Equipment to be supplied: **STEP VAN MOUNTED TV/SEAL LOW VISCOSITY SYSTEM**

33,650 Mile

TV STEP VAN 16' GAS, COMPONENT LIST

1 - **TV STEP Van, GAS w/Automatic Transmission and 16' (Minimum) Loadspace**

1 - **TV STEP Van Equipment to include:**

- 2 Amber Electronic Strobe Warning Beacons Roof Mount
- 2 Adjustable Floodlights Rear of Vehicle Area Illumination
- 1 Standard Drivers Seat with Seatbelt and Sunvisor
- 1 Standard Passenger Seat with Seatbelt and Sunvisor
- 1 12 Volt Light, Cab Area
- 1 Back-Up Alarm
- 1 AM/FM Radio
- 1 Rear Mounted Arrowboard
- 1 Front Mounted Lightbar
- 1 Air Conditioning

1 **TV STEP Van Power Package to include:**

- 1 120 Volt 60 HZ Commercial Grade Generator, Gas Powered with Electric Start
- 1 Generator Remote Start/Stop Cable Assembly
- 1 Generator Storage Compartment with a Lockable External Access Door
- 1 Generator Slide Out Rail Assembly for External Servicing
- 1 Commercial Power Supply Receptacle, 15' Cord and Plug
- 1 Electric Supply Center with Circuit Breaker Box, Commercial Power and Generator Power Connectors

1 **TV STEP Van Control Room Interior to Include:**

- 1 Sliding Black Out Curtain
- 1 Armstrong Crosswalk Vinyl Floor Covering
- 1 Laminated Surface Wall Covering
- 1 Laminated Ceiling Covering
- 1 Bulkhead Wall with Plexiglas Window in Passage Door from Control Room to Equipment Room
- 1 Built In Contoured Control Console w/Rack Mounts for Electronic Equipment, Desk Top and Storage Cabinet
- 1 110 Volt Fluorescent Light Fixture
- 1 Electrical Outlet Dual Receptacle
- 1 Fire Extinguisher 10 BC Rating W/Bracket
- 1 Operators Chair
- 1 Closet/Cabinet 16" W x 14" D x 71" H
- 1 Padded Bench Seat with Underneath Storage
- 1 Wall Mounted Electric Heater

1 **TV STEP Van Equipment Room Interior to Include:**

- 1 Interlocking Aluminum Floor
- 1 Smooth Aluminum Wall Covering
- 1 Embossed Aluminum Ceiling Cover
- 1 Electrical Outlet Dual Receptacle
- 1 Downhole Pole Mounting Bracket Assembly
- 1 Work Top with Hand wash basin and Upper Storage Cabinet
- 1 110 Volt Fluorescent Light Fixture
- 1 Wall Mounted Electric Heater

1 **System Engineering Control Panel to include:**
- 1 Voltage Readout, Generator Power Supply
- 1 Hertz Readout
- 1 Generator Hour Meter
- 1 Remote Generator Start/Stop Switch
- 1 Beacon On/Off Switch

1 **Color Industrial TV Monitor, 450(min.) Line Resolution, NTSC Color Standard**

1 **3" Diameter Solid State Color Sewer TV Camera 460 Line Horizontal Resolution (min.) w/Remote Adjustable Optical Focus and Automatic Light Compensating Iris with remote override, Multi Conductor, NTSC Color Standard to include:**
- 1 Camera Transportation and Storage Case

1 **Pan and Tilt Camera System to include:**
- 1 Solid State Color Sewer TV Camera with a Panning and Rotational Camera Head, Remote Adjustable Optical Focus and Automatic Light Compensating Iris with remote override, NTSC Color Standard
- 1 Camera Controller w/Remote Focus, Iris and Auto Centering Control
- 1 Camera Lighting System
- 1 Pipe Grade Verification System (Inclinometer) to read and transmit pipe grade data [+ 15 degrees (+ 27% grade) with maximum error of + 1%]
- 1 Camera Transportation and Storage Case

1 **Color TV Power Control Unit-Multi Conductor Rack Mount, NTSC Color Standard to include:**
- 1 TV Camera Remote Optical Focus Control
- 1 TV Camera Automatic Iris Remote Control
- 1 TV Camera Lighthead Intensity Control w/Meter
- 1 Camera Test Cable Assembly

1 **Video Grab/Pipeline Data Recorder Display System, Rack Mount, to include:**
- 1 Data Alpha Numeric Information Display, with Multi Paging and Defect Codes
- 1 Rack Mount Computer Graphic Controller
- 1 Software package for Pipeline Data Recorder/Video Grab
- 1 Printer, Parallel Color Inkjet with Connecting Cable
- 1 Keyboard
- 1 Mouse
- 1 17" SVGA Monitor with Rack Mount

1 **Video Cassette Recording System to include:**
- 1 Rack Mount for VCR
- 1 Removable Video/Audio Tape Recorder, Industrial Cassette, NTSC Color Standard, VHS Format - Front Load
- 1 Audio Recording Microphone
- 1 2-Hour 1/2" Recording Tape Cassette
- 1 Cable Assembly - VCR to Power Control Unit

1 **Combination TV Transmission & Tow Cable Assembly to include:**
- 1 1000'-Multi Conductor Kevlar Fiber Armored Cable, 2000 lb. rating
- 1 Kevlar Armored Cable Terminal Connector
- 1 Y Eliminator Cable
- 1 5-Pin and 4 pin Dummy Protector Plug
- 1 Cable Strain Relief

1 **Set Up for Future Use of Lateral Inspection System (LIS)**

1 **Electric Motor Drive Television Cable Reel to include:**
- 1 Power Level Wind & Multi-Ratio Manual Transmission
- 1 Footage Meter with Local Mechanical Readout and Remote Electronic Counter
- 1 Transmission Control at Viewing Station

- 1 Local Reel Mount Electrical & Mechanical Control
- 1 Sealed Continuous Contact Collector Assembly minimum of 12 conductors
- 1 Controller Cable Reel/Power Winch Motor

1 **High Performance Lighthead for Intermediate Pipe Inspection with Dual 85 Watt/82 Volt Bulbs, for 8" to 30" Pipe Sizes**

1 **Low-Profile, High Performance Lighthead for Small to Intermediate Pipe Inspection with Three 20 Watt/24 Volt Bulbs, for 6" to 15" Pipe Sizes**

1 **Camera Transportation Skid Set to include:**

- 1 8" to 15" Pipe Diameter Skid Spacer Plate Kit
- 2 Bottom Stainless Steel Runners
- 3 Top Stainless Steel Runners

1 **Electric Power Winch for Remote Manhole w/Level Wind to include:**

- 1 1/2 HP High Torque Power Driver
- 1 3/16" Stainless Steel Winch Tow Cable 1000'
- 2 Power Cord Reel Assembly w/500' Power Cord
- 1 Winch Power Cord Extension Assembly 20'
- 1 Power Winch Drum Emergency Hand Crank
- 1 Hand held remote winch controller

1 **Self-Propelled Camera Transporter to include:**

- 1 Transmission Coupling and spacer set for 6", 8", 10", 12", 15" Pipe Sizes with Freewheel and Powered Reverse
- 1 Spare Parts Kit to include Additional Chain Links and Rubber Pads
- 1 Transporter Controller w/Automatic Safety Off Switch

1 **Low Viscosity Chemical Pumping System to Include:**

- 1 Air Motor Drive
- 1 Pump Mounting Frame
- 2 1:1 Ratio Positive Displacement SS Pumps w/By Pass
- 1 Pump Manifold Assembly with Stainless Steel Disconnects
- 1 Pump Adjustment Tool
- 1 Transfer Pump for Acrylate or Acrylic Chemical
- 1 Chemical Tank Assembly with Dual, Non Corrosive, 30 Gallon Working Capacity Tanks W/Clear Sight Gauge

