

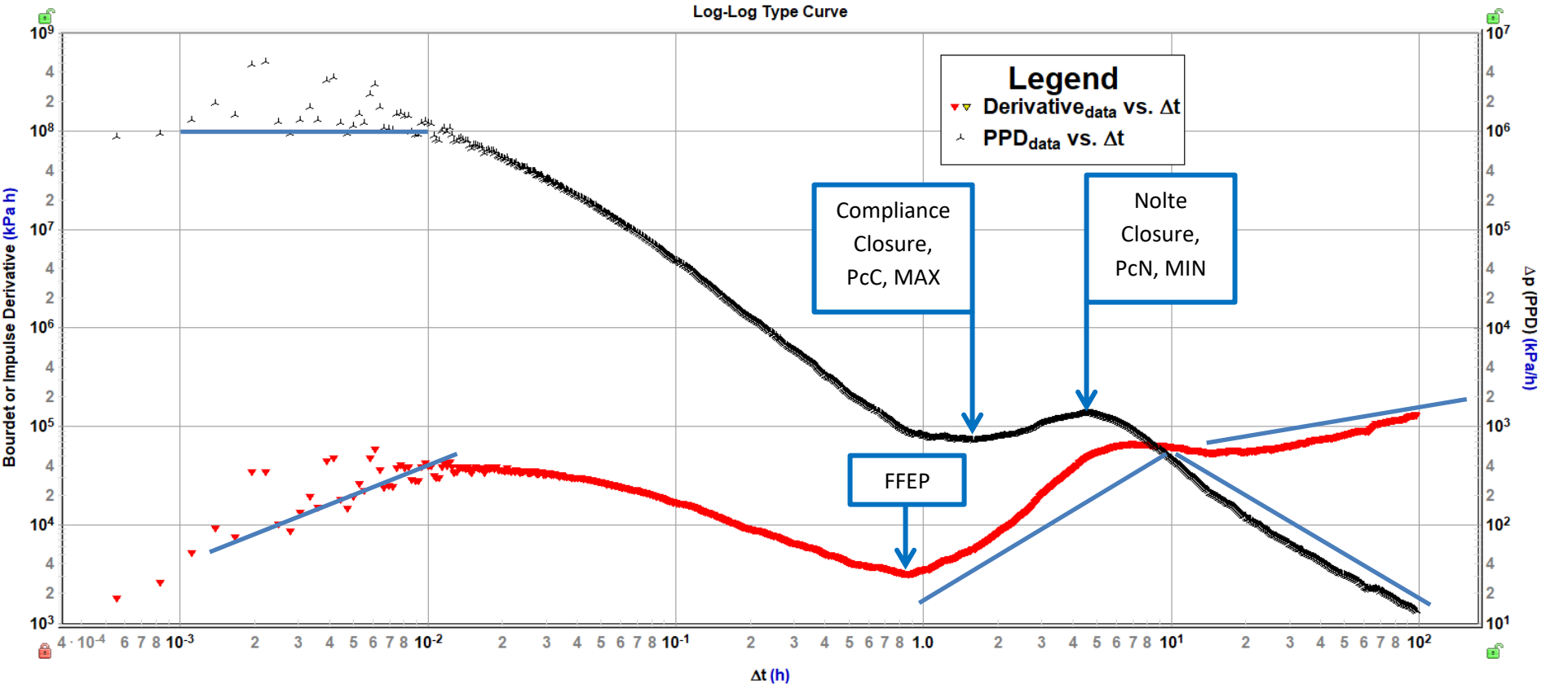
Appendix 1 – Diagnostic Fracture Injection Test Quality Coding Table

