks to within 5,000 lbs.

10. Clearance

Plate "C" modified. Clearance diagram to be submitted for BNSF approval.

11. Other Carbody Modifications

a. Air hose and packing hook holder and switch chain holder to be applied in long hood near sand box. Similar to BNSF order 966740.

b. Basic hinged engine maintenance doors in top of unit.

c. Wheel type handbrake located at right rear of long hood. 125 lbs. of force is required to set the hand brake.

d. Fusee and Torpedo holder, part number 9337033, will be located in the nose storage area (outer vestibule). Design and location approved by the BNSF.

e. Side handrails to include access for batteries and air compressor with removable stanchions in these areas.

f. Flange Lube

TSM Type II (low pressure) flange lubrication system, controlled through the use of "ECE"/EM2000 Systems, applied to units 1-106.

Flange Lubrication System material already in inventory, either purchased or made, specifically for the application to locomotive units 107 - 169, is to be packaged on shipping palettes for shipment to the customer. Reference ECR No. 14486 for specific instructions regarding material. Shipping instructions will be issued by EMD Program Management Office c/o Phil Langan. Purchasing shall copy Phil Langan on all invoices/payments made by/to suppliers for flange lubrication system material which is subject to cancellation charges.

Do not apply Flange Lube System to locomotive Units 170 - 217.

g. 3 inch removable drain plugs - five locations.

h. BNSF to provide AEI labels, BNSF p/n 02-834-00206, and AEI "slip in" mounting plates, BNSF p/n 20-798-00308. EMD to apply one label on each side of the locomotive. AEI tags to be mounted on side sills as depicted in BNSF AEI tag placement window drawing dated 6/4/90.

i. Recessed cooling fan hatch assembly provided to meet BNSF clearance requirements.

j. The vertical handrails right and left side No. 1 ends which attach to the short hood will be provided with the vertical handrail extension modification.

k. Grab iron on lower left side front short hood to be deleted per customer request.

l. Locomotive side steps will be the four (4) step configuration.

m. Number 2 end number boxes will not be provided. In place of the number boxes, locomotive road numbers will be white Scotchlite reflective decals applied on the No. 2 end sheet to the green painted background.

n. Engine hatch power assembly doors are captive to the locomotive (non-removable).

o. BNSF turbocharger / aftercooler carbody access doors to be a three-panel door arrangement.

p. Blue flag bracket located on right side of unit, below side sill, and flag staff holding bracket to be applied to nose of locomotive engineer's side. Per detailed instructions. ATSF drawing No. 4C-104301.

q. Deck plates will use raised diamond pattern.

r. Steel extra holder mounted on last door of long hood, sand box end, engineer's side. Top of holder to be 54" from deck per ATSF drawing No. 4C-7856. Similar to BNSF order 966740.

s. Partial Provision for Electrically Controlled Pneumatic (ECP) brake on units #140 through unit 169. The partial includes #8 AWG twisted pair, two conductor trainline complete cable, shielded armored cable from the #1 end to #2 end.

The units that have "Partial Provision for Electrically Controlled Pneumatic (ECP) brake (Unit #140 through Unit #169) will have an aftermarket parts kit made available as a service release to be applied by the BNSF after delivery of the units. These parts kits will include all the material necessary to bring the units from "Partial Provision for Electrically Controlled Pneumatic (ECP) brake to "Full Provision for Electrically Controlled Pneumatic (ECP) brake.

Full Provision for Electrically Controlled Pneumatic (EPC) brake on unit 170 through the remainder of the order. Includes addition of:

(1) Partial Provision for (#8 AWG twisted pair, 2 conductor trainline complete cable, shielded, armored cable from #1 end to #2 end).

(2) End junction boxes, inter-car connectors, and termination connector assemblies.

(3) Car ID junction box

K. FUEL TANK

1. Description

Units to be equipped with impact resistant fuel tank.

a. Capacity

Fuel tank provides 4,790 gallon capacity, with 100 gallon retention tank on units 170 through 217. Engine water drain will not be discharged into the retention tank.

b. Filler Pipes

One filler pipe located on each corner of tank.