1 **Quad-Line Chemical/Air/Water Hose Assembly 500' to include:**

- 4 Hose Terminal Quick Connector SS Locking
- 2 SS Check Valve Assembly Chemical Hose
- 1 Packer Joint Testing/Sealing Adapter w/Transducer

1 **Quad Line Hose Reel Electric Powered Rewind, W/5 Speed Manual Transmission to Include:**

- 2 Stainless Steel Dual Passage Rotary Joints
- 1 Electric Reel Drive Motor Control, Reel Mount
- 1 Transmission Control Linkage, Reel Mount

1 **Test and Seal Control Panel Rack Mount to Include:**

- 1 Quick Inflate High Speed Packer Inflation System
- 1 Quick Deflate System
- 1 Remote Pressure Sensing System
- 1 Pipe Joint Air Test System
- 1 Pipe Joint Water/Liquid Test System W/Leak Rate Loss Flow Meter
- 1 Sealing System Control Panel with Monitoring Gauges, Pump Controls and Stroke Counter

1 **Water Storage And Supply Tank 82 Gallon Capacity Minimum to Include:**

- 1 Air Operated Water Pump
- 1 82 Gallon Water Tank

1 **Air Compressor Electric Drive 7.9 CFM \@100 PSI to include:**

	1	30 Gallon Air Receiver Tank
	1	Rear Air Chuck
1	**Chemical Handling Package to include:**	
	2	Chemical mixing paddles
	1	Chemical scoop
	1	Chemical measuring cup (plastic)
	1	Safety goggles
	1	Work gloves
	1	Dust respirator
1	**Low-Void Packer Assembly for 8" Pipelines**	
1	**Chemical Training Mix, 60 gallons of mixed chemical AV118 or equal**	
1	**Cable Manhole Guide System to include:**	
	2	TV Invert Pulley Assemblies
	6	Quick Coupling Extension Poles
	2	Manhole Adapter Hooks
	1	Manhole Top Roller Assembly
	1	Chemical Hose Pulley Assembly
1	**TV/Seal Maintenance Tool Kit**	
3	**TV/Seal Operations Manual**	
1	**Systems Parts Book**	
1	**TV/Seal Inspection Report Binder**	
1	**Instructional Video Training Tape, TV Systems Operation**	
1	**Instructional Video Training Tape, Seal System Operation**	
1	**Instructional Video Training Tape, Trouble-Shooting Operation**	
1	**Instructional Video Training Tape, TV Cable Repair Operation**	
4	**Days Training at Customer's location**	

DETAILED SPECIFICATIONS

16 Foot STEP VAN CAB AND CHASSIS

Engine	Vortec 5700, 350 Cu In V-8 SFI Gas 235 Hp @ 4000 RPM 325 lb-ft @ 2800 RPM
Exhaust System	Aluminized Stainless Steel
Emission Control	Meet Federal & State Standards
Cooling System	Heavy Duty, Engine & Transmission
Wheelbase	157"
GVWR	14,100
Suspension	Heavy Duty Springs Heavy Duty Shock Absorbers
Brakes	4 Wheel Anti-lock, Disc
Steering	Power
Alternator	105 amp
Transmission	4 Speed Automatic with Overdrive, Electronic
Axle	5.13 Rear Axle Ratio
Tires & Wheels	6 each (Dual Rear) 8Rx19.5/E Blackwall
Fuel Tank	40 Gallon

STEP VAN CAB AND CHASSIS

Miscellaneous	Dual Wipers Dual Windshield Washers External Dual Mirrors (Westcoast W/A) Directional Turn Signals Emergency Four-Way Flashers Back-Up Alarm High Back Bucket Seats (1) Seat Belts (1) Warning and Directional Light Controls Fire Extinguisher 10 BC Rear Arrowboard Front Lightbar Air Conditioning

STEP VAN BODY

Construction	Aluminum
Rear Doors	Full Opening, Swing Type, Dead Bolt
Rear Bumper	12 Ga Full Width Step with Grab Handle
Lighting	Stop/Turn/Hazard Licenses Plate Back Up

STEP VAN BODY DIMENSIONS

Interior Height	82 Inches Minimum
Interior Width	90 Inches Minimum
Interior Loadspace	16 Foot Minimum

INTERIOR

The interior shall be divided into three areas; a drivers area, an Operators Control Room and an Equipment and Storage Room. A full length industrial grade blackout curtain shall divided the drivers area from the Control Room. The Control Room shall be located at the front of the vehicle. A wall to wall washable laminate covered exterior plywood bulkhead with a operator pass through door will divide the Control Room from the Equipment and Storage Room. The vehicle body shall include front and rear amber warning beacons, dual adjustable halogen rear work floodlights

VAN CONTROL ROOM

The Control Room shall be located at the front of the van body. A roof mounted 13,500 BTU air conditioner with built in heat strip shall be supplied. All free standing cabinets and doors shall be constructed of 7 plyMaranti plywood and will be mounted 3 inches above the floor surface on runners to minimize any potential water damage from capillary absorption of free standing water during wash down. All exposed surfaces of the bulkhead doors, door cut outs, cabinets, and cabinet doors shall be constructed with a minimum 1" industrial aluminum liner to provide maximum protection from potential impact. The base of allfree standing cabinets will be lined with a 3" aluminum kick plate to provide maximum protection from damage caused by impact or moisture. Cabinets not constructed of 7 ply Maranti plywood shall be deemed not acceptable. All cabinet doors will be installed with metal Sure Lock flush mounted latches, eliminating the unwanted opening of doors during transit. Plastic door latches shall be deemed not acceptable.

Cabinets installed directly on the floor surface shall be deemednon acceptable due to lack of protection from potential long term water damage. Cabinets installed with no protective aluminum liner for exposed surfaces or no 3 inch aluminum kick plate on the base shall be deemed not acceptable, due to lack of protection form potential long term impact damage.

The Control Room floor shall be constructed of a ¾" AC exterior rated plywood substrate with built in water relief channels to prevent moisture gathering under the floor, thus minimizing potential long term water damage. The plywood substrate shall be covered with an industrial rated Armstrong Crosswalk floor. The Control Room walls and ceiling will be covered with a gray laminate surface.

A built in ergonomic control console with a smooth 45 degree contour shall be constructed to bring all controls within a comfortable reach of the operator. The console shall be positioned so the operator can see the Equipment Room area through a clear Plexiglas panel in the bulkhead. The console shall be equipped with 19 inch rack mounts for the electronic components and an angular panel for remote equipment controllers. Locations in the angular panel shall be provided for the Pan and Tilt Camera Controller, TV Reel Motor / Power Winch Controller, and the Self Propelled Camera Transporter Controller. The exact controllers furnished will be indicated on the component list. The contoured control console shall include a counter top covered with industrial grade Formica, and will include a storage compartment under the counter top with sliding doors. The top of the contoured control console shall be open to accommodate additional storage.

A padded bench / storage seat with seating for 2 persons and a removable top to facilitate storage shall be installed, along with a 16" W X 14" D X 71" H closet cabinet. There shall be a 24" wide X 72" high opening with a swing out door between the viewing room and cab to facilitate a walk through passage way. A swing out door will be installed between the viewing room and the Equipment Room.

A 24" , 110 VAC fluorescent light and single duplex grounded interior duplex electrical outlet shall be supplied in the Control Room.

A wall mounted, electric heater shall be supplied in viewing room.

EQUIPMENT/ STORAGE ROOM

The Equipment/Storage Room will be located in the rear of the van. The floor shall be constructed of 2 X 6 pine planks, water sealed and covered with extruded aluminum flooring with non-skid strips. The floor shall be flat without protruding wheel wells. Side walls shall be constructed of 3/8" exterior plywood covered with Kemlite laminate.

