TRACKING · EFFORTS AND MOST DEMANDING SCENARIOS

PEAK DEMANDS

ATHLETE	DATE	TEST	MSS
Player 9 (anonymised)	2026-10-31	Full match	9.20 m/s

01 SUMMARY

9.66 km
TOTAL DISTANCE
103 m/min · 94 min

646 m
HIGH SPEED
> 5.5 m/s · 28 efforts

7
SPRINTS
> 7.0 m/s · max 9.03 m/s

21 / 25
ACCELERATIONS / DECELERATIONS
> 2.5 m/s²

186 m/min
PEAK 1 MIN
start 68:56

READING

9,661 m in 94 min (103 m/min), of which 646 m above 5.5 m/s and **7 sprints**.

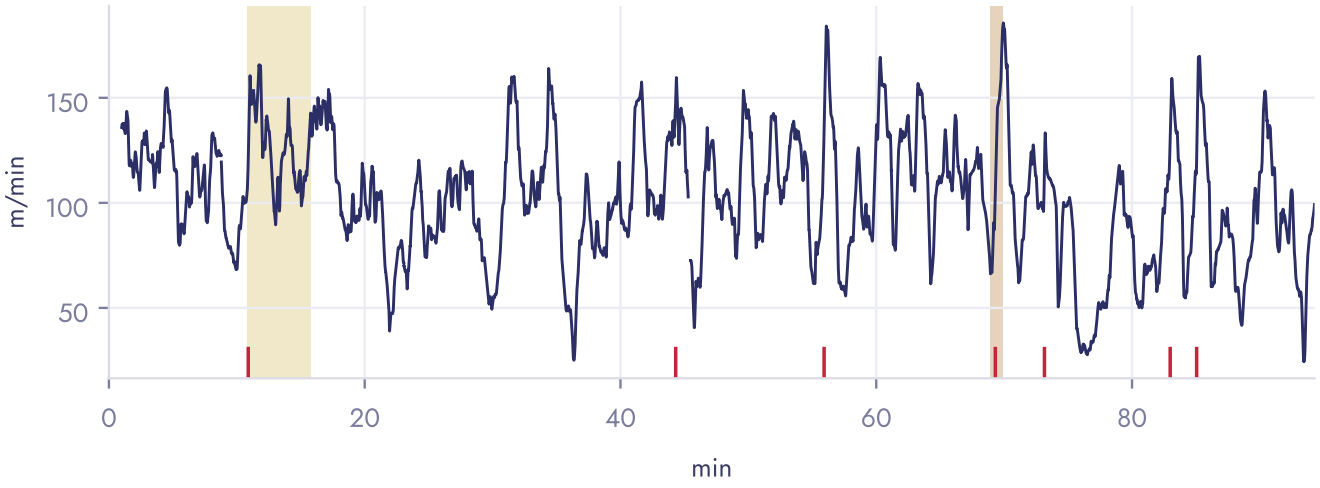
The most demanding minute reaches **186 m/min** (at 68:56), 1.8 times the match average; the next window drops to 77 m/min. Fixed epochs would have underestimated it by 2 %.

Peak intensity falls with duration along a power law of exponent -0.27 (R^2 0.92): a reference for programming drills of different lengths.

5 sequences of repeated high-speed efforts (≤ 60 s recovery), the longest with 2 efforts; 0 meet Spencer's stricter criterion (≥ 3, mean recovery < 21 s).

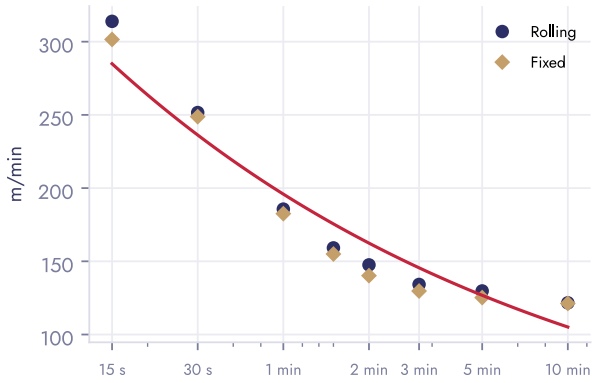
Direction changes: **24 %** of the horizontal mechanical work comes from turning rather than from speed changes — a part classic GPS metrics ignore (open model, section 6).