Four Snyder II automatic fuel adapter applied - two per side.

c. Gauges

(1) Top mounted pneumercator dial-type on both sides of tank.

(2) One eight inch fill gauge adjacent to each filler pipe, total of four.

(3) Engineer to view fuel level through the use of micro flat screen display monitor, "ECE".

(4) Complete application of Pulse electronic fuel gauge to be mounted by filler pipe. One (1) electronic gauge adjacent to the filler pipe on the engineer's side of the locomotive. Pulse electronic fuel gauge 10594067 provided on units 1- 95.

Pulse electronic fuel gauge 40059886 provided on units 96 - 217.

2. Other Fuel Tank Modifications

a. Fuel tank vent pipe shortened and cut at 45 degree angle per BNSF specification.

b. The two inch drain line from the locomotive retention tank to be equipped with McMasters Carr part no. 5589K15 "D" coupler and part no. 5594K15 dust plug.

L. STYLING AND PAINTING

In accordance with drawings prepared by EMD and approved by customer. Paint scheme to be applied according to the revised locomotive paint criteria AI133.

1. Paint

a. Exterior

(1) Upper Locomotive - per painting and styling drawing 10643822, (Rev. F) and RFC D57069 approved by the Burlington Northern Santa Fe: A three color polyurethane paint scheme consisting of the following colors:

Green
Orange
Black

Rev. (F) Includes the following changes:
1.) Cooling screens to be one color, green.
2.) Longhood door latches (knuckle busters) to be background color
3.) Eliminate yellow/black touch-up on bottom stripes - air duct and RHS longhood welds at the bottom
4.) Eliminate yellow/black in-between door hinges and cab slip joint including at sub-base hinges. Leave as background color - mainly orange.
5.) Orange anti-skid on cab roof flat surface and green anti-skid on top of Longhood flat surface.
6.) Apply BNSF graphics, BNSF letter boards, cigar band, front chevron, rear logo, exterior stick on road numbers, top and bottom carbody reflective stripes on top of paint per Decal application drawing 10649465.

(2) Lower Locomotive - Silver per painting and styling drawing 10643822 Rev. F, approved by the Burlington Northern Santa Fe Railroad.

(3) Green nonskid on walkways, sand fill platform areas, and long hood roof area per drawing 10643822 Rev. F.

b. Interior

(1) Interior trim - colors:
#1 High Voltage Cabinet - Beige
Console - Brown Semi-gloss
Workstation - Brown Semi-gloss
Headliner - Beige
Sidewalls - Beige
Upper Console - Beige
Short Hood - Beige
Instrument Panels - Semi-gloss black
#2 Control Cabinet - Suede Gray

2. Reflective/Non-Reflective Markings

a. Side sills painted green with white diamond pattern reflective delineators 3M-980-10 or equivalent as shown on the approved painting and styling drawings.

3. Identification

a. A 'F' is located on the side sill near the end of each side to identify the short hood end as the front.

b. Number Boxes

Number panels are of fiberglass construction and include white on black background.

c. Road and serial numbers are as follows:

ROAD NUMBERS	SERIAL NUMBERS
9865-9942	976814-1 thru 976814-78
9995-9999	976814-79 thru 976814-83
8800-8842	976814-84 thru 976814-126
8873-8876	976814-127 thru 976814-130
8903-8941	976814-131 thru 976814-169
8942-8989	976814-170 thru 976814-217
	(B PASS begins at Unit 976814-170)

d. Other Identification Modifications

(1) Paint marking - location where painted, month, year.

(2) On both sides of the engine, just below the cylinder test valves, stencil "710G3B-ES Engine", using at least 2" high numbers and letters.

(3) Decals displaying nominal locomotive weight visible in cab.

(4) Decals displaying letters BNSF and unit number located in cab and visible to engineer.

(5) SD70MAC loco applied to side sills in white Scotcheal per painting and styling drawing.

(6) "Assembled in Sahagun, Mexico" decal to be placed near engineer's side builder's plate.

(7) "B-Pass": BNSF has specifically requested EMD to paint trainline brake pipe cut-out handles, one handle located at each end of locomotive, yellow.