The ceiling shall be 1/4" exterior plywood covered with a Kemlite laminate. The electrical system shall be designed to fully meet the environmental, safety, and electrical requirements of the vehicle as specified.

A 24", 110 VAC fluorescent light and a 12 VDC cargo bay light will be installed in the Equipment Room. All Equipment Room electrical boxes, outlets, and wiring conduit will be UL approved for exterior use in a wet environment. No exposed wiring will be acceptable. All electrical wiring shall be in accordance with applicable electrical codes including NEC.

A wall mounted, electric heater shall be supplied in equipment room.

GASOLINE GENERATOR W/ELECTRIC START - 6000 WATT

A generator shall be mounted in an enclosed cabinet with a fire retardant liner, locking vented door with a recessed stainless steel lock, and spark free exhaust system. The Generator shall be mounted on a slide out rail assembly to facilitate service and inspection.

A 30 amp external shore power receptacle shall be provided. Shore power to generator switchover shall be accomplish through a UL approved automatic changeover switch with suitable time delay to avoid damaging power surges. A 25 foot, 30 A shore power extension cable shall be supplied.

The power source for the system will be a 6000 watt commercial grade alternating current gasoline powered generator. It shall be the product of a firm regularly engaged in the manufacture of gasoline powered generators. The commercial grade generator shall be designed for commercial mobile applications capable of handling the load of intermittent heavy duty use for utility trucks, mobile communications, electronics test

vehicles, mobile service and repair vehicles, emergency vehicles andsewerline television inspection units. The generator shall be capable of continuously producing 6000 watts of power (50.0 amps) at 120 volts AC while rotating at 3600 RPM without undue heating, wear or vibration. The engine shall be a liquid cooled4 cycle/two cylinder unit developing at least 12.2 hp. It shall be designed to operate the generator at 60 cycles + or - 2cps and shall be governor controlled to maintain these cycles under varying load conditions. The engine shall be equipped with an electrical starting device for local and remote start/stop, electrical fuel pump and low oil pressure shutdown. The entire assembly shall be furnished with vibration isolators and aheavy duty industrial muffler to insure quiet operation.

SYSTEM ENGINEERING PANEL

The engineering panel shall provide monitoring of the power supply to the system. The panel circuitry shall be assembled in a rack mounted chassis for installation in a built in control console. Theface plate shall be heavy gauge aluminum finished with an industrial grade surface and shall have permanent labels designating the function of the various switches and controls.

Provisions shall be made on the panel for the following items:

AC Volt Readout
AC Frequency Readout (58-62 Hertz)
Generator Remote Start/Stop
Generator Run Time Readout

COLOR INDUSTRIAL MONITOR - NTSC 14"

The television viewing monitor shall be a high quality, industrial grade color unit providing a minimum of 450 lines of horizontal resolution. Scanning shall be 525 lines, 60 fields, 30 frames, interlaces 2:1 NTSC color Standard. All circuits shall be of a solid state design with the exception of the picture tube. The picture shall measure a minimum of 14" diagonally. The monitor shall be housed in a metalcabinet which acts as a shield to minimize the effects of local magnetic fields such as transformers, coils, wraps or cable, etc. MONITORS HOUSED IN PLASTIC CABINETS THAT HAVE INADEQUATE OR NO PROTECTION FROM LOCAL MAGNETIC FIELDS, THEREBY CONTRIBUTING TO A LOSS OF PURITY IN THE COLOR PICTURE, WILL BE DEEMED NOT ACCEPTABLE. The monitor will be equipped with a speaker to allow for audio playback from a video tape recording. The monitor shall be fitted with a rack mount for installation into a control console. Standard color monitor controls shall be provided and permanently labeled as to function.

SOLID STATE COLOR SEWER TELEVISION CAMERA - MULTI CONDUCTOR

The multi conductor color sewer television camera shall be specifically designed for operation through a minimum of 2000 feet of multi conductor cable in sanitary and storm sewers. The camera shall be designed for high vibration and impact service. Chassis construction shall include 100% solid state circuitry designed to withstand shocks and vibrations normally sustained while being pulled through a pipe. The camera module shall be an industrial model only. REPACKAGED CONSUMER GRADE CAMERAS (I.E. CAMCORDERS) WILL BE DEEMED UNACCEPTABLE FOR USE IN A PIPELINE TELEVISION INSPECTION SYSTEM. The image pick-up device shall be solid state incorporating the latest technology. The camera outside diameter shall be no greater than 3 inches to allow for inspection in small size pipes. Operating temperature ranges of the camera shall be 0 degrees C to 65 degrees C. CAMERAS THAT INCLUDE BUILT IN LIGHTS THAT ALLOW THE CAMERA HOUSING TO HEAT UP BEYOND 50° C WILL NOT BE ACCEPTABLE.

SOLID STATE COLOR CAMERA REQUIREMENTS - MULTI CONDUCTOR

The camera shall be capable of providing a minimum of 460 lines of horizontal resolution and 400 lines of vertical resolution. The image pick-up device will contain in excess of 379,000 picture elements (pixels). Scanning shall be 525 lines, 60 fields, 30 frames, interlaces 2:1 - NTSC Color Standard. The camera shall develop a true color and transmit a sharp image picture on video bandwidths only. Picture transmission systems that require the use of R.F. suppressers and are subject to local transmitter interference shall not qualify as being equal. Full color video bandwidths shall be provided with no sacrifice of low frequency response. There shall be no visible streaking of the low frequency test bars when viewing a standard EIA Test Chart. The composite video signal derived from the video camera shall be 1.0V (140 IRE Units) at the monitor after transmission through 1000' of multi conductor cable. The camera shall be equipped with an automatic iris to control the illumination range for an acceptable picture between 3 and 100,000Lux. THERE SHALL BE NO GEOMETRICAL DISTORTION OF THE IMAGE.

CAMERA OPTICAL LENS - REMOTE CONTROLLED

The camera shall be equipped with a standard C Mount 6MM, F1.2 wide angle lens with an optical viewing angle to 70 degrees. The lens shall be an auto iris type with a manual override remotely controlled from the viewing station.

COLOR CHIP INSPECTION CAMERA - MULTI CONDUCTOR - MINIMUM TECHNICAL SPECIFICATIONS

Features:

1. Remote controlled focus and iris
2. Automatic white balance
3. Low lag and high resistance to image burn-in
4. High resistance to vibration or mechanical shock
5. Precise image geometry and long life
6. Excellent color rendition and low light sensitivity
7. Image pickup device (CCD)

Electrical Specifications:

Image pick-up device	Interline transfer 1/2 inch CCD color
Picture elements (pixels)	768 (H)x494 (V)=379,392 elements
Sensing area	6.35mm x 4.83mm(same as 1/2 inch camera tube)
System standard	NTSC color 525 lines, 60 fields/second
Supplied lens	6mm (F1.2) with auto iris with manual override
Lens mount	Standard "C" mount 1"x32 threads
Horizontal resolution	460 lines
Vertical resolution	400 lines
S/N ratio	48db

Minimum illumination	3 lux (F1.2)
Illumination range	3-10,000 lux (1-1,000 ft.candles)
Color temperature	Auto: 2100 degrees K - 10,000 degrees K
Power requirement	Multi conductor 12V .5 amp 6 watts DC Video output 1.0 volt p-p 75 OHMS
Vibration	7G (11 Hz to 200 Hz)

CAMERA PROTECTIVE HOUSING

The camera shall be housed in a high strength, stainless steel tube no more than 3 inches in diameter and 22 inches in length. The housing shall be 1/8" minimum thickness. Thinner walled stainless steel housings that easily dent on impact will not be considered equal. The front of the housing shall have aviewport of distortion free quality quartz glass. The rear of the housing shall have a recessed bell to protect the 3 pin indexed cable connector. There shall be no external mechanical adjustment ports in the housing.