Quality Code	A Excellent	B Very Good	C Acceptable	D Poor	E Incomplete	F Misrun
Test Element						
Pressure & Temperature Data	Full .CSV or .PAS file; >=1 hertz frequency; Start & finish dates/times; Cumulative time sufficient for clear after-closure flow regime identification (>1/2 log-cycle of time, typically >100 hrs) & P* extrapolation	Full .CSV or .PAS file; >=0.1 hertz frequency; Start & finish dates/times; After closure flow regime < 1/2 log cycle (typically <=100 hrs)	.CSV or .PAS file with sub-optimum data frequency (<0.1 hertz); after closure flow regime not identifiable	No pressure file, but digitized or .PDF file conversions yield acceptable analysis; gauge resolution insufficient for PTA derivative calculations	No pressure data details	Data files corrupted or reported in unusable format
Injection Rates & Volume	Full .CSV or .PAS file; Time-synchronized to pressure data; rate data file provided; integrates to match cumulative volume reported	Rate data file provided but integration does not match cum. volume reported	No data file; rate and/or cumulative volume reported; pressures may still be measured but fracture and permeability measurements not possible		No rate or volume data reported	N/A
Well Integrity & Test Results	No pressure or rate disruptions during pumping or pressure fall-off; full flow regime development available for pre-closure, closure and after closure analysis	Pressure or rate disruptions present but do not affect selection of flow-regime ID or pressure picks	Pressure or rate disruptions present affect some flow-regime identification or pressure picks	Pressure or rate disruptions present affect most flow-regimes or pressure picks	N/A	Severe pressure and/or rate disruptions eliminate any capacity to provide analysis. Flow regimes present or the lack thereof do not indicate hydraulic fracturing occurred
Gauge Location	Reported location (e. g.: Surface, Casing Valve) or downhole with measured depth & true vertical depth details				Gauge location unknown; estimation possible with gauge data beginning and endpoint values	N/A
Well Data	Well orientation (Vertical, Deviated, Horizontal) reported; well Injection point location measured depth & true vertical depth reported				Injection point true vertical depth unknown; approximate value may be estimated with regional knowledge	N/A
Injection Fluid Data	Chemical composition of wellbore and injected fluid and density known		Injection and wellbore fluid unknown, assume fresh water			N/A
Operational information	Completion report documents full DFIT operations (e. g.: toe-port opening), pressure testing & pre-DFIT testing		No completion report			N/A

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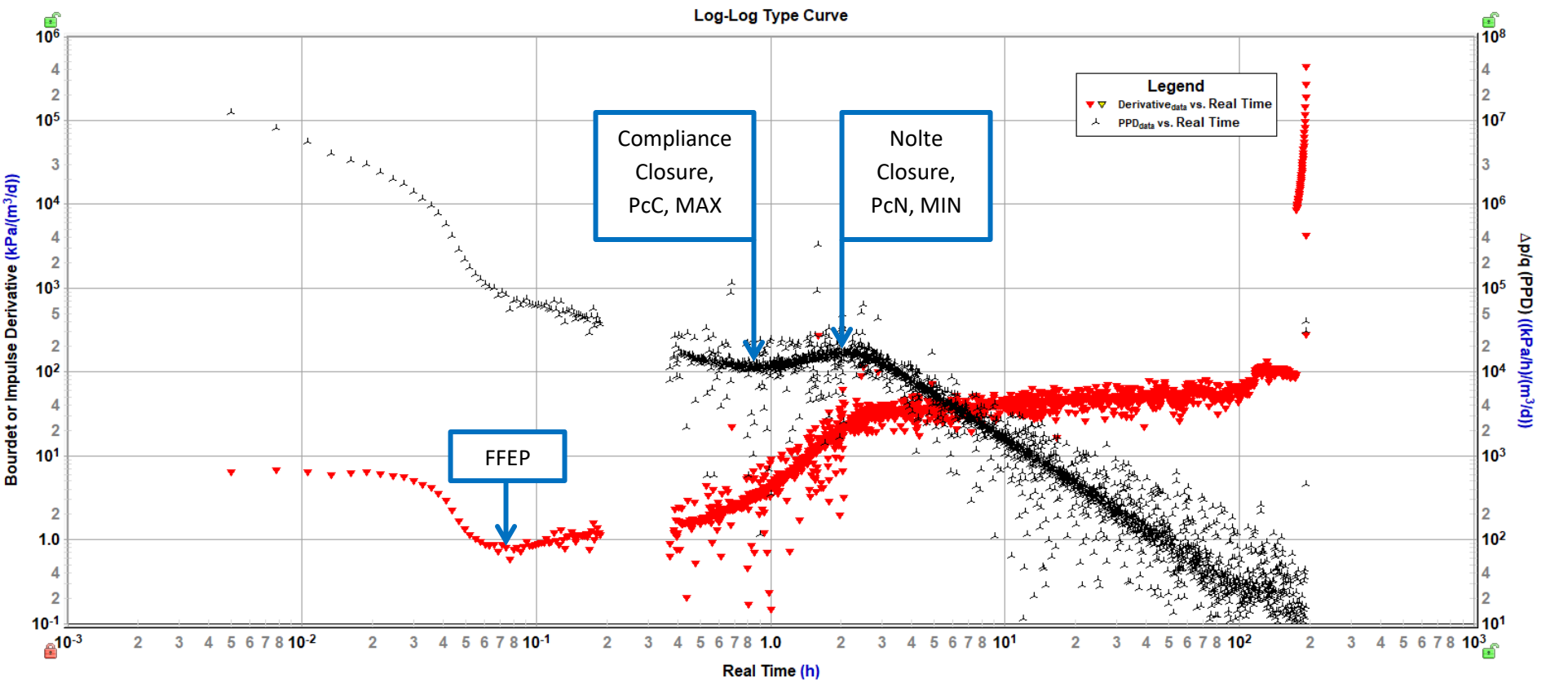
EXAMPLE OF TEST WITH QUALITY CODE A - EXCELLENT

In this example, clearly defined flow regimes exist before, during and after fracture closure. All relevant pressure values can be derived including FFEP, PcC, PcN and reservoir pressure.



