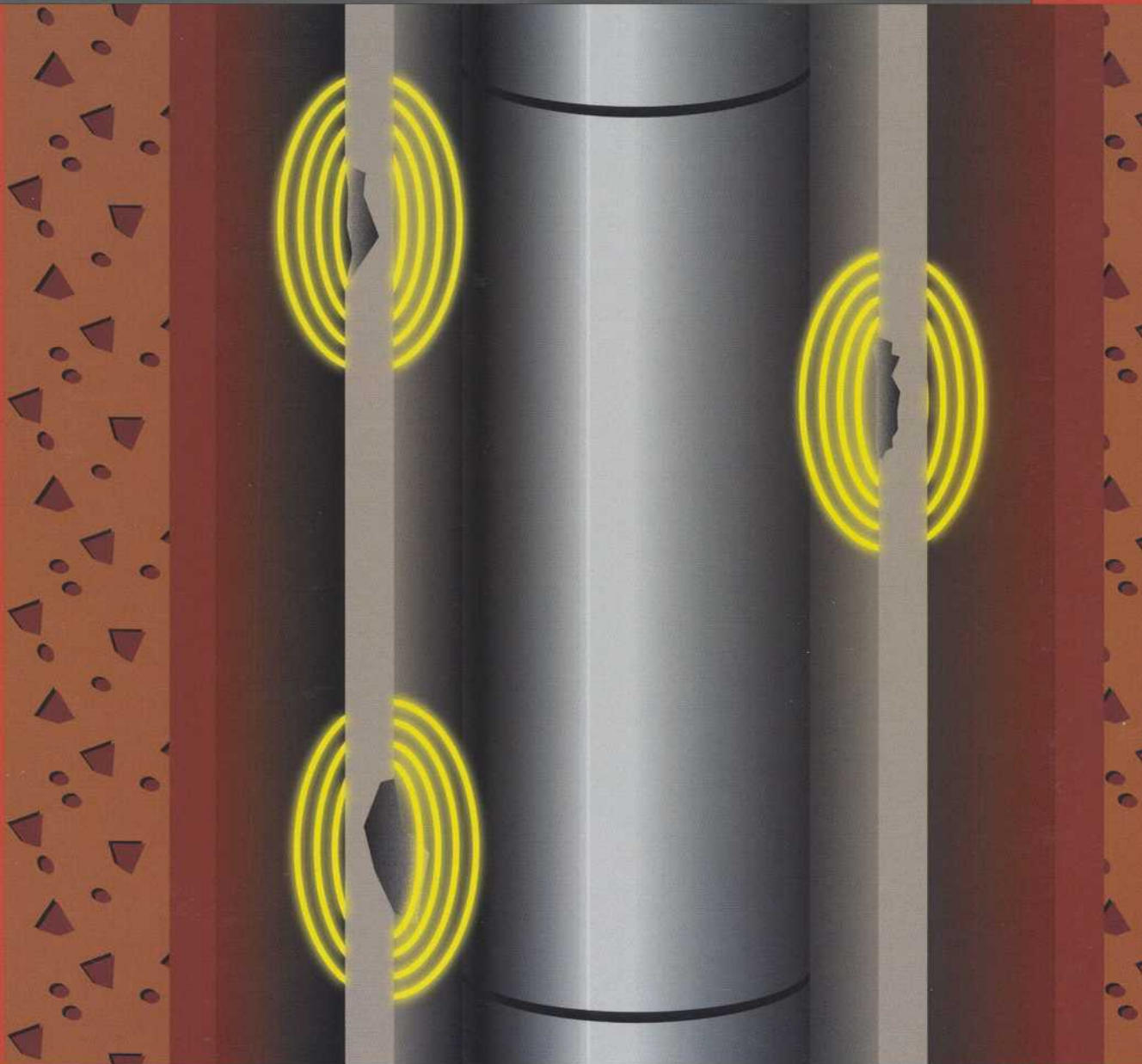


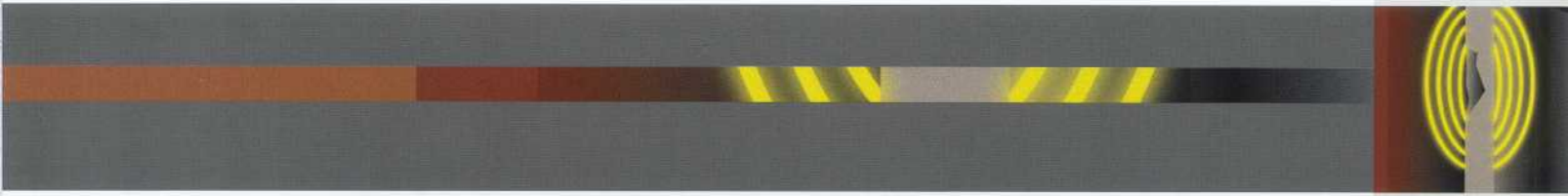
Vertilog



Downhole pipe inspection service cuts workover costs
and reduces production downtime


**BAKER
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Baker Atlas



The **VertilogSM** pipe inspection service from Baker Atlas provides fast and accurate analysis of tubular goods, identifying downhole conditions that can compromise safety and interrupt production.

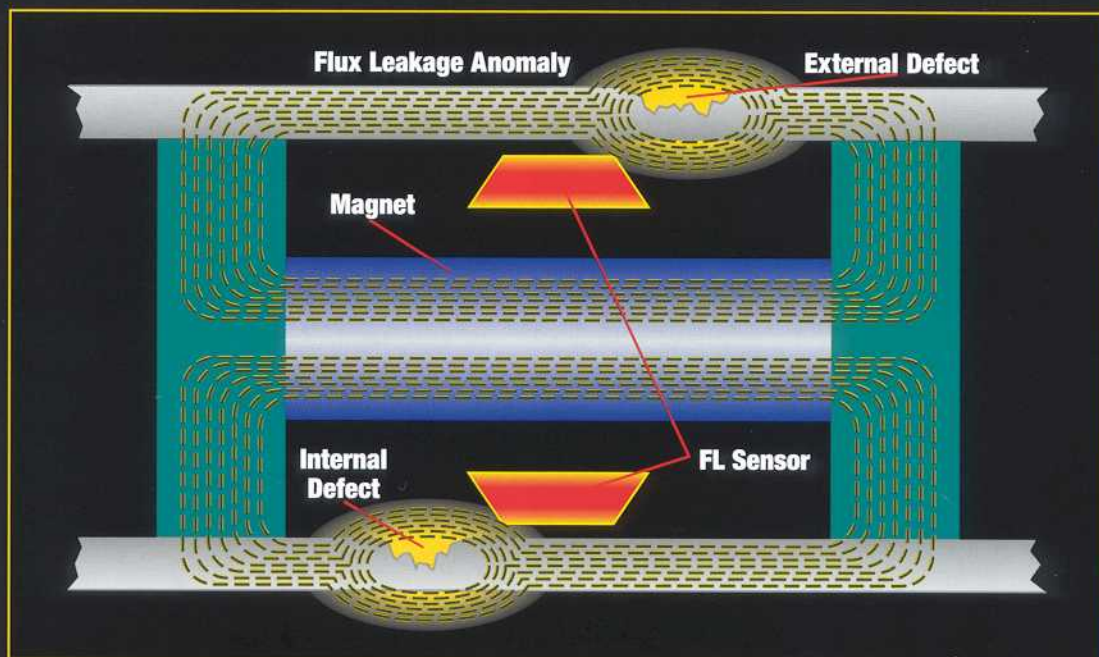
Pipe string failure due to corrosion or mechanical defects can occur at anytime in the life of a well. To protect your investment, inspection of the production tubing and casing on a regular basis using the Vertilog service can provide early detection of problem areas and allow for timely planning of remedial action.

The Vertilog pipe inspection logging service

provides a detailed evaluation of tubular goods, ranging in size from 2-7/8- to 9-5/8-in. OD. This information reduces pipe string condition and integrity uncertainties; thus, allowing oil and gas producers to make informed workover decisions that save time, expense, and minimize lost production.