SOLID STATE COLOR CAMERA CONTROL CIRCUITRY

The color camera shall be equipped with the necessary circuitry to allow for the remote adjustment of the optical focus and automatic iris from the power control unit at the viewing station. COLOR CAMERAS THAT REQUIRE MANUAL EXTERNAL FOCUS OR IRIS ADJUSTMENTS SHALL BE DEEMED NOT ACCEPTABLE. The camera shall be equipped with the necessary circuitry to automatically white balance the color picture to the light source within a range of 2200 to 3200 degrees K.

PAN & TILT SOLID STATE MULTI CONDUCTOR COLOR CAMERA

The Pan & Tilt Camera will be specifically designed to provide a close up view of the sewer pipe walls, lateral openings and discharges through the panning and rotation of the camera head. The camera will be designed so that the pan motion begins on a side to side basis, rather than up and down, before rotating. This will speed inspection of lateral connections since most are side entry type. Chassis construction shall include 100% solid state circuitry designed to withstand shocks and vibration normally sustained while being pulled through a pipe. The image pickup device shall be solid state CCD type incorporating the latest technology. Operating temperature ranges of the camera shall be 0 degrees C to 65 degrees C. CAMERAS INCORPORATING BUILT IN LIGHTING SYSTEMS THAT GENERATE HEAT EXCEEDING THE OPERATING TEMPERATURE PARAMETERS LISTED BY THE BASE STOCK CAMERA MANUFACTURER WILL NOT BE ACCEPTABLE.

PAN & TILT SOLID STATE MULTI CONDUCTOR COLOR CAMERA REQUIREMENTS

The camera shall be capable of providing 460 lines of horizontal resolution and 400 lines of vertical resolution. The image pick-up device will contain in excess of 379,000 picture elements (pixels). Thehigh resolution image sensor will not burn even when pointed at direct sunlight. Scanning shall be 525 lines, 60 fields,30 frames, interlaces 2:1- NTSC color standard. The composite video signal derived from the video camera shall be 1.0V (140 IRE Units) at the monitor after transmission through 2000' of twelve conductor cable. The lens shall be an automatic iris type with a manual override (controlled from the control console) to control the illumination range for an acceptable picture between 3 and 100,000 lux. There shall be no geometrical distortion of the image.

PAN & TILT SOLID STATE MULTI CONDUCTOR COLOR CAMERA TECHNICAL SPECIFICATIONS

Features:

1. Remote controlled focus and Iris
2. Automatic white balance
3. Image pickup device (CCD) that has a lower random noise feature in comparison with other devices (i.e. MOS or CID)
4. Rotation 360°
5. Mechanical Pan (Tilt) 275°
6. Optical Pan (Tilt) 330°
7. Auto Centering

Electrical Specifications:

Internal Lights	6 Bulbs - Xenon filled
Image pick-up device	Interline transfer 1/2 inch CCD color
Picture elements(pixels)	768 (H)x492 (V)=379,392 elements
Sensing area	6.35mm
System standard	NTSC color 525 lines, 60 fields/second
Supplied lens	7.5mm (F1.4) with auto iris
Resolution Lines	460 Horizontal/400 Vertical
S/N ratio	48db
Minimum illumination	3 Lux(F1.2)
Illumination Range	3 - 10,000 Lux 1-1,000 Ft Candles
Color temperature	Auto: 2100 degrees K - 10,000 degrees K
Video output	1.0 volt p-p 75 OHMS
Vibration	7G
Shock	70G
Geometric distortion	None

PAN & TILT SOLID STATE MULTI CONDUCTOR COLOR CAMERA CONTROLLER

The panning and rotational camera head shall be remotely controlled from the control console. The controller shall be designed for mounting in a stand alone angular panel. The controller shall be equipped with a joystick to pan the head and rotate the lens to allow viewing around the barrel of the pipe. The controller shall be equipped with a remote focus switch for a quick close-up view of defects in the pipe. The controller shall be equipped with an automatic iris override that allows the operator to override the camera's automatic light compensating circuitry operating range to compensate for various light reflective conditions within the pipe. An automatic centering switch shall be provided to allow auto repositioning of the camera field of vision to the0 degree X-Y axis position. **Cameras not capable of remote automatic centering shall not be deemed acceptable.**

PAN & TILT SOLID STATE MULTI CONDUCTOR COLOR CAMERA PROTECTIVE HOUSING

The camera shall be housed in a high strength, damage resistant stainless tube. The rear portion of the camera shall not exceed 3 inches in diameter. The forward portion of the camera shall not exceed 4 inches in diameter and will include the camera head mounting fork, camera head and lighting. The housing shall be 1/8" minimum wall thickness. THINNER WALLED STAINLESS STEEL HOUSINGS THAT EASILY DENT ON IMPACT SHALL NOT BE ACCEPTABLE. The front of the camera head housing shall have a view port of distortion free, heat resistant glass. The rear of the housing shall have a recessed bell to protect the 5 pin indexed cable connector. A "Y" Eliminator cable will be provided to connect a lighthead for large pipe lighting.

PAN & TILT SOLID STATE MULTI CONDUCTOR COLOR CAMERA LIGHTING

The camera head shall include two banks of lights, 18 watts per bank, for a total of 36 watts. An external lighthead can be added for large pipe inspection (18" - 30") if it is required.

PIPE GRADE VERIFICATION SYSTEM (INCLINOMETER)

The system shall be supplied with a pipe grade verification system to detect and record variations in pipe angle from true horizontal. The inclinometer shall be able to read and transmit pipe grade variations from ± 15 degrees from horizontal (± 27% grade) with a maximum error of ± 0.1 degree. The data shall be able to be displayed in a numerical or graphical format which may be printed or exported to an external database. The inclinometer shall include a vertical sensing, single axis, precision sensor mounted internally to the camera. **Inclinometers with external electronic modules towed behind the camera, prone to getting hung on offsets or protruding services will be deemed unacceptable.**

CAMERA POWER CONTROL UNIT - MULTI CONDUCTOR

The power control unit shall provide all the necessary power and controls to operate and monitor the television inspection system. All circuits shall be of solid state design, assembled in a rack mounted chassis for installation in a built in control console. The faceplate shall be heavy gauge aluminum finished with an industrial grade finish and shall have permanent labels designating the function or purpose of the various switches, readouts and controls. The PCU shall have a back plate for all cable connectors each separately indexed and locking, and labeled as to purpose. Each camera system shall be equipped with a test cable to allow for the direct by-pass of slip rings, TV cable and any applicable connectors for testing purposes.

POWER CONTROL UNIT MINIMUM TECHNICAL REQUIREMENTS

The power control unit shall operate off of 120 volts AC current. The PCU shall contain a solid statelighthead power source whose input shall be throughan isolation, variable voltage transformer and whose output shall be from 0 volts to 120 volts DC. A light intensity adjustment control and DC volt readout shall be provided on the front panel. Input and output of both the camera and lighthead power shall be protected by circuit breakers with indicators to identify open circuits. Circuits shall be isolated to provide operator protection from electrical shock hazards.

POWER CONTROL UNIT REMOTE CAMERA ADJUSTMENT

The power control unit will be equipped with the following remote camera adjustments:

Focus Control

A two pole switch spring loaded to off, permits the operator to adjust the camera focus for changes in pipe diameter or different views of defect conditions. In the neutral position, the camera focus will be electronically locked.

