

Rate-weighted Productivity Plot = q-weighted J-plot

One of the [Productivity Diagnostics](#) methods based on correlation between rate-weighted average [pressure drawdown](#):

(1)
$$\overline{\delta p}(t) = \frac{1}{Q} \int_0^t (p_{wf}(\tau) - p_e(\tau)) q_t d\tau$$

and rate-weighted average [total sandface flowrate](#):

(2)
$$\bar{q}_t(t) = \frac{1}{Q} \int_0^t q_t^2(\tau) d\tau$$

where

τ	production/injection time
q_t	total sandface flowrate as function of time τ
p_e	drain-area formation pressure as function of time τ
p_{wf}	bottomhole pressure as function of time τ
Q_t	total sandface cumulative offtake/intake : $Q_t(t) = \int_0^t q_t(\tau) d\tau$

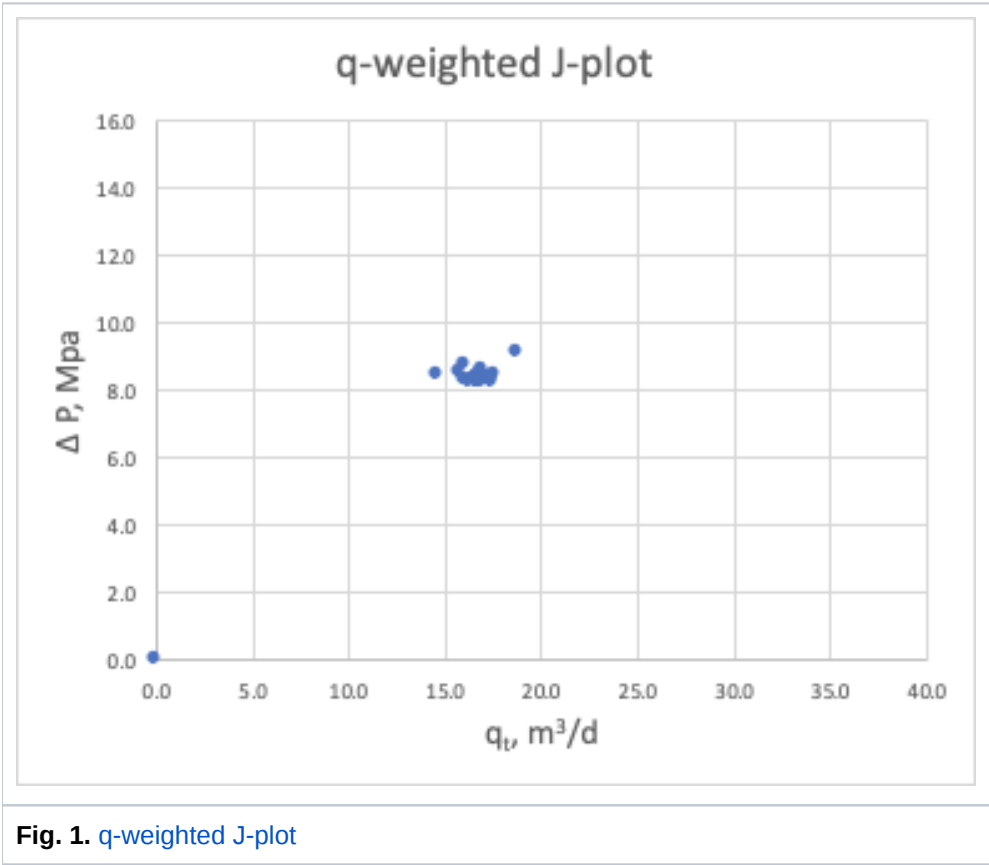


Fig. 1. [q-weighted J-plot](#)

It shows unit slope on log-log plot for [stabilized reservoir flow](#):

(3)
$$\overline{\delta p}(t) = J^{-1} \bar{q}_t(t)$$

where

J	constant productivity index
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Due to integration procedure the **q-weighted J-plot** has a better tolerance to uncertainties in **formation pressure** and **bottomhole pressure** comparing to **Unweighted J-plot** and usually results in more accurate estimation of **productivity index**.

It is highly recommended to plot **sandface flowrates** rather than **surface flowrates** to achieve better linearity in correlation for **stabilized reservoir flow**.

The average **pressure drawdown** $\overline{\delta p(t)}$ is usually calculated over interpolated values of **formation pressure** and **bottomhole pressure** :

$$\overline{\delta p(t)} = \frac{1}{Q} \int_0^t (p_{wf}(\tau) - p_e(\tau)) q_t(\tau) d\tau = \frac{1}{Q} \sum_k (p_{wf}(\tau_k) - p_e(\tau_k)) q_t(\tau_k) \delta\tau_k$$

The main difference between **q-weighted J-plot** and **t-weighted J-plot** is the averaging methodology.

The **t-weighted J-plot** gives equal weight to all data points $w(t) = \frac{1}{t}$, while **q-weighted J-plot** gives more weight to higher **flowrate** data points, lower weight to lower **flowrate** data points and zero weight to no-flow data points ($q = 0$):
 $w(t) = \frac{q_t}{Q}$.

When **flowrate** is constant $q = \text{const}$ both methods are equivalent because $w(t) = \frac{q_t}{Q} = \frac{1}{t}$.

The **q-weighted J-plot** provides the same accuracy of **productivity index** estimation as **Hall Plot** but additionally provides a useful insight into the ranges of historically averaged **flowrates** and **drawdowns**.

See Also

Petroleum Industry / Upstream / Production / Subsurface Production / Field Study & Modelling / Production Analysis / Productivity Diagnostics