Preliminary Specification for
ES40ACdbi Evolution series Locomotive

1.1General data

Model	ES40Acdbi
Emissions	UIC 2 capable
Car Body	Wide Body with internal walkways
Operator Cab	Dual with lift hand drive
Weight	139.5 MT +/- 3% (23.25 MT/axle +/- 3%)
Weight Distribution	+/- 2%
Wheel Arrangement	AAR "Co-Co" , all axles powered
Length, centerline of traction Pin to pulling face of nearer coupler	3,910 mm
Length between traction pin centers	13,701 mm
Truck wheelbase	3,700 mm
Length between front and rear coupler Pulling faces	21,520mm
Maximum units in consist	3
Width over cab sides	3,119 mm
Height over operator's cab and horn	4,763 mm
Gauge	1,435 mm
Clearance	per GE Dwg. PAE7050-310
Min. Rail Clearance	61 mm
Coupler Height	950-1045 mm (worn wheels)
Full throttle power for traction	2,929 kW @ 1050 rpm
Gear Ratio	85/16
Maximum operating speed (worn wheels)	120kph
Ambient temperature	-10 C to +50 C
Derated locomotive performance Possible at temperatures exceeding	45 C
Maximum tractive effort (at UIC conditions)	534 kN (54,450 kgf)
Continuous tractive effort (at UIC conditions)	427 kN (43,540 kgf)
Maximum breaking effort (at UIC conditions)	338kN (34,466 kgf)

Capacities fuel	6500 liters usable9000 liters possible at higher axle loads
Sand capacity	200 liter
Engine cooling water	1136 liter (300 gallon) estimate
Engine lubricating oil	1400 liter (370 gallon) estimate
Curve negotiation (yard) single unit	No less than 125m , max speed 5kph
Coupled pair	No less than 125m , max speed 5kph
Curve negotiation (line)	Minimum 180 m radius at 40 kph
Friction enhancer type	Sand

1.2 platform superstructure

Layout	box beam design
Anticlimber	provided , bothends
Inside walkways	non-skid, steel tread
Couplers	automatic coupler
Draft gear	customer specified
Pilot plates	"sandplow" equipped Vertically adjustable pilot plat
Buffers	provided

1.3 Trucks

Model	3 axle , tandem motor , bolster less , low weight transfer
Type	Fabricated frame (UIC 615-4) bolsterless
Suspension • Primary • Secondary • Stabilization • Journal bearings	 soft coil springs stiff rubber springs lateral and vertical shocks Tapered roller – class GG

1.4 Air equipment

compressors • Type • Air delivery • Intake air filter	 2 motor driven twin rotary screw compressors supported with single skid and isolation Total for 2 compressors= 200 CFM@1050 engine rpm (5565 liters/min or 5.565cu meter/min) 1 per compressor
Compressor Drive • Type • Control • Governor setting • Main reservoir capacity	 3-phase ac motors 2 speed via pole changing 130psi to 140psi 930 liters minimum
Moisture removal • MR drain valves (2) • Air dryer • Filters (2)	 Automatic Desiccant type Coalescing element type

1.5 Breaking

Pneumatic • Rigging (tentative) Type • No. of shoes • Material • Slack adjusters	Electronic airbrake (26L based schedule) single shoe 12, one/wheel Composition not required
Parking brake	provided. Spring applied , air release. Capable of Holding locomotive on 3% grade
Braking Resistor Unit • Model • Electric/Dynamic	provided 17EM series two stack

1.6 Engine

Model	GEVO V12
Type	45 V-12, 4-stroke cycle, turbocharged
Valve train	2 intake + 2 exhaust/cylinder
Bore and stroke	250 mm bore X 320 mm stroke
Compression Ratio	17:1
Maximum Engine speed	1050 rpm
Maximum Engine speed (low idle)	330 rpm
Fuel injection	Electronic
Exhaust	Dual pipe manifolds and single muffler via main alternator, inverter
Cranking	Controlled off batteries

1.7 Engine support

Intake Air Filtration • 1st stage • 2nd stage • 3rd stage	 Perforated V-screen GE spin- Cleaners (vortex type) Disposable baggies
Radiators Fan • Model • Type • Drive • Control	Mechanically bonded 5GYA30 1829 mm diameter 3 phase ac motor skip cycle , variable speed
Lube oil	Generation 4 recommended
Coolant	Borate-Nitrite treated water
Water drain	An automatic water dump system will be provided
Fuel supply	Electronic injection via electrical pump with an AC primingPump , thermal regulating valve thermostatically controlled Fuel heating , with solenoid operated emergency shutdownValve and inline fuel strainer

1.8 Drive Train

Transmission type	Electric , ac/ac
Alternator • Model • Type • Drive • Control	 GE 5GMG205 3 phase ac Direct, engine flange coupling Auxiliary alternator winding with static regulator
Rectifier • Model • Type	 GE 17FM792 Press pack silicon diode ,full wave bridge , air cooled
Inverters (6) • Models • Type	 17M789 and 17FM790 3 phase , VVVF , IGBT , PWM, forced air cooled
Traction motors (6) • Model • Type • Suspension	 GE 5GEB30 3 phase AC induction Roller bearings on axle, bolted motor link to truck frame
Gearing • Type • Lubrication	 Single reduction spur Oil filled, split-line metal gear case
Controls • Excitation • Designation type	 GE advance concept Constant horsepower
Adhesion	GE Advance concept
Designation type	Speed-based creep and torque regulator, individual axle control