Benefits

- Provides quantitative evaluation of most weights and grades of production tubing and casing
- Provides 360° pipe inspection with the string in place
- Allows for differentiating between metal loss and metal gain as well as internal and external corrosion defects
- Distinguishes between general corrosion, isolated pitting, and perforations or holes in the pipe
- Provides high-quality survey using either conventional wireline or slickline conveyance
- On-site data analysis provides fast and accurate results that reduce workover decision time and minimizes lost production.



The Vertilog pipe inspection service uses magnetic flux leakage measurements to identify corrosion and defects that can cause production loss and pose safety risks.

Advanced Instrument Design

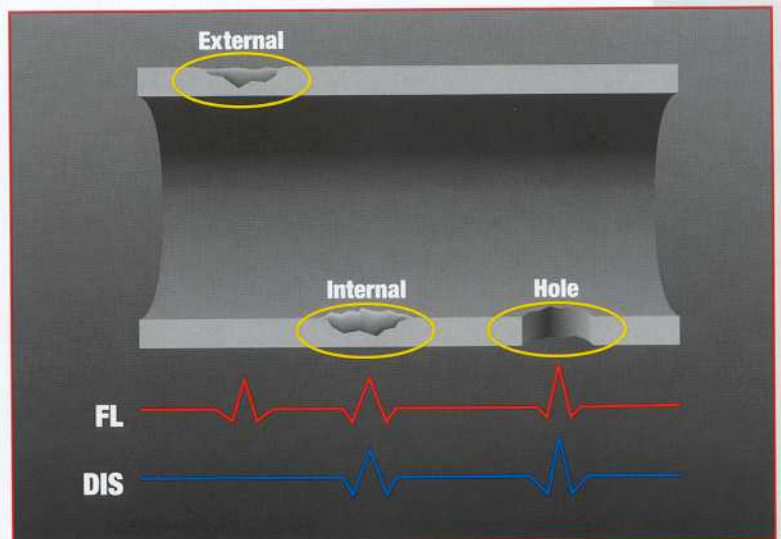
The Vertilog instrument utilizes a powerful permanent magnet to produce high flux density levels within the pipe string wall. An overlapping array of flux leakage (FL) sensors detect localized flux perturbations caused by internal or external defects in the pipe. A corresponding array of discriminator (DIS) sensors differentiate internal defects from external defects. The combination of advanced magnetic design and full circumferential sensor coverage results in highly sensitive and repeatable corrosion inspection surveys. The innovative system electronics allow the Vertilog service to operate in either wireline (digital telemetry) or slickline (downhole digital memory) logging modes.

Applications

- Detects internal and external tubular corrosion and quantifies the extent and depth of penetration
- Monitors corrosion rates over time through the use of successive logging surveys
- Determines the effectiveness of corrosion inhibitor programs
- Identifies pipe string makeup and location of collars, pups, mandrels, valves, and crossovers
- Identifies perforations and determines shot phasing and density
- Determines the appropriate timing and scope of workovers and pipe string replacement

