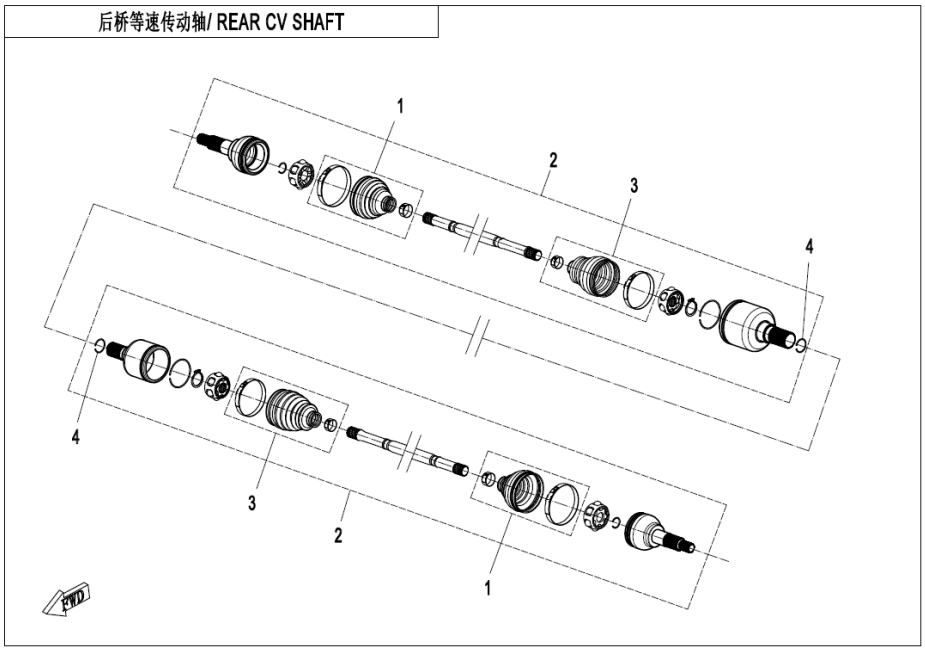
ENGINEERING SPECIFICATION DOCUMENT

Front CV Axle Integration
Honda Civic EF (1988–1991) & Honda CR-V K-Series AWD Transmission



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Document Version: 1.0 Draft
Last Updated: November 26, 2025
Project Status: In Design (Axle Specification)

1 Project Overview

This document defines the functional and dimensional requirements for a pair of front CV axles that interface a stock Honda Civic EF (1988–1991) front hub assembly with a JDM Honda CR-V K-series AWD manual transmission (5-speed or 6-speed). The intent is to:

- Retain the **OEM EF front hubs and bearings** for simplicity and parts availability.
- Use **CR-V K-series AWD inner CV joints** compatible with the selected transmission.
- Specify a **custom axle shaft** between these joints with correct spline counts and compressed lengths.
- Provide sufficient documentation so a driveline shop (or DSS, etc.) can manufacture repeatable axle sets.

These axles are part of an AWD K-series powertrain conversion for the EF Civic platform and must withstand track use and high traction loads.

2 System Configuration

2.1 Vehicle and Powertrain

- **Chassis:** 1988–1991 Honda Civic (EF) – front hubs retained in stock location.
- **Engine:** K-series (K24-based) swap.
- **Transmission Options:**
  - JDM 2002–2006 Honda CR-V K24A AWD 5-speed manual transmission.
  - JDM 2007–2009 Honda CR-V K24A AWD 6-speed manual transmission.
- **Front Axle Concept:**
  a) Outboard CV joint splined to stock EF front hub.
  b) Inboard CV joint splined to CR-V AWD transmission (via intermediate/half shaft as applicable).
  c) Custom shaft length and plunge range to suit EF track width and engine/trans positioning.

3 Interface Definitions

3.1 EF Civic Front Hub Interface (Outboard Joint)

The EF Civic platform was produced with two common outer spline counts depending on trim. This project assumes a non-HF performance model (DX/Si), but the spline count must be confirmed on the actual car.