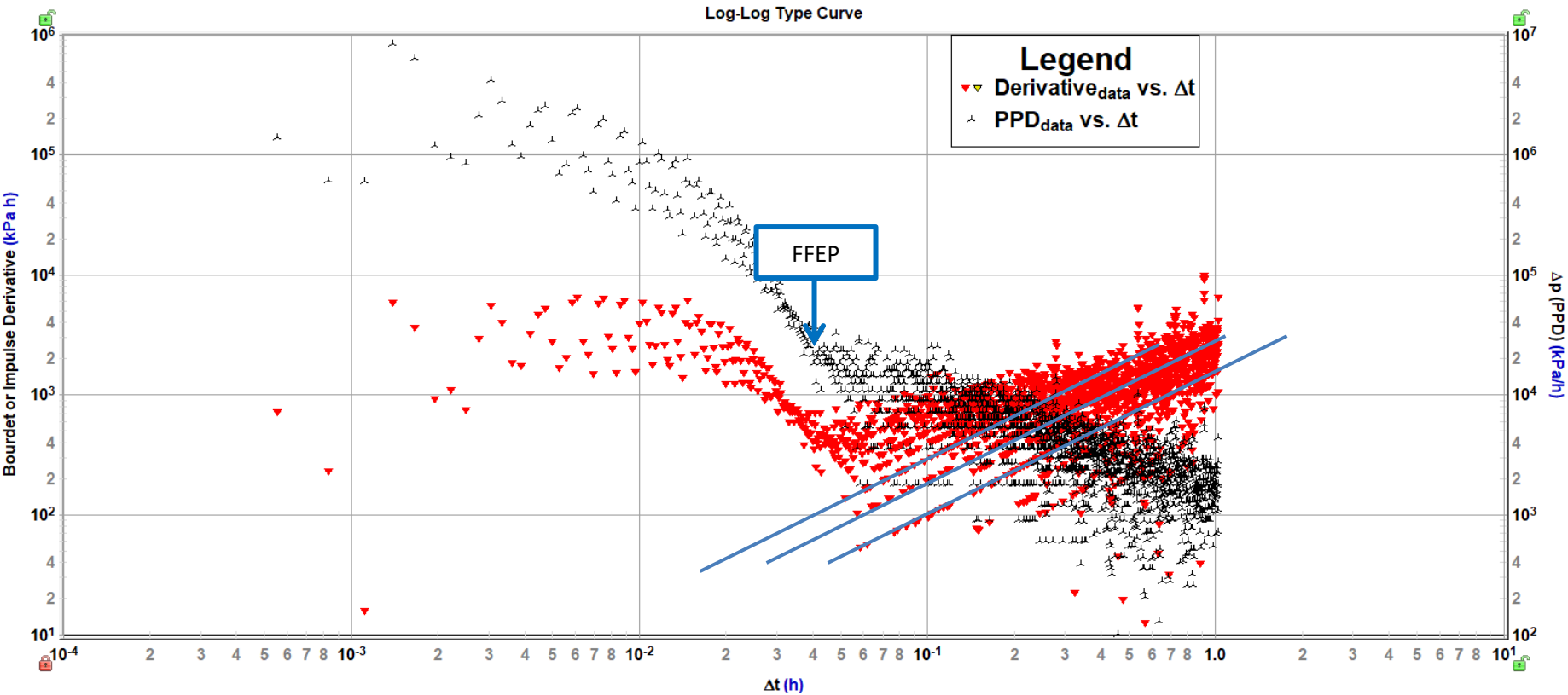
EXAMPLE OF TEST WITH QUALITY CODE B - VERY GOOD

This example has a pressure disruption present at 0.2 hrs (likley due to rigging out the pump truck) but this event is not impactful on key pressure picks (e.g. FFEP, Closure).



EXAMPLE OF TEST WITH QUALITY CODE C OR D – ACCEPTABLE TO POOR

In this example, a pressure data file is present but the quality of the gauge is poor. Pressure measurements are at the limits of the guage resolution and the analyst is forced to apply data smothing (averaging) to assist in the analysis. The test duration is not sufficient to observe closure or after-closure events. FFEP is the only possible value obtained from this test.