Features

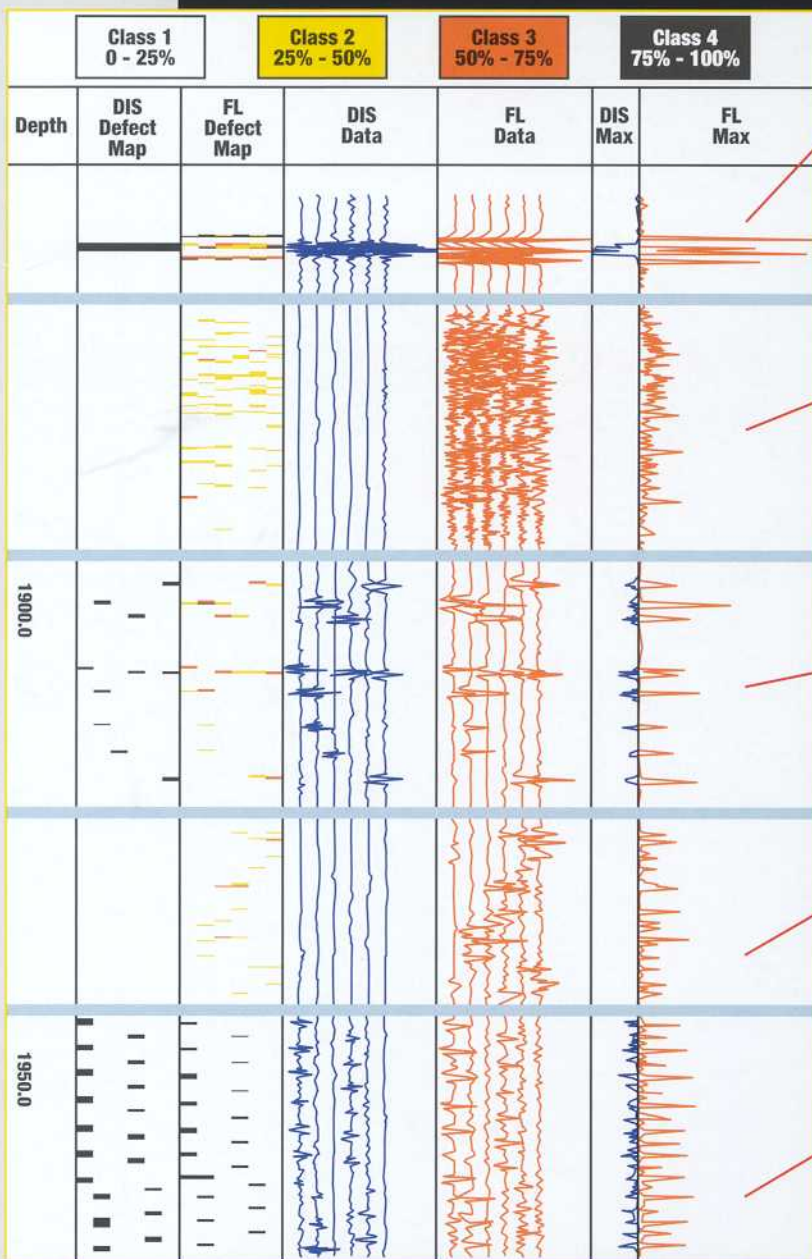
- Seven mandrel sizes provide inspection capabilities in most weights and grades of pipe strings ranging from 2-7/8-in. production tubing to 9-5/8-in. casing.
- Rare-earth permanent magnet design provides more sensitive and repeatable surveys.
- 360° internal and external sensor coverage
- High-speed digital telemetry designed for use with single-conductor wireline allows high sample rates and superior defect resolution
- Bipolar measurements differentiate metal loss (corrosion) from metal gain (hardware)
- On-site quantitative data analysis streamlines workover decisions.



Typical flux leakage (FL) and discriminator (DIS) sensor response to common defects - The FL sensors respond to internal and external anomalies, while the DIS sensors respond to internal anomalies only.

The Vertilog presentation includes both the acquired individual flux leakage and discriminator sensor measurements and computed results. The analysis software classifies and color codes the identified defects into one of four categories - Class 1 (white) - 0-25% penetration, Class 2 (yellow) - 25-50% penetration,

Class 3 (orange) - 50-75% penetration, and Class 4 (black) - 75-100% penetration. The data examples presented show distinct log signatures of the Vertilog service in a wide range of pipe string conditions.



Collar

FL and DIS sensors provide very large responses at pipe joint connections. The FL sensors respond primarily to the increased collar mass, while the DIS sensors produce a much sharper response at the joint makeup point.

General exterior corrosion

A general wall thickness loss of up to 50% is observed around the entire circumference of the pipe. All FL sensors are very active, indicating the severity and radial extent of the corrosion, while the DIS sensors are flat, indicating that the corrosion is limited to the external surface of the pipe.

Isolated internal pitting

Several distinct pits of up to 80% pipe wall penetration are observed with the FL sensors (note the classic chevron shape of the raw data curves). The matching responses of the DIS sensors clearly show these defects to be internal pits.