3.1.1 Spline Specification (Hub Side)

- **Outer CV → Hub Spline Count:**
  - Typical values:
    - **23-spline outer** for HF/STD models.
    - **26-spline outer** for DX/Si models.

  - **Build Assumption:** `Outer_Hub_Spline = 26` (EF DX/Si). The actual car must be verified by counting splines on an existing axle or hub.
- **Axle Nut Size:** OEM EF uses a 32 mm axle nut (for reference only).
- **Hub Pattern:** 4x100 mm (no change).

3.1.2 Outboard Joint Requirements

- Joint style: Fixed Rzeppa-type outer CV joint.
- Interface: EF Civic EF-specific outer CV housing with required spline count and shoulder geometry to match OEM hub and wheel bearing stack-up.
- ABS: Base design assumes **no ABS tone ring** on the front axle; tone ring can be added in a future revision if needed.

3.2 CR-V AWD Transmission Interface (Inboard Joint)

For the K24A CR-V transmissions, typical aftermarket axle data indicates:

- **2002–2006 CR-V AWD (manual):**
  - Inboard (transmission side) spline: **27 splines** (male or female depending on side).
  - Outboard spline (CR-V hub side): typically **28 splines**.
- **2007–2011 CR-V AWD (manual):**
  - Inboard spline: typically **27 splines**.
  - Outboard spline: commonly **30 splines** on many aftermarket listings.

For this project, the **inner CV specification** is:

- **Transmission Spline (Inboard):** `Inner_Trans_Spline = 27`.
- **Joint Type:** Tripod or plunging Rzeppa inner CV joint compatible with the CR-V AWD differential/half-shaft stubs.
- **Side-Specific Geometry:**
  - Left side interfaces directly with the transmission/transfer output (or half-shaft).
  - Right side typically mates to an intermediate/half shaft (jackshaft) on the engine block; the custom axle runs from jackshaft to EF hub.

3.3 Summary of Spline Interfaces

Location	Component	Nominal Spline Count
Outboard (wheel side)	EF Civic EF front hub	23 or 26 (build uses 26; verify on car)
Outboard (CV stub)	Custom EF-style outer CV joint	Matches hub spline (23/26) – TBD per car
Inboard (trans side)	CR-V K-series AWD transmission / jackshaft	27 splines (typical)
Inboard (CV stub)	CR-V-style inner CV joint	27 splines

Table 1: Front axle spline interface summary (EF hub & CR-V AWD transmission).

4 Axle Geometry and Length

4.1 Design Philosophy

- Use OEM CR-V axle geometry as a starting point for plunge and tripod travel.
- Adjust shaft length to suit EF track width, engine position, and subframe geometry.
- Maintain sufficient plunge at full droop and full bump to avoid joint binding or pull-out.

4.2 Nominal Length Parameters

OEM CR-V axles are **not equal length**. Typical data shows different compressed lengths for left and right sides. For this custom application:

- Define separate target lengths:
  - L_{LHS} = Effective compressed length from inner CV snap ring seat to outer CV shoulder (left).
  - L_{RHS} = Same measurement for the right side.
- Lengths must be measured on the **actual car mock-up** with:
  - K-series engine and CR-V AWD transmission installed on the final mounts.
  - Front suspension at static ride height.
  - EF knuckles and hubs installed with target camber/toe settings.

4.3 Measurement Procedure (For Custom Shop)

For each axle side:

1. Install the inner CV stubs (CR-V style) fully into the transmission and/or jackshaft until the snap ring seats.
2. Install the EF hub/knuckle assembly with wheel bearings and a dummy outer CV (or turned stub) seated and torqued.
3. With the vehicle at ride height (using stands under control arms or a drive-on lift), measure the **centre-to-centre distance** between:

- The plunge centre of the inner CV joint.
- The plunge centre of the outer CV joint.