02 THE MATCH MINUTE BY MINUTE



Distance per minute (60-s rolling average). Bands: most demanding 1- and 5-min windows; red ticks: sprints.

03 ▶ MOST DEMANDING SCENARIOS



Peak of the rolling average (dots) and of fixed epochs (diamonds) for each window length; line: fitted power law. $I = 592 \cdot t^{-0.270}$, R^2 0.921.

READING

Over 15 s the peak is 3.0 times the match average; over 10 min, 1.2 times.

Fixed epochs underestimate the peak by 0.3 to 5.0 % depending on duration.

A single peak is unstable from match to match: look at the next window and at how often near-peak passages recur too.

WINDOW	M/MIN	HSR	ACC+DEC	W/KG	FIXED	START	NEXT WINDOW	≥ 90 %
15 s	314	211	40.0	7.71	−3.9 %	69:13	73	3
30 s	252	106	30.0	5.10	−1.1 %	68:58	118	2
1 min	186	53	17.0	3.37	−1.7 %	68:56	77	4
1 min 30	159	35	12.0	2.54	−2.6 %	10:49	107	8
2 min	148	27	14.0	2.32	−5.0 %	61:29	103	6
3 min	134	31	10.3	1.91	−3.3 %	10:44	130	12
5 min	130	20	7.6	1.78	−3.5 %	10:46	111	8
10 min	122	13	7.0	1.62	−0.3 %	7:16	90	5

m/min: distance; HSR: m/min above the threshold; acc+dec: efforts per minute; Fixed: underestimation by fixed epochs; Start: time of the peak (min:s); ≥ 90 %: distinct passages at 90 % of the peak.

04 ▸ EFFORTS

TYPE	COUNT
Sprints	7
> 5.5 m/s	28
Accelerations	21
Decelerations	25
Direction changes	91
Repeated sequences	5
Spencer	0
> 85 % MSS	4
> 90 % MSS	2
> 95 % MSS	0

4.1 Repeated-sprint sequences

START	COUNT	RECOVERY	DISTANCE (M)
7:47	2	8 s	21
44:02	2	14 s	28
49:16	2	13 s	36
55:14	2	37 s	46
69:06	2	8 s	52

4.2 Sprints

START	DURATION	MAX SPEED	ENTRY SPEED	M
73:09	3.0 s	9.03	7.02	24
85:03	5.3 s	8.63	7.06	43
69:19	3.0 s	8.18	7.01	23
55:55	1.3 s	7.35	7.02	10
44:19	1.0 s	7.26	7.00	7
10:54	1.7 s	7.23	7.00	12
82:59	2.4 s	7.20	7.00	17

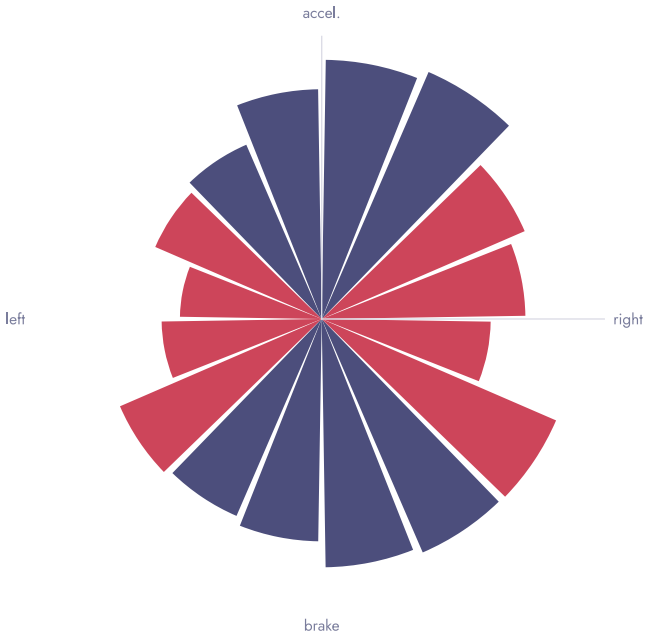
05 ▸ DIRECTION-SENSITIVE MECHANICAL LOAD