Isolated external pitting

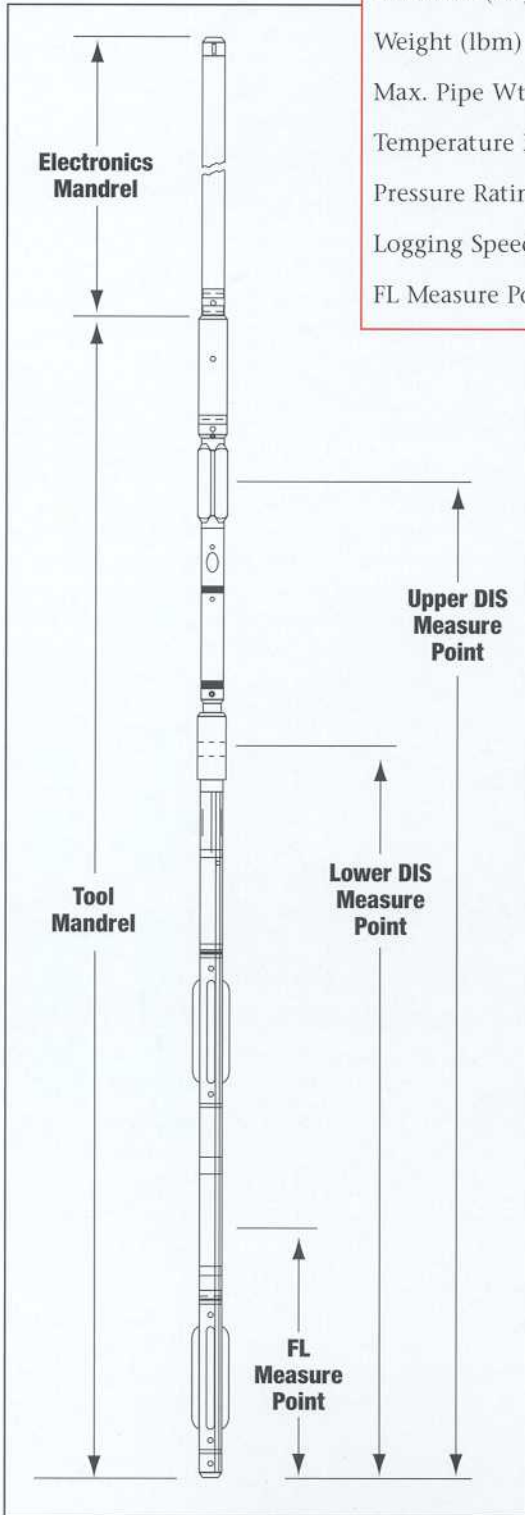
The FL sensors identify several individual pits with 35-50% pipe wall penetration, however the flat baseline of the DIS curves indicates the pitting to be external.

Perforations

Perforations are indicated by regularly spaced FL and DIS sensor responses. A shot density of 4 spf and 180° shot phasing are clearly indicated in this perforated interval. The sudden shift in the position of the holes indicates that the interval was perforated with two guns, fired separately.

Specifications

Instrument Group	2-7/8 in.	3-1/2 in.	4-1/2 in.	5-1/2 in.	7.0 in.	8-5/8 in.	9-5/8 in.
Total Length (ft)	15.8	15.9	17.4	17.6	21.25	21.375	21.45
Diameter (in.)	2.2	2.7	3.6	4.5	5.7	7.25	8.25
Weight (lbm)	90	140	245	270	330	350	370
Max. Pipe Wt (lbm/ft)	6.5	9.3	15.5	23.0	40.0	49.0	58.4
Temperature Rating (°F)	300	300	300	300	300	300	300
Pressure Rating (psi)	12,000	12,000	12,000	12,000	12,000	12,000	12,000
Logging Speed (ft/min)	125	125	125	125	125	125	125
FL Measure Point (ft)	2.1	2.2	2.8	3.0	4.5	4.6	4.7



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