4. Specify a **compressed shaft length** L_{comp} such that the inner joint has:
   - Approximately 30–40% of its plunge travel used at static ride height.
   - Remaining plunge available for both droop and bump.
5. Repeat measurements at full droop and full bump to confirm that:
   - The axle does not bottom out the inner or outer joint.
   - The axle does not pull the inner tripod/CV out of the cup.

The measured values should be recorded in a design table (example placeholders):

Side	L_{comp} [mm]	Plunge Reserve (Droop) [mm]	Plunge Reserve (Bump) [mm]
Left Front	**TBD**	**TBD**	**TBD**
Right Front	**TBD**	**TBD**	**TBD**

Table 2: Axle length and plunge margin (to be populated after mock-up measurement).

4.4 Estimated Axle Lengths from Reference Builds

To sanity-check the EF AWD axle lengths, data from other K-series platforms is used as a guide:

- JDM DC5/RSX Type R K-series front axles (FWD) have published compressed lengths of roughly:
  - Driver side: $\approx 25.25\,\text{in} \approx 641\,\text{mm}$.
  - Passenger side: $\approx 23.375\,\text{in} \approx 594\,\text{mm}$.
- 2002–2006 CR-V AWD front axles show compressed lengths in the $\approx$ 660–800 mm range depending on side and manufacturer, reflecting the wider track and SUV packaging.

Reference Setup	**Driver Compressed [mm]**	**Passenger Compressed [mm]**	**Note**
DC5 / RSX Type R (K-series FWD)	≈ 641	≈ 594	Typic refere
2002–2006 CR-V AWD (front)	$\approx$ 660–800	$\approx$ 660–800	Longe track etry.

Table 3: Approximate front axle compressed lengths from K-series donor platforms (for guidance only).

Given that the EF chassis is narrower than a CR-V and closer to EG/DC/EK dimensions, the target EF AWD axle lengths are expected to land slightly below CR-V values and in the same ballpark as other K-swapped Civics.

Side	Design Window [mm]	Target Design [mm]	Measured Final (KC) [mm]
Left Front (EF AWD)	620–650	**TBD**	_____
Right Front (EF AWD)	580–610	**TBD**	_____

Table 4: Estimated EF AWD front axle compressed length targets with space for final measured values.

5 Materials and Strength Requirements

5.1 Performance Target

- Power level: **High-performance K-series** (forced-induction capable in future).
- Use case: Track days, hard launches, high grip tires.

5.2 Material Specification

- **Axle Shafts:**
  - Material: 4340 chromoly or equivalent high-strength alloy steel.
  - Heat treatment: Through-hardened or induction hardened per driveline shop standard for 500+ whp applications.
  - Surface finish: Ground or fine-turned to minimize stress risers.
- **CV Joints:**
  - Inner: CR-V spec high-quality tripod or plunging Rzeppa, sized for K-series torque.
  - Outer: EF hub-compatible Rzeppa joint with upgraded cage/ball design if available.

5.3 Boots and Lubrication

- High-temperature neoprene or TPE boots rated for track temperatures.
- High-moly CV grease, filled per joint manufacturer's specification.

6 Manufacturing Data Package

This section defines the information to be sent to a driveline manufacturer (e.g., Driveshaft Shop, Cardanic, etc.) for custom axle production.

6.1 Required Inputs to Vendor

1. Vehicle: 1988–1991 Honda Civic EF (track build).
2. Engine/Transmission: K24 + CR-V AWD K-series transmission (5MT or 6MT).
3. Outboard hub type:
   - Exact model/trim of EF.
   - Confirmed outer hub spline count (23 or 26).
   - Whether ABS tone ring is required: **No** (base design).
4. Inboard interface:
   - Transmission model / year.

- Inner spline count: 27.
- Whether the axle mates directly to trans or to an intermediate shaft (specify side).