1.9 ventilating equipment

Rectifier/inverter/electrical compartment Intake air filtration • 1st stage • 2nd stage • 3rd stage	 perforated V-screens GE spin-cleaners (vortex type) paper media canister

Traction motor • Intake air filtration ○ 1st stage ○ 2nd stage	 perforated V-screens GEspin-cleaners (vortex type)
Blower • Model • Type • Drive • Control	 GDY91 centrifugal 3 phase ac motor Two speed
Alternator • Intake Air Filtration ○ 1st stage ○ 2nd stage	 Perforated V-screens GE spin-cleaners(vortex type)
Blower • Model • Type • Drive • Control	5GDY100 Centrifugal 3 phase ac motor Direct connected to auxiliary supply

1.10 Battery system

Battery • Type • Charging	 Either NiCad or lead acid 74 volt variable regulator (based on ambient temperature)3 phase AC

1.11 Crew amenities

Seating	1 drive + 1 helper (per cab)
Water cooler	Provided
Air conditioner	One per cab
Lighting	Central overhead incandescent, recessed incandescent overheads Over driver and helper, high intensities over driver and helper desks
Visor/shade (rolling type)	Front windshield in each cab for protection From sun

1.12 Appurtenances

Data Logging • Event recorder • Incident data pack • Incident log	 Included in GE diagnostic system Included in GE diagnostic system Included in GE diagnostic system
Headlights	Two 350W, 74 V sealed beam
External lights	Walkway on each side , 4 side step(one each ladder).4lights on each said under platform- over the space between wheel sets.
Overspeed protection	Adjustable, integrated into GE control System
Locked Axle	Via screen algorithm with operator Warning
Mother cutout	Via screen switches on a per motor/Inverter basis
Radio	Provisions only
Ground detection	Power and auxiliary circuits
Alerter/Vigilance	Integrated with GE control system
Fire suppression system	System includes fire alarm and a Button (switch) in each cab. On Operation of the button, fire Extinguishing system will operate
Train control system	Mechanical provision only. Control system interface quote to Be provided separately subject to Definition of system

1.13 Instrumentation

Display (1 per operator cab)	GE smart display
Speed indicator (1per operator cap)	located on helper's desk in k/h
Loadmeter	GE bar graph showing tractive on Smart display in kgf
Air gauges	Digital, integrated into GE control System, air flow indication Included, provided on smart display
Fuel gauges	Fuel tank sight glass. Fuel data provided on smart display

1.14 Diagnostics

Self-Test	Using Evolution series diagnostic System; single step
Diagnostic Display panel	Integrated into GE smart display

2 PERFORMANCE

That calculation steady-state speed for various train weights and grades are listed in tables below

Gross Tonnes	Trailing Tonnes	Level	0.6%grade	1.4% Grade	2.0% grade
750	610.5	120.0	117.5	74.0	57.9
1000	860.5	120.0	98.2	59.5	43.4
1250	1110.5	120.0	85.3	48.3	35.4
1500	1360.5	120.0	74.0	40.2	29.0
1750	1610.5	120.0	66.0	33.8	24.1
2000	1860.5	114.2	59.5	30.6	21.5
2250	2110.5	109.4	53.1	25.7	18.5
2500	2360.5	104.6	48.3	24.1	16.8

Gross Tonnes	Trailing Tonnes	Level	0.6%grade	1.4% Grade	2.0% grade
320	180.5	120	120	120	114.2
450	310.5	120	120	109.4	88.5

Notes
All table values are in kph

3 Mass of main parts of locomotive

Body (without thermal, electrical and pneumatic, and cabling)	98500 kg
Diesel engine (dry)	19840kg
Main alternator	7560kg
Traction motors	2255kg x 6
Compressors	1000kg

3.1PERMANAT LOADS

FUEL	5840KG
WATER	1305KG
OIL	1465KG
SAND	400KG

Total mass with permanent loads

Tonnes=139.5+3%

4 Characteristics of diesel engine

Name of manufacturer and type	General Electric GEVO12
Nominal UIC power	3169 kw
Nominal speed	1050 RPM
Type of injection and combustion chamber	Electronic fuel injection bore =250mm, stroke=320mm with4valveCombustion chamber
Method of supercharging	Free wheeling single Turbocharger
Total cubic capacity of cylinders	188.4 liters
Maximum water temperature at the outlet	116 C
Maximum oil temperature at the outlet	113 C
Weight of motor, with its accessories but without the turbo blowers	20125kg with turbo (dry engine with intercoolers)
Wight of oil in operation order	1087kg
Fuel consumption per hp/hour at nominal rating in non-emissions mode	196 grams/kilowatt hour

5 Characteristics of the alternator

Manufacturer and type	General Electric model GMG205
Output at continuous rating	875 DC-1350V DC at 3281 kw input
Nominal speed	1050 RPM
Number of phases and coupling	3 phases ,Y connection
Nominal voltage between phases	1055V line to line
Nominal voltage ,rectified side	1350 Volts DC
Maximum no-load voltage , rectified side	2000V DC at full excitation
Current continuous rating ,rectified side(mean value)	3750Amperes DC

AC current at stator (continuous rating ,r.m.s.value)	• 2850 Amperes
Maximum excitation current	400A
Number of poles	10
Class of insulation ○ Stator – ○ Rotor –	 class H class H
Diameter	1816mm
Weight	7560 kg(GMG207)