6.60 kJ/kg
HORIZONTAL WORK
70.3 J/kg/min

24 %
DIRECTIONAL SHARE
30 % within manoeuvres

3.37 W/kg
PEAK 1-MIN POWER
start 68:56

39
MECHANICAL BURSTS
≥ 50 % of the 1-s peak



Movement signature: mechanical work by orientation of the acceleration (top: speeding up, bottom: braking, sides: turning left / right).

MANOEUVRE	COUNT	WORK	DIRECTIONAL SHARE
Acceleration	145	12 %	9 %
Deceleration	124	11 %	5 %
Turn (left)	151	18 %	47 %
Turn (right)	164	29 %	43 %
Curved acceleration (left)	64	8 %	24 %
Curved acceleration (right)	71	9 %	24 %
Curved braking (left)	71	7 %	25 %
Curved braking (right)	69	7 %	22 %

IET · PEAK 1-MIN POWER (3.37 W/KG)	≥ 60 %	≥ 70 %	≥ 80 %
Minutes	10.4	6.4	2.3

06 ▸ DIRECTION AND EXPOSURE (GPS 3.0)

6.1 Intensity exposure time (IET)

REFERENCE	≥ 60 %	≥ 70 %	≥ 80 %
Peak 1 min (186 m/min)	36.1 min	17.7 min	5.5 min
Bundle S1min	0.0 min	0.0 min	0.0 min

Estimated Maximal S1min = 28.2 km/h (470 m/min). Estimated Maximal MP1min (Eq. 2): 8.2 W/kg — the paper's reference for a mechanical power not reproduced here.

07 METHOD

Positions smoothed and differentiated with a Savitzky-Golay filter (0.6-s window); tracking jumps removed. The complete acceleration is split into a tangential (speed change) and a centripetal (turning) component; $|a|^2 = a_t^2 + a_c^2$.

Efforts: passages above a threshold held for at least 1 s (speed) or 0.5 s (acceleration). Repeated sequences: at least 2 efforts no more than 60 s apart (Buchheit et al. 2010); Spencer et al. (2004) criterion: at least 3 efforts, mean recovery < 21 s.

Most demanding scenarios: peak of the rolling average for each duration, compared with fixed epochs (Varley et al. 2012; Fereday et al. 2020), power law $I = c \cdot t^n$ (Delaney et al. 2018). The peak alone is unstable (Novak et al. 2021): it is given with its time, the next window and the number of passages at 90 % of the peak.

GPS 3.0 (Buchheit et al. 2026): intensity exposure time (IET) = minutes during which the 60-s rolling average exceeds 60, 70 or 80 % of a reference — the match peak minute and, when MAS and MSS are known, Bundle's maximal 1-min speed (MAS + 0.695·(MSS – MAS)). The paper's mechanical work comes from a proprietary analyser that is not published: it is not reproduced here.

Direction-sensitive work (open model): speed-change work is the absolute sum of the changes in kinetic energy of the centre of mass (Gray et al. 2018), after a 0.2 m/s hysteresis filter that keeps tracking noise out. Direction-change work counts kinetic energy along and across the heading at the start of each manoeuvre (per-axis accounting, Cavagna et al. 1976): a 90° turn at speed v costs v^2 per kg, a stop-and-go cut only speed work. Horizontal, centre of mass only; not comparable with ADI watts.

Data: Metrica Sports sample data, game 2, Home team, Player9.

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Report generated by peakdemands 0.1.0. Thresholds and windows are parameters: compare only at equal method.