M. SHIPMENT

1. Consignment and Routing

Twenty (20) cab keys should be sent to:

Mr. John W. Nixon
Director Locomotive Systems
Burlington Northern Santa Fe Railroad
2600 Lou Menk Drive
Fort Worth, Texas 76131

The balance of the order requirement should be sent to:

Mr. David Albright
Shop Superintendent
Burlington Northern Santa Fe
500 West Kansas Avenue
Alliance, NE 69301

2. Operating Supplies

Units to be fully serviced and shipped running. Electro-Motive will provide the following supplies:

a. 2000 gallons fuel oil

b. 400 pounds sand

c. Treated engine coolant

d. 436 gallons of EMD's standard high VI SAE 40 lubricating oil with EMD approved additive package.

N. DRAWINGS

Standard set of reproducible drawings provided: Loco Schematic & Conduit Diagram, Wire Running List, Air Piping Diagram, Clearance Diagram, Cab Arrangement, Styling & Painting, Module Drawings, General Truck Arrangement, supplemented as follows:

Does NOT include radial truck or AC equipment drawings.

1. One set of air piping drawings including bill of materials and one set of electrical schematics on half-size mylar. Air brake piping to include gross land net braking ratios. (Mylars of electrical schematics and air piping to be furnished prior to/or at time of delivery).

2. Two sets of duplicards provided.

3. Sixteen (16), 3/4 front view 11 x 14 color photographs land frames. Four (4) sets of black and white 8 1/2 x 11, side view, full front and rear and 3/4 front view. Two (2) sets of black and white constructions photos taken prior to carbody application.

4. Traction motor and rotor (there is no armature) serial numbers, and locations to be provided at time of delivery.

5. Three (3) weeks prior to delivery of first unit, EMD to provide a reproducible sepias of electrical schematic, if final revision are not yet available for distribution as described above.

6. Clearance diagram to include all modifications which would affect clearance outline.

7. Complete set of locomotive drawings to be provided on computer tape as available. Magnetic tape on IBM 9 track format (800 or 1600 BPI density) File to be IGES neutral format.

8. One hundred (100) locomotive service manuals will be sent to locations as directed by BNSF.

9. Drawings to be sent to:

Mr. John W. Nixon
Director Locomotive Systems
Burlington Northern Santa Fe Railroad
2600 Lou Menk Drive
Fort Worth, Texas 76131

Publications to be sent to:

BNSF Standard Distribution
Destination addresses will be provided directly to EMD
Service Publications by the Proposal Manager.

O. SPECIAL INSTRUCTIONS

1. Wording for cab cards is as follows:

Units 1 - 212:

OPERATOR	-	Burlington Northern Santa Fe Railroad
OWNER	-	Burlington Northern Santa Fe Railroad
CODE NO.	-	0110

Units 213 - 217:

OPERATOR	-	Burlington Northern Santa Fe Railroad
OWNER	-	General Motors Corp. - EMD
CODE NO.	-	4151

2. Locomotive serial number record sheet to include type of inertial filter and speed recorder serial number.

P. SAFETY AND HEALTH

1. EMD will furnish to the Burlington Northern Santa Fe a description of any baseline or optional features available to enhance the employee safety and ergonomics of the cab environment. Further EMD shall thoroughly describe all locomotive design features that have been specifically developed to provide enhanced employee safety and ergonomics, including supporting rational and design-to criteria (e.g., percentile ranges for anthropometric body dimensions being accommodated, or requirement to have a clear view of all critical areas from a user's visual location.

EMD shall provide detailed drawings, photographs, and supporting descriptive details such as, forces, reach envelopes, adjustment ranges, and field of vision provided by the proposed design(s).
EMD shall provide detailed descriptions of any proposed electronic information displays in the cab, to include accurate depiction's of display symbol fonts and their sizes, as well as viewing distances, display type, intensity, contrast, access logic, design and locations of associated controls (e.g., "soft" buttons, etc.)

Scott Zelinka
Proposal Manager
Locomotive Inquiry Group

Mike Williams
Proposal Manager
Locomotive Inquiry Group