Automatic Iris Control

This control allows the operator to override the camera's automatic light compensatingcircuitry operating range in the event an excess of light or lack of light produces a poor picture response. With the proper adjustment, the operator can change the iris opening to compensate for the light level available thereby improving the picture response.

SYSTEMS REQUIRING MANUAL EXTERNAL CAMERA SETTINGS OR THE REMOVAL OF THE CAMERA FROM THE SEALED HOUSING IN THE FIELD TO MAKE THESE ADJUSTMENTS, SHALL BE DEEMED NOT ACCEPTABLE.

PIPELINE DATA COLLECTION & PICTURE CAPTURE SYSTEM (PDC&PCS)

A Pipeline Data Collection & Picture Capture System shall be provided. The system shall be a rugged rack mounted video titling/data acquisition system which has the capability of digitizing and storing single frames of video images live video "mini-movies" as well as collecting, storing and printing pipe line inspection data for display and report generation.

The included software package shall be a 32 bit Windows 95/NT application and shall be fully Object Oriented. It shall be capable of printing pipeline inspection reports with captured images of defects or other related significant visual information on a standard inkjet color printer located in the inspection truck. The software shall have the following features:

Image Capture - Selected digitized picture images shall be stored on the system controller's hard disk drive. The picture files shall be exportable to Industry Standard Formats to include JPEG, BMP, TIFF, formats and are transferable by disk to an external personal computer utilizing standard viewers and printers. Any captured image shall be able to be printed on the ink jet color printer in the inspection truck. Picture files will be stored and exported with inspection data.

Video Capture – Selected live video sequences shall be captured and stored on the system controller's hard disk drive. The compressed video files shall be stored in industry standard AVI format and are transferable by disk to an external personal computer utilizing standard viewers. System shall capture at least 5 seconds of live video per observation, if desired. Video files shall be stored and exported with the inspection data.

Data Base - The system software shall be an MS Windows 95 based data acquisition system incorporating an ODBC windows standard data base format. Inspection files shall be able to be exported into other databases and other computers. Information on software file headers format shall be provided to allow the inspection database to be customized with the correct headers into the users unique application or software. There shall be an option to allow pressure display. The user selectable defect codes shall include standard defect codes and user defined codes. There shall be user selectable defect severity codes to include standard codes and user defined codes. All graphic and tabular reports shall be in color to match the defect severity codes. There shall be graphic and tabular reports to include graphic of pipe showing all observation points and pertinent data, and pipe inclination data in an intuitive graphic format.

Data Sorting - The program shall be capable of sorting all data stored using generic sort key and user defined sort fields.

Titler - The keyboard, mouse, and footage counter shall provide the interfaces to the Video Character Generator and PDC&PCS controller's Windows program. Camera footage shall be maintained in real time and shall be displayed on the video monitor as well as the video character generators illuminated footage display at the control console. All other information for titling shall be sent to the character generator by a serial communication port connection from the system controller.

Printer - The desk top, color Ink Jet Printer shall interface with the controller parallel printer port. It shall be capable of reproducing color video captured pictures or color inspection reports without the need to change ink cartridges. Printer resolution shall be a minimum of 600x300 dpi color. Memory shall be a minimum of 512K

Support – Manufacturer to have full time, in-house support staff for both hardware and software. Suppliers having third party suppliers of software, thus requiring customer to contact third party for warranty and support services *shall be deemed unacceptable*.

System shall have the capability of being customized to meet local area requirements and regulations as necessary. These available changes shall encompass variations of the operation layout and functions and printed reports.

The system shall consist of the following minimum equipment:

- 19" rack mountable video character generator & Titler
- 19" rack mountable controller
- Genuine Intel Pentium (P5) Processor - 350 MHz (Megahertz) MMX, Minimum
- 64 MB (Megabytes) of SDRAM (Synchronous Dynamic Random Access Memory) DIMM, 10ns (nanoseconds) speed - Minimum
- 3 ½ inch 1.44 MB High Density FDD (Floppy Disk Drive)
- Industrial Hardened Case with air filtering
- Video capturing board
- 4 Mb Video Card
- 101 key enhanced Heavy Duty keyboard
- Logitech PS/2 mouse
- SVGA Multimedia Monitor w/ Speakers 17"
- 4.0 GB (Gigabyte) ULTRA WIDE SCSI (Small Computer System Interface) HDD (Hard Disk Drive), 8ms (millisecond access time)
- 24x CD-ROM IDE Drive
- Iomega Jazz Drive, SCSI, 2 GB
- Adaptec SCSI controller
- Desk top Color Ink Jet Printer, 600x300 dpi, 512K

Software for controller:
MS Windows 95
DataCap Version 3.0

VIDEO CASSETTE RECORDING SYSTEM

A video cassette recording system shall be provided to permanently record on video tape any transmission from the closed circuit television camera. The recorder shall have four video heads. It shall have a minimum recording time of 120 minutes and shall use 1/2" wide tape contained in a cassette. The recorder shall be capable of providing black and white or color tapes. The video recorder shall reproduce in all the following operating modes: 60 cycles field frequency, random sync, 2 to 1 industrial sync, EIA sync and NTSC color. It

shall be equipped with an audio channel for narration of the recorded video. Both video and audio signals may be recorded at the same time.

The video cassette recorder shall be rack mounted in the Control Console. Desk mounted recorders that are subject to damage during travel will not be acceptable. Theface plate will allow for complete access to the tray controls and the cassette deck for cassette replacement. Recorders that must be removed from the rack mount to replace cassettes will be deemed not acceptable. A microphone with amplifier for adding audio to thevideo tapes shall be provided.

Video Head	Four (4)
Standard	VHS NTSC
Tracking	Automatic microprocessor control
Playback Speeds	Five (5)
Horizontal Resolution	240 lines
Speeds	Three (3) SP, LP, EP
Audio Frequency	70 Hz to 10,000 Hz
S/N Ratio	>45 db

TV CABLE REEL ASSEMBLY

A TV cable reel assembly will be supplied with a minimum storage capacity for 1000' 5/8" or 2000' 1/4" diameter video transmission cable. The reel shall be chain driven and properly reinforced to withstand 200% of the maximum motor torque to insure trouble-free operation. The reel shall be powered by a variable speed electric motor and driven through a multi-gear ratio transmission. The transmission will have multiple speeds to limit the motor load during varying towing conditions. The reel shall be equipped with an automatic level wind assembly to evenly pay out or rewind the cable to prevent pile-ups, entanglements and burying. The reel shall be built into a rugged frame designed for fixed mounting into a unit. The reel drum and level wind shall be open to view to allow for inspection during operation. TV REEL SYSTEMS THAT ARE NOT CONTROLLED REMOTELY OR DO NOT HAVE A MULTI RATIO TRANSMISSION WILL NOT BE ACCEPTABLE.

TV CABLE REEL SLIP RING ASSEMBLY

The reel shall be equipped with a continuous contact rotary slip ring assembly. The assembly will be equipped with a minimum of twelve (12) slip rings to conduct the necessary current and signals through the reel. SLIP RING ASSEMBLIES WITH FEWER THAN TWELVE (12) RINGS WILL NOT BE ACCEPTABLE. The slip ring assembly shall be fully enclosed in a dust and weatherproof high strength aluminum housing. Systems equipped with the high maintenance copper slip ring assemblies shall not be considered acceptable. Mercury Slip Rings shall not be considered acceptable.

CABLE FOOTAGE METER, LOCAL MECH./REMOTE ELECTRONIC READOUT

The unit shall be equipped with a distance counting meter designed to accurately measure cable travel in feet and tenths of feet. The metering head shall be constructed of machined cast aluminum parts and shall include the necessary sheaves, wheels and guides. The meter shall be equipped withan LCD for use at the rear of the unit and an electronic counter which is connected to the Data Display System at the operator's station.