5. Desired shaft material: 4340 chromoly (or vendor's recommended high-strength option).
6. Measured compressed length(s) for left and right axles (L_{comp}).
7. Intended use: High-performance track car, AWD, sticky tires.
8. Target wheel horsepower (for sizing safety factor).

6.2 Example Request Summary (Text Block)

> "Build a pair of custom front CV axles for a 1988–1991 Honda Civic EF track car using stock EF front hubs (26-spline outer) and a JDM 2002–2006 Honda CR-V K24A AWD 5-speed transmission. Inner joints must be CR-V K-series AWD compatible (27-spline). Outer joints must fit the EF hub without modification. Shaft lengths and plunge margins are specified in the attached measurement table."

7 Quality and Validation

7.1 Dimensional Inspection

- Verify spline counts against specification on both ends.
- Check shaft overall length and compressed length against design values within vendor tolerance.
- Confirm snap ring groove locations and chamfers for proper engagement.

7.2 Vehicle-Level Testing

- Initial low-speed shakedown to verify:
  - No binding at full steering lock in both directions.
  - No vibration under light acceleration up to highway speeds.
- Progressive load testing:
  - Medium-throttle pulls in 2nd/3rd gear.
  - Full-throttle pulls once no abnormal noise/vibration is observed.
- Post-test inspection:
  - Check boots for tears and clamps for movement.
  - Inspect for grease leakage at inner and outer joints.
  - Re-torque axle nuts after heat cycling.

8 Cost and Pricing Estimates

8.1 Performance Axles (Reference Pricing)

Approximate pricing for front axle pairs (USD, excluding shipping/duty):

- **Driveshaft Shop EF K-series Basic Axle Level 0 (Pair):**
  - $\sim$ \$640 USD per pair.
  - Chromoly center bar, billet inner CV, upgraded tripod and outer joint.
- **Driveshaft Shop EF K-series 700HP X4 Axles (Pair):**

  - $\sim$ \$1,400 USD per pair.
  - 700–1000 whp-rated X4 line with 300M materials.
- **Insane Shafts K-series swap axles (EG/DC/EK etc.):**
  - Typically $\sim$ \$650–\$800 USD per pair for 500 hp-rated sets (reference for strength/cost).
- **Fully custom hybrid CV axles (Dutchman / DSS custom apps):**
  - Often in the $\sim$ \$800–\$1,500 USD per pair range depending on complexity, material (4340 vs 300M), and whether they use donor joints.
- **OEM / aftermarket CR-V donor axles (for inner joints):**
  - Typical aftermarket pricing: roughly \$150–\$250 CAD for a pair (online sources), or \$90–\$150 CAD each, depending on brand.

For rough CAD conversion, an exchange rate of ≈ 1.35 CAD/USD is assumed for budgeting.

8.2 Axle Budget Table with Placeholders

Option	Estimated Cost [USD]	Approx. Cost [CAD]	Actual Cost Paid (KC) [CA
EF K-series Level 0 axle pair (DSS)	$\sim$ \$640	$\sim$ \$865	_____
EF K-series 700HP X4 axle pair (DSS)	$\sim$ \$1,400	$\sim$ \$1,890	_____
Fully custom hybrid CV axle pair	\$800–\$1,500	\$1,080–\$2,025	_____
OEM / aftermarket CR-V axle pair (donors)	\$110–\$185	\$150–\$250	_____

Table 5: High-level CV axle cost benchmarks for budgeting (values approximate at time of writing).

Use the last column to log what you actually spend for your specific EF AWD axle solution (including shipping, duty, shop labour if applicable).

9 Future Revisions and Options

- Optional upgrade to 36 mm swap hubs (e.g., 28-spline outer hubs) for higher torque capacity, while keeping the same inner CR-V spline.
- Integration of ABS tone rings if an ABS-compatible hub/knuckle is used.
- Alternate shaft diameters or material for extreme power levels.
- Revision of estimated length windows once final mock-up measurements and track testing are complete.