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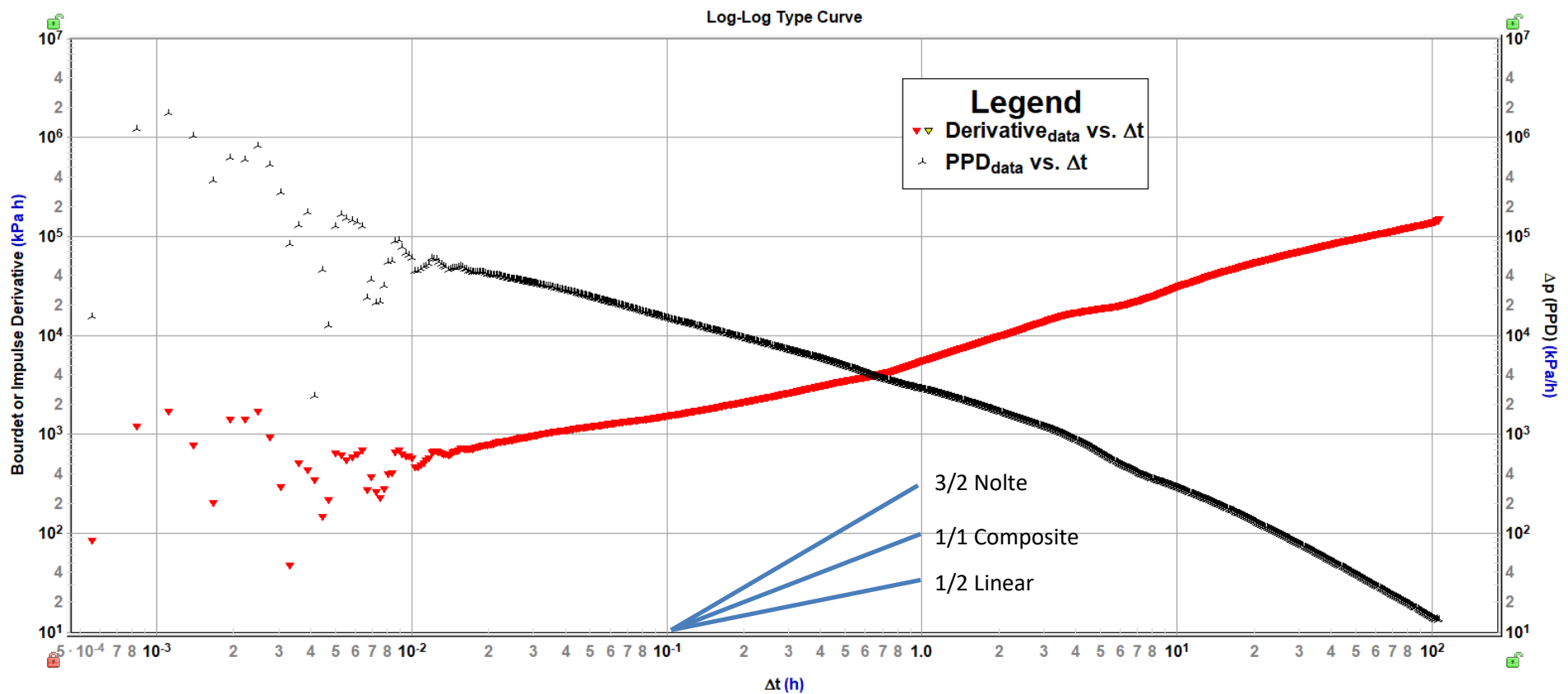
QUALITY CODE E – INCOMPLETE

Incomplete data sets can vary from lack of test data details (e.g. no landing depth reference, pressure valves closed and opened intermittently, or lack of injection or pumped volumes reported). These types of data sets result in low confidence level of analysis and results should be used with extreme caution.

(no example illustrated)

EXAMPLE OF TEST WITH QUALITY CODE F – MIS-RUN

This example has no clear early flow regimes that an analyst would identify for Wellbore/Near-field behavior (Storage, Friction, Tortuosity) nor Fracture/Farfield effects (Radial- or Linear-Tip-Extension, Composite). Nor is there an indication of closure or after-closure flow regimes. With no indication of fracture behavior it is likely that this test did not produce a significant hydraulic fracture and is therefore a mis-run.



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Tests that do not demonstrate identifiable flow regimes often have abnormal pump charts like the one exhibited below. Note that there is no linear slope compression and identifiable breakdown pressure associated with the injection period. This test likely had a leak in the system or fluid was feeding into the formation, wellbore cement, or an adjacent formation or fracture that prevented the creation of a significant new hydraulic fracture.