CONTROLLER TV CABLE REEL MOTOR/POWER WINCH MOTOR

A single combined controller will be furnished to operate either the TV Cable Reel Motor or Power Winch Motor if supplied. It will be designed for mounting at the control console in an angular panel. The controller shall be equipped with an ON/OFF switch, an ON indicator light, clutch control (forward/reverse switch) and speed

control with built in automatic off positioning for safety when the operator releases the speed control. CONTROLLERS THAT DO NOT INCLUDE A SAFETY OFF SWITCH WILL NOT BE ACCEPTABLE.

TV CABLE REEL CONTROL REMOTE AND LOCAL

A gear shift selector and linkage shall be provided at the control console to operate the reel mounted transmission. The combination of the reel motor controller and transmission gear shift selector will maximize the efficiency of the television inspection operation and minimize the load on the reel and motor. A speed controller, gear shift selector and on/off switch shall be provided at the reel for local control during set up.

COMBINATION VIDEO TRANSMISSION/TOW CABLE, DOUBLE KEVLAR FIBER ARMORED, NYLON JACKETED - MULTI-CONDUCTOR

A combined video and towing cable shall be furnished in a continuous length of not less than 1000 feet. The cable shall consist of a coaxial center core wrapped with a wire mesh ground return. An additional wire mesh shall encircle both the coax and ground return and shall act as a Faraday shield. **Cables with only a single wire mesh acting as a ground return shall be deemed unacceptable.** A grouping of not less than 10 separately insulated and color coded standard copper conductors shall form a perfectly round lay pattern around the core. A mesh wrap of Kevlar fibers shall encircle the complete conductor grouping to provide the cable with the required towing tensile strength. An additional mesh wrap ofKevlar fibers shall encircle only the center coax to provide additional tensile strength to the video conductor. **Cables without a mesh wrap of Kevlar fibers around the coax only shall be deemed unacceptable.** The exterior of the cable shall consist of a minimum 1/16" thick abrasion resistant high density Nylon composite (Rilsan) outer jacket. **Cable jackets not manufactured with a nylon outer covering shall be deemed unacceptable.** The cable shall have a minimum break strength of 2000 lbs., shall be not more than .405 inches in diameter and withstand external pressures of up to 400 psi. **The cable weight shall not exceed 110 lbs. per 1000 feet.**

CABLE TERMINAL CONNECTION KEVLAR FIBER ARMORED - MULTI-CONDUCTOR

The end of the multi-conductor cable shall be equipped with ascotchcast splice chamber to allow for the direct wiring of the female connectors. An adjustable strain relief shall be provided to transfer the cable towing strength from the cable to the camera skids or transporter. The terminal connection shall consist of the necessary connectors and dummy plugs.

LOW PROFILE HIGH PERFORMANCE, SMALL PIPE LIGHTHEAD

A specially designed low profile high performance lighthead will be furnished to provide the proper illumination to inspect a minimum of 6 inch diameter pipe. The lighthead shall add no more than 1 inch to the diameter of a 3 inch sewerline camera.

The Low Profile Lighthead shall include a yoke that contains 3 light cartridges, connecting cable assembly and a maintenance kit. The entire lighthead will be constructed of aluminum with a hard anodized coating that will be scratch resistant and retard wear. LIGHTHEADS CONSTRUCTED OF RAW ALUMINUM OR WITH A SOFT ANNODIZED SURFACE WILL NOT BE ACCEPTABLE

The yoke assembly will be equipped with two Teflon standoff rods to minimize heat transfer from thelighthead to the camera case. BUILT IN OR EXTERNAL LIGHTHEADS THAT ALLOW HEAT TO BUILD UP INSIDE THE SEWERLINE CAMERA (AFFECTING PERFORMANCE) THAT EXCEEDS THE MAXIMUM OPERATING TEMPERATURE RECOMMENDED BY THE TV CAMERA MANUFACTURER WILL NOT BE ACCEPTABLE. The yoke will be equipped with a stainless steel retaining clamp for easy mounting.

Each light cartridge shall include an aluminum body, 2 pin insert molded connector, 20 watt/24 volt quartz halogen lightbulb with a polished optical reflector and a screw on O-ring sealed retainer. Each retainer shall be equipped with a Lenticuled Diffuser lens. The specially manufactured optical reflector focuses the light output of each bulb to the center point of the diffuser lens. The diffuser lens will be manufactured of Pyrex glass that is high heat, chemical and thermal shock resistant.

The combination of the polished optical reflector and Lenticuled lens will provide maximum light distribution to the pipe walls for use with a Radial View Style Camera.

A special 3 way cable assembly with insert molded connectors will be furnished to connect the lighthead assembly to the main cable connector. All male and female connections will be the water tight snap on type. SCREW ON BENDIX TYPE CONNECTORS WILL NOT BE ACCEPTABLE

The entire lighthead assembly shall be designed for easy servicing and bulb replacement in the field without removing the lighthead from the camera. The complete individual lighthead cartridges shall be fully replaceable in minutes by loosening a set screw and the connector. The lightbulb shall easily be replaced by unscrewing the retainer from the body. The retainer shall be grooved for a firm grip. The light cartridge body will be equipped with a heat resistant silicone O-ring to achieve a water tight condition when the retainer is replaced. LIGHTHEADS CONSTRUCTED WITHOUT O-RING SEALS SUBJECT TO LEAKAGE WILL NOT BE ACCEPTABLE.

Each lighthead will be furnished with it's own maintenance kit. The kit will consist of a schematic, operating and maintenance instruction sheet, a tube of O-ring lubricant and a thread cleaning brush.

HIGH PERFORMANCE INTERMEDIATE PIPE SIZE LIGHTHEAD

A high performance lighthead shall be furnished to provide the proper illumination for inspecting lines ranging from 8" to 36" diameters.

The High Performance Lighthead shall include a lamp holder yoke, 2 light cartridges, connecting cable assembly and a maintenance kit. The entire lighthead shall be constructed of aluminum with a hard anodized coating that shall be scratch resistant and retard wear. LIGHTHEADS CONSTRUCTED OF RAW ALUMINUM OR WITH A SOFT ANNODIZED SURFACE SHALL NOT BE ACCEPTABLE.

The yoke assembly shall be equipped with two Teflon standoff rods to minimize heat transfer from the lighthead to the camera case. BUILT IN OR EXTERNAL LIGHTHEADS THAT ALLOW HEAT TO BUILD UP INSIDE THE SEWERLINE CAMERA (AFFECTING PERFORMANCE) THAT EXCEEDS THE MAXIMUM OPERATING TEMPERATURE RECOMMENDED BY THE TV CAMERA MANUFACTURER SHALL NOT BE ACCEPTABLE. The yoke shall be equipped with a stainless steel retaining clamp for easy mounting.

Each light cartridge shall include an aluminum body, 2 pin insert molded connector, 85 watt/82 volt quartz halogen lightbulb with a polished optical reflector and a screw on O-ring sealed retainer. The lens shall be manufactured of Pyrex glass that is high heat, chemical and thermal shock resistant.

A special 2 way cable assembly with insert molded connectors shall be furnished to connect the lighthead assembly to the main cable connector. All male and female connections shall be the water tight snap on type.

The entire lighthead assembly shall be designed for easy servicing and bulb replacement in the field without removing the lighthead from the camera. The complete individual lighthead cartridges shall be fully replaceable in minutes by loosening a set screw and the connector. The lightbulb shall easily be replaced by unscrewing the retainer from the body. The retainer shall be grooved for a firm grip. The light cartridge body shall be equipped with a heat resistant silicone O-ring to achieve a water tight condition when the retainer is replaced.

