ENDURANCE · INTENSITY-DURATION

CRITICAL POWER

ATHLETE	DATE	TEST	BODY MASS
Synthetic athlete	2026-10-12	4 time trials, ergometer	72.0 kg

01 SUMMARY

278 W
CP
3.86 W/kg

20.4 kJ
W′
SEE 1.7 %

0.999
R^2
4 efforts

READING

Critical power **CP = 278 W** (3.86 W/kg); reserve above it **W′ = 20.4 kJ**.

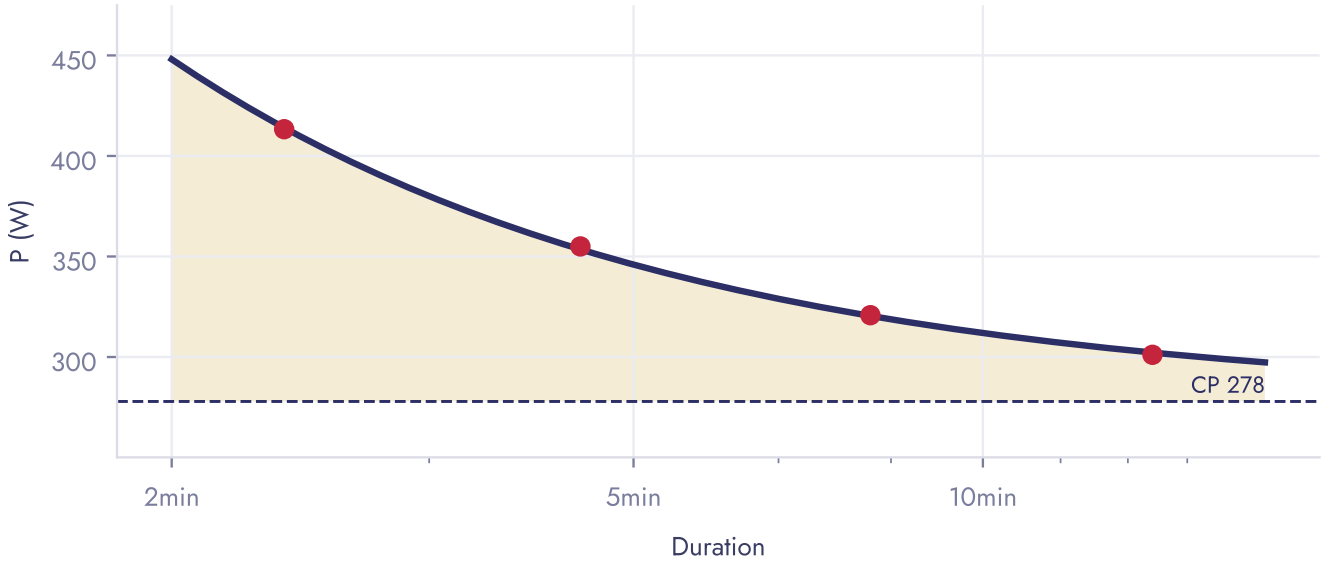
CP separates the intensities that can be stabilised from those that lead to exhaustion: above it, W′ is depleted the faster the further above one goes.

Standard error: 0.5 % on CP, 1.7 % on W′ — estimate **precise** (indicative guides: ≤ 5 % on CP, ≤ 10 % on W′).

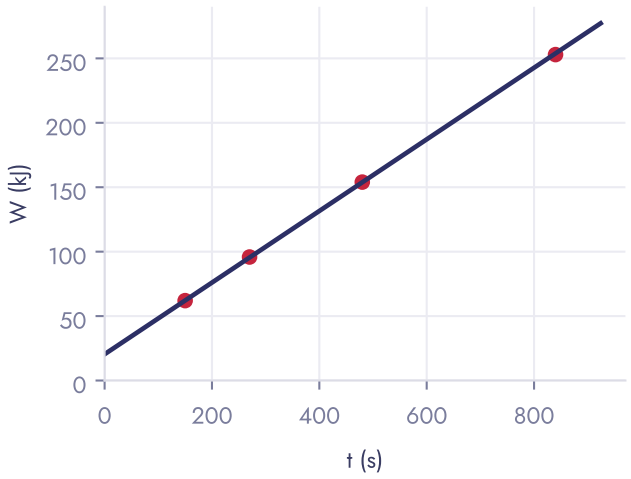
Across models, CP ranges from 274 to 278 W: the spread shows how much the model choice matters.

During the session, the reserve fell to **22 %** and stayed 16 s below 25 %.

02 INTENSITY-DURATION RELATIONSHIP



Maximal efforts (dots), fitted model (line) and critical value (dashed). The area above the critical value is the finite reserve.



Work (or distance) against duration: the slope is the critical value, the intercept the reserve.