LIGHTHEADS CONSTRUCTED WITHOUT O-RING SEALS SUBJECT TO LEAKAGE SHALL NOT BE ACCEPTABLE.

CAMERA TRANSPORTATION SKIDS 8-15" PIPE SIZES

A transportation skid assembly shall be supplied to provide protection for the camera andlighthead from in-line obstructions. A cast aluminum yoke with an inside lining of high friction cushion material shall firmly grip the camera while providing maximum protection to the camera and its case. Spacer plates shall be provided to attach the bottom skid runners to the yoke. The camera skid assembly shall be adjustable to inspect line sizes from 8" to 15" by substituting spacer plates. This adjustment shall be made without removal of the camera from the yoke assembly. Two corrosion resistant stainless steel skid runners shall be provided to tow the camera through the line. The runner ends shall be bent upward to provide a natural lift when encountering pipe offsets and small obstructions. The runner ends shall bemachine slotted to insert the ball ends of the camera tow and tag cables. Three corrosion resistant stainless steel skid guards shall attach to the yoke to protect thelighthead in the event the camera should be turned over in the line. The skid runners and guards shall be machined to a round and smooth contour to minimize fouling from debris in the sewer lines.

REMOTE ELECTRIC POWER WINCH

An electric power winch assembly shall be supplied to retrieve ortow from a remote manhole. The winch frame shall be of cast aluminum construction and equipped with dolly wheels and large handles at the frame ends for easy movements.

The winch drum shall contain 1000' of 3/16" mullet-strand stainless steel cable. A cast aluminum pulley shall guide the cable into the manhole. The winch will be powered by a 1/2 HPheavy duty electric power drive with variable speed and directional control. The winch will incorporate a rotary clutch for towing or disengaging from the operators control position. An adjustable tension spring loaded brake shall prevent entanglement during cable pay out. A shear pin shall be incorporated to prevent winch tow loads greater than the safe tow load of the cable.

A hand held remote control shall be provided for remote operation at the power winch. Control functions shall included forward, reverse, speed (variable). The operator control position shall be the master control position.

ELECTRIC WINCH POWER CABLE

Power to the winch shall be furnished through 1,000 feet of 14/4 SJO gauge power cord. For ease of handling the power cord will be supplied in two (2) 500 foot lengths installed on individual heavy duty cast aluminum reels. A separate 20 foot power cord will be supplied for connection to the power winch.

CAMERA TRANSPORTER (6" to 15" lines)

A self-propelled camera transporter with sufficient power and traction shall be provided. The transport assembly including specified camera will facilitate the remote inspection of lines ranging from 6" to 15" including offsets and protrusions.

Weighted track width adjustment bars shall be provided for operation in pipes ranging from 6" through 15" diameter. The weighted width adjustment bars shall automatically position the camera and lighting system to the centerline of the pipe being inspected. The transporter weights (not including camera) shall increase for each pipe size as follows:

6" - 26#
8" - 28#
10" - 32#
12" - 36#
15" - 38#

The transporter shall incorporate a dual fastener, rubber cleat, track drive system designed to match the contour of the pipe regardless of pipe size. Self cleaning, agricultural type, steel sprockets shall be provided to prevent chain binding. The drive motor shall be heavy duty and specifically designed to meet the power requirements of the system, regardless of size of pipe being inspected. A desktop transporter controller shall be provided. The controller will include the following indications and controls:

- Speed control.
- Forward, reverse, and free wheel control.
- Fused power on/off switch (with indicator).
- Fuse socket.
- Amp meter.

The transporter shall be capable of operating in power forward, power reverse, and free wheel. The transporter shall be retrieved in the free wheel mode by the video cable reel. This will reduce the normal wear on the drive motor and drive train by 50%. **Powered reverse only transporters, which have the potential of running over the cable termination during retrieval operation, thus requiring the operator to coordinate the speed of the transporter with the speed of the video cable reel will be deemed unacceptable. However, powered reverse shall be supplied to facilitate precise inspections and backing out of dropped manholes.**

The transporter, when used with the pan & tilt camera, shall have a minimum of 1" top clearance, 1" bottom clearance, and 5/8" clearance on both sides in a 6" pipe. All transporter / pan & tilt combinations with less clearance than specified will be deemed unacceptable. The combined length of the transporter /pan & tilt camera assembly shall not exceed 31" with the camera in the home position. This will allow the inspection and traversing of 6" diameter off set, meandering, or relined pipe; it will also facilitate entry into short inverts. Camera/transporter assemblies exceeding 31" in length will be deemed unacceptable.

Multi-Grout Chemical Low Viscosity Pumping System

A multi-grout chemical pumping system shall be provided which has the capability of placingtwo part gel type sealant to a leaking joint at the required pressure to assure proper joint sealing. Low viscosity sealant shall be dispensed at a rate of up to 10 g.p.m.

The dual chemical pump unit shall deliver the chemicals in a 1:1 ratio. All wetted pump parts shall be constructed of stainless steel for corrosion resistance and longer life. All chemical hoses, connecting to the pump, shall be equipped with quick disconnect fittings.

The dual pumps shall be operated by a single air drive motor to assure a fixed delivery of the each chemical with each pump stroke. The pump speed (strokes per minute) shall be variable according to applied air pressure. A stroke counter, with remote readout, shall be included for measurement of the volume of mixed chemicals pumped. The air delivery pumping system shall incorporate an over pressure relief valve for safe operation of the system

CHEMICAL TANK ASSEMBLY

The sealing system shall be supplied with two separate chemical mixing and storage tanks constructed of a

heavy duty non corrosive material. Each tank shall be individually color coded to prevent cross mixing of chemicals. The capacity of each tank shall be not less than 30 gallons. Each tank shall be equipped with a hinged cover and visible level indication.

CHEMICAL HOSE REEL ASSEMBLY

An electric powered hose reel assembly will be supplied with a storage and operational capacity to accommodate a minimum of 500 feet of quad seal hose. An electric motor with chain driven gearbox of sufficient size and power shall be provided that is capable of retracting the chemical filled quad hose when fully extended (500').

The air and chemical hoses shall be connected through specially designed stainless steel rotary couplings to allow for continuous operation without disconnection. A remote dump valve will be attached to the air coupling for the quick deflation of the packer assembly. The hose reel assembly shall be supplied with a metal drip tray to catch run off or spills.

QUAD LINE CHEMICAL/AIR HOSE

The System shall be supplied with 500' of quad line sealing hose having a minimum burst pressure of 500psi. The hose shall consist of two 5/8" ID flow lines for passage of chemicals, one 3/8 ID line for packer inflation, and one 3/8" ID line for air or water testing of a joint. One chemical flow lines shall include afull moisture proof inner liner.

Each hose shall be equipped with a stainless steel quick disconnect fitting notched with a locking ring. Each chemical flow line shall be equipped with a stainless steel check valve assembly to prevent chemical back flow. A stainless steel H-block assembly shall be provided. The H-block shall contain a void sensing pressure transducer, a check valve and a mainline electronic cable connection to relay pressure data to the control panel. Systems that do not locate the pressure transducer at the packer assembly shall be deemed unacceptable.

Chemical Handling/Safety Package

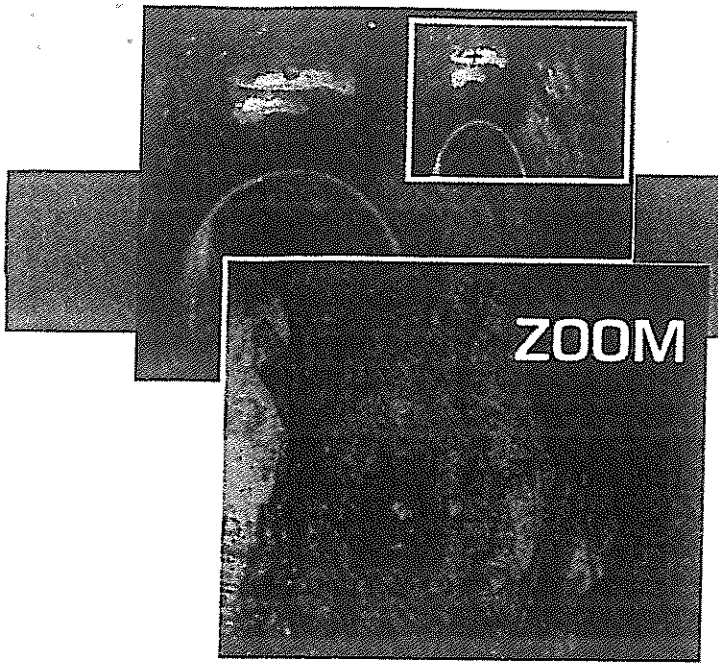
The system shall be supplied with a chemical handling and safetypackage which shall include as a minimum the following articles.

2 each chemical mixing paddles
1 each chemical scoop
1 each chemical measuring cup (plastic)
1 each safety goggles
1 each work gloves
1 each dust respirator with replacement cartridges
1 Batch of chemical for Training Purposes Minimum 120 Mixed Gallons – AV118 or Equal

TEST AND SEAL CONTROL CENTER

The control center shall provide the user with all the necessary controls for regulating the inflation pressures of the packer, quick inflation and deflation of the packer, air or water test of a joint, chemically sealing of leaking joints, and constant monitoring of the packer void pressure during testing and sealing operations.

The control center will include a quick inflate system to quickly seat and seal the packer elements to the pipe walls. The system shall supercharge the packer inflation lines with high pressure air prior to reaching the



"The Standard of the Industry"

CUES®

ZoomMaster™ Video Processor

The **CUES ZoomMaster™ Video Processor** allows every video camera or video recorder to have a real time 20:1 zoom capability. Operating with any 1 V p-p composite video input, the **ZoomMaster™** can magnify the video image from any standard NTSC or PAL CCTV camera or playback of any high resolution, prerecorded video tape. Unlike cameras with optical zoom lens, the **ZoomMaster™** neither increases existing camera size, nor creates any optical distortions of the video image.

Being a real time zoom system, the **ZoomMaster™** is simple to operate. A picture-in-picture (p-i-p) displays the full image for selection of the area to be magnified. The p-i-p display has a zoom position cursor that will automatically change from white to black depending on the intensity of the picture background. Only two joysticks are used for the control of the zoom operations. One joystick controls the zoom in/out from 1:1 to 20:1 magnification. The second joystick moves the zoom area position cursor anywhere within the original unmagnified image. A third joystick is provided for positioning the p-i-p display anywhere in the monitor picture area.

Applications are virtually unlimited and provide a major impact on such key functions as the ability to do detailed wall or casing inspection regardless of pipe size; the quick locating and verification of dimples in lined pipe prior to opening; the close-up inspection of offset joints or lateral connections before and after reinstatement; the ability to extend the length of mainline lateral inspection for blockage or in-depth infiltration and leak analysis.

SPECIFICATIONS

VIDEO SIGNAL STANDARDS	NTSC - PAL
ZOOM RANGE	20:1
AREA MAGNIFICATION	400:1
SIGNAL INPUT/OUTPUT	1 V p-p COMPOSITE VIDEO
PICTURE-IN-PICTURE (p-i-p)	VARIABLE SIZE & POSITION
POWER	110-220 VAC. 50-60 Hz

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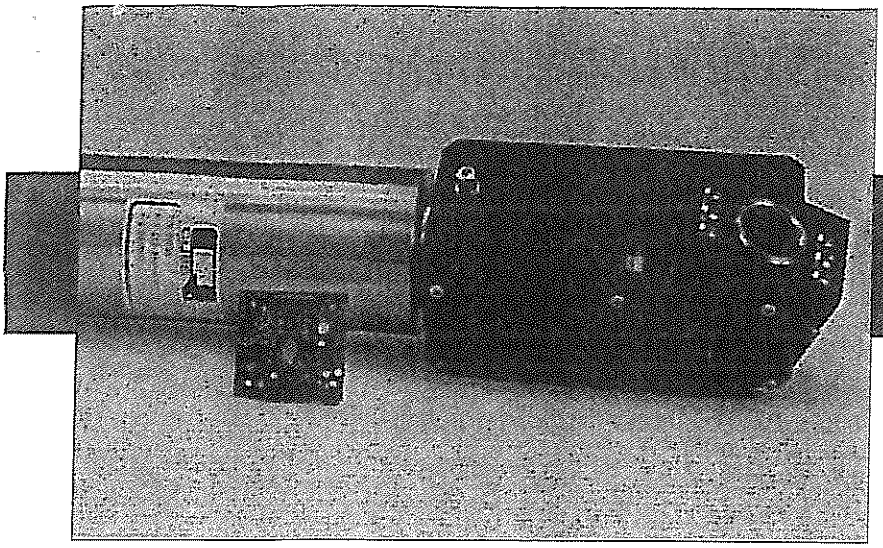
PATENT PENDING



"The Standard of the Industry"

CUES®

Slopemaster™ Inclinometer

FEATURES

- Improperly installed or sunken lines often results in rapid pipe failure. Failures will include the accumulation of dangerous materials, debris, early fatigue, fractures and open joints. In waste water lines, it can also include the heavy accumulations of grease, increased levels of Hydrogen Sulfide gas, foul odors, increased bacterial growth, internal/external leakage, corrosion and reductions in flow.

- The **Slopemaster™** grade verification Inclinometer is designed to fully meet existing code requirements for pipeline television inspection and slope verification.

- The heart of the system is vertical sensing, single axis, precision, military grade, Inclinometer mounted on a single internal circuit board. Its accuracy, rugged construction, reliability, and wide range environmental parameters meets the special requirements necessary for accurate slope measurement in industrial and utility pipeline.

- The system operates with **CUES** multi-conductor or single-conductor* TV inspection systems. The simultaneous display of the grade information with the live television picture precludes possible misinterpretation of slope due to debris, offset joints, etc., a restriction often found with measurement only type grade verification systems.

- The **Slopemaster™** has a tilt angle measurement range of ±15 degrees with a maximum nonrepeatable accuracy error of less than 0.1 degree. It is totally Mercury free and does not contain any hazardous materials.

- The **Slopemaster™** can be used with many **CUES** data display and recording systems. Data systems are available for automatic slope data collection, display, recording, and plotting.

*Requires separate tow module.

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Specifications subject to change without prior notice. ■ Visit our web site at www.cuesinc.com

FORM OF PROPOSAL

CONTRACT TV-~~99~~

Gentlemen:

The undersigned bidder, having examined the Notice to Bidders and the contract specifications, proposes to furnish the Warminster Municipal Authority with the specified vehicle at the following price:

A.	TV/Seal system mounted in a GMC Step Van with 16' box.	$ 153,850.00
B.	Addition of ZoomMaster Video Processor.	$ 12,500.00
C.	Addition of Slopemaster Inclinometer.	$ INCLUDED IN BASE BID
D.	ADDITION OF LATERAL INSPECTION SYSTEM	$ 24,225.00
	TOTAL	$ 190,575.00

Bidder's Name: ELXSI d/b/a CUES

Bidder's Address: 3600 RIO VISTA AVENUE

ORLANDO, FLORIDA 32805

Phone No. 800-327-7791 Fax: 407-425-1569

Authorized Signature: _____

DAVID DOOLITTLE, VICE PRESIDENT

Print Name and Title