2.1 Efforts used

DURATION	MEASURED	MODEL	RESIDUAL
2 min 30	413.3	414.0	-0.7
4 min 30	355.0	353.5	1.5
8 min 00	320.8	320.4	0.4
14 min 00	301.1	302.2	-1.1

03 MODEL COMPARISON

MODEL	CP (W)	W′ (KJ)	MAX	SEE CP	SEE W′	R^2
Hyperbolic (2-param.) selected	**277.9**	**20.42**	**—**	**0.5 %**	**1.7 %**	**0.9994**
Linear 1/time	277.9	20.42	—	0.5 %	1.7 %	0.9994
Linear work-time	276.4	20.94	—	0.3 %	2.1 %	0.9987
3-parameter (Morton)	274.0	23.24	1,654	0.0 %	0.3 %	1.0000

04 PREDICTIONS

4.1 Sustainable intensity

DURATION	W
2 min 00	448
3 min 00	391
5 min 00	346
10 min 00	312
20 min 00	295

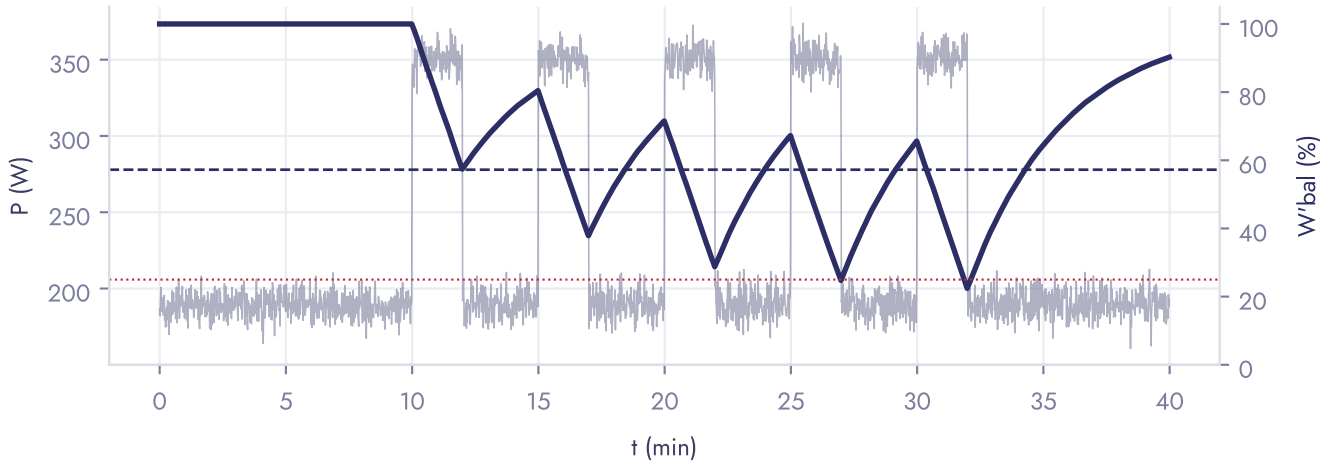
4.2 Time limit

TARGET	TIME LIMIT
292 W (+5 %)	24 min 30
306 W (+10 %)	12 min 15
333 W (+20 %)	6 min 07
375 W (+35 %)	3 min 30

05 SESSION W′ BALANCE

22 %
W′ MINIMUM
4.6 kJ

16 s
BELOW 25 %



Session intensity (grey), critical value (dashed) and remaining reserve (blue).

06 METHOD

The relationship between the intensity of a maximal effort and its duration is hyperbolic: P = CP + W′/t (Monod & Scherrer 1965; Hill 1993). The linear forms (work-time, intensity-1/time) give the same parameters by regression; the 3-parameter model (Morton 1996) adds a finite maximal intensity at t → 0.

Every parameter comes with its standard error in % (SEE); by default, the selected model is the one minimising the summed SEE of CP and W′, among those keeping at least two degrees of freedom. Protocol and model choices are discussed by Muniz-Pumares et al. (2019); efforts should last between about 2 and 15-20 min for the relationship to hold.

W′ balance: differential model (Clarke & Skiba 2013; Skiba et al. 2014). Above the critical value the reserve is depleted by the excess; below it, it recovers the faster the lower the intensity. Established in cycling: read it as an order of magnitude.

· Monod H. & Scherrer J. (1965). The work capacity of a synergic muscular group. Ergonomics 8, 329–338.

· Moritani T. et al. (1981). Critical power as a measure of physical work capacity and anaerobic threshold. Ergonomics 24, 339–350.

· Hill D.W. (1993). The critical power concept: a review. Sports Med 16, 237–254.

· Morton R.H. (1996). A 3-parameter critical power model. Ergonomics 39, 611–619.

· Jones A.M. & Vanhatalo A. (2017). The 'critical power' concept: applications to sports performance with a focus on intermittent high-intensity exercise. Sports Med 47 (Suppl 1), 65–78.

· Muniz-Pumares D. et al. (2019). Methodological approaches and related challenges associated with the determination of critical power and curvature constant. J Strength Cond Res 33, 584–596.

· Puchowicz M.J., Baker J. & Clarke D.C. (2020). Development and field validation of an omni-domain power-duration model. J Sports Sci 38, 801–813.

· Skiba P.F. et al. (2012, 2014); Clarke D.C. & Skiba P.F. (2013). W′ balance models. Med Sci Sports Exerc 44, 1526–1532; 46, 1433–1440; PLoS One 8, e65473.

Report generated by critpower 0.1.0. Values depend on the efforts being maximal and on measurement quality; read them with the athlete